Appendices

(No. of pages including blank pages = 520)

Appendix 1 Noise Compliance Report 2019 (384 pages)

Appendix 2 Annual Groundwater Monitoring Review 2019 (134 pages)

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Appendix 1

Noise Compliance Report 2019

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20 December 2019

Phillip Brown
Environment and Community Relations Superintendent
Ashton Coal Operations Pty Ltd
PO Box 699
Singleton NSW 2330 Australia

Re: EPL 11879 - Noise compliance assessment report 2019

Dear Phil,

1 Introduction

EMM Consulting Pty Limited (EMM) has been engaged by Ashton Coal Operations Pty Limited (Ashton Coal) to prepare this Noise Compliance Assessment Report for the period 1 January 2019 to 31 December 2019. The Noise Compliance Assessment Report is required as per Condition R5.1 of Environment Protection Licence (EPL) 11879 dated 21 November 2019 which is reproduced as follows:

> R5.1 Noise Compliance Assessment Report
>
> A noise compliance assessment report must be submitted to the EPA on an annual basis with the Annual Return as set out in Condition R1. The report must be prepared by an accredited acoustical consultant and determine compliance with noise limits at noise monitoring points specified in Condition (s) P1.4 and L4.2 to L4.4.

2 EPL amendments

EPL 11879 was varied twice during the 2019 reporting period.

Some conditions in EPL 11879 relating to noise were updated on 27 March 2019 (within the reporting period) and are summarised as follows:

- Condition P1.4 was added, providing three attended noise monitoring points (point ID 12 to 14) and one meteorological monitoring point (point ID 15) for the purposes of determining meteorological conditions for noise monitoring;
- Conditions L3.1 to L3.3, pertaining to blasting, were removed;
- Condition L4.6 was added, specifying relevant noise limits for the attended noise monitoring locations;
- Condition M8 was added, specifying that night-time attended noise monitoring must be carried out on a monthly basis; and
- Condition E.1 was added, requesting a report outlining the relevant noise assessment groups, their attended noise monitoring point and applicable noise limits.

Some conditions in EPL 11879 relating to noise were also updated on 21 November 2019 (within the reporting period) and are summarised as follows:

- Condition P1.4 was amended, including an additional meteorological monitoring point (point ID 32) for the purposes of determining meteorological conditions for noise monitoring;
- Condition L4.1 was updated to reference the attended noise monitoring locations;
- Conditions L4.2 and L4.5 were updated to reflect condition re-numbering;
- Conditions L4.3, L4.4 and L4.6 were removed;
- Condition M4.1 was updated to reference approved methods to calculate temperature inversions; and
- Condition E.1 was removed, as the requirements of this condition had been completed.

3 Noise policy

Condition L2.3 of EPL 11879 states that noise generated by Ashton Coal is to be measured in accordance with the relevant requirements of the EPA's Industrial Noise policy (2000). It is of note that the EPA released the Noise Policy for Industry (NPfI) in October 2017, which supersedes the INP. As part of the NPfI implementation and transitional arrangements, the INP continues to apply when referenced in existing licences. The exception is for the INP Section 4 modification factors which have been transitioned to the NPfI Fact Sheet C through the INP application notes. The INP application notes state that Section 4 of the INP has been withdrawn and the modifying factor adjustments outlined in Fact Sheet C of the NPfI are to be applied when assessing the characteristics of a noise source (if relevant). This approach was adopted for the attended noise monitoring assessment undertaken during the 2019 reporting period.

4 Compliance

Monthly attended noise monitoring was undertaken by Global Acoustics (January) and EMM (February to December) for the period relevant to this report (refer Appendix A to Appendix L for complete noise monitoring reports).

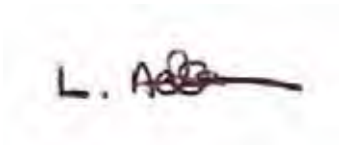
As presented in the attached monthly reports, results of routine attended monitoring indicate that noise emissions from Ashton Coal operations satisfied the relevant EPL noise limits (Condition L2.1 of EPL 11879) at all assessment locations during periods when noise limits were applicable.

5 Conclusion

Monthly attended noise monitoring undertaken during the relevant reporting period (1 January 2019 to 31 December 2019) demonstrated that noise emissions from Ashton Coal night-time operations satisfied the relevant limits at all monitoring points in accordance with the EPL 11879.

We trust the preceding meets your current requirements. If you have any questions or need anything further, please do not hesitate to contact our office.

Yours sincerely



Lucas Adamson
Acoustic Consultant
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Review: Katie Teyhan (20/12/2019)

Appendix A

Monthly attended noise monitoring report - January 2019

Ashton Coal

Environmental Noise Monitoring

January 2019

Prepared for

Ashton Coal Operations Pty Ltd

Global Acoustics

Noise and Vibration Analysis and Solutions

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Ashton Coal

Environmental Noise Monitoring
January 2019

Reference: 19007_R01
Report date: 24 January 2019

Prepared for

Ashton Coal Operations Pty Limited
PO Box 6699
Singleton NSW 2330

Prepared by

Global Acoustics Pty Ltd
PO Box 3115
Thornton NSW 2322

Prepared:	Tambalyn Durney Consultant	QA Review:	Robert Kirwan Consultant

Global Acoustics Pty Ltd ~ Environmental noise modelling and impact assessment ~ Sound power testing ~ Noise control advice ~ Noise and vibration monitoring ~ OHS noise monitoring and advice ~ Expert evidence in Land and Environment and Compensation Courts ~ Architectural acoustics ~ Blasting assessments and monitoring ~ Noise management plans (NMP) ~ Sound level meter and noise logger sales and hire

EXECUTIVE SUMMARY

Global Acoustics was engaged by Ashton Coal Operations to conduct monthly noise monitoring for the Ashton Coal Project (ACP) in accordance with the relevant Project Approval, Environment Protection Licence (EPL), and Noise Management Plan (NMP).

Environmental noise monitoring described in this report was undertaken during the night of 14 January 2019. The survey purpose is to quantify and describe the existing acoustic environment at monitoring locations around the site and compare results with relevant limits.

Activities from ACP complied with the relevant project specific noise limits at all monitoring locations. during attended noise monitoring for January 2019. Criteria may not always be applicable due to meteorological conditions at the time of monitoring.

Global Acoustics Pty Ltd

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Appendices

1 INTRODUCTION

1.1 Background

Global Acoustics was engaged by Ashton Coal Operations to conduct environmental noise monitoring for the Ashton Coal Project (ACP). ACP is an underground mine located to the north-west of Camberwell, off the New England Highway.

Monthly attended noise monitoring is a requirement of the ACP Noise Management Plan (NMP). Monitoring described in this report was undertaken at three locations during the night period of 14 January 2019.

The survey purpose is to quantify and describe the existing acoustic environment at monitoring locations around the site and compare results with relevant limits.

1.2 Attended Noise Monitoring Locations

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

Table 1.1: ACP ATTENDED NOISE MONITORING LOCATIONS

Report Descriptor	Monitoring Location
N2	Camberwell Village (west)
N3	Camberwell Village (north-east)
N4	South of New England Highway

Figure 1: ACP Attended Noise Monitoring Locations

Source: ACP

1.3 Terminology & Abbreviations

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

Table 1.2: TERMINOLOGY & ABBREVIATIONS

Descriptor	Definition
L_A	The A-weighted root mean squared (RMS) noise level at any instant
L_{Amax}	The maximum A-weighted noise level over a time period or for an event
L_{A1}	The noise level which is exceeded for 1 per cent of the time
$L_{A1,1minute}$	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, which is approximately the average of the maximum noise levels
L_{A50}	The noise level which is exceeded for 50 per cent of the time
L_{A90}	The level exceeded for 90 percent of the time, which is approximately the average of the minimum noise levels. The L_{A90} level is often referred to as the "background" noise level and is commonly used to determine noise criteria for assessment purposes
L_{Amin}	The minimum A-weighted noise level over a time period or for an event
L_{Aeq}	The average noise energy during a measurement period
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
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
IA	Inaudible. When site-only noise is noted as IA, there was no noise from the source of interest audible at the monitoring location
NM	Not Measurable. If site-only noise is noted as NM, this means some noise from the source of interest was audible at low-levels, but could not be quantified
Day	This is the period 7:00am to 6:00pm
Evening	This is the period 6:00pm to 10:00pm
Night	This is the period 10:00pm to 7:00am

2 CONSENT & CRITERIA

2.1 Project Approval & Project Specific Criteria

The sections of the Project Approval relating to noise are reproduced in Appendix A. Different noise limits exist for ACP when open cut mining operations are not being undertaken. As this is currently the case, noise impact assessment criteria are outlined in Appendix 6 of the project approval (MOD 5) and are detailed in Table 2.1.

Table 2.1: ACP NOISE IMPACT ASSESSMENT CRITERIA

Descriptor	Day/Evening/Night Impact Assessment Criteria $L_{Aeq,15minute}$	Night Impact Assessment Criteria $L_{A1,1minute}$
N2	38/38/36	46
N3	38/38/36	46
N4	38/38/36	46

Appendix 8 of the Project Approval states:

> *Data collected for the purposes of determining compliance with the relevant conditions of this approval is to be excluded under the following meteorological conditions:*
>
> *a) during periods of rain or hail;*
>
> *b) average wind speed at microphone height exceeds 5 m/s;*
>
> *c) wind speeds greater than 3 m/s measures at 10 m above ground level; and*
>
> *d) temperature inversion conditions greater than 3°C/100m.*

This has been interpreted to mean that criteria used for determining compliance are not applicable under the above meteorological conditions.

2.2 Environment Protection Licence

ACP holds Environment Protection Licence (EPL) number 11879. The most recent license revision was issued on 17 August 2017. The relevant sections of the EPL relating to noise are reproduced in Appendix A.

2.3 Modifying Factors

The EPA 'Noise Policy for Industry' (NPfI, 2017) 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.

2.3.1 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.*

2.3.2 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 of 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

Noise monitoring was conducted at the monitoring locations in accordance with Australian Standard AS1055 'Acoustics, Description and Measurement of Environmental Noise' and relevant NSW EPA requirements. Meteorological data was obtained from ACP's weather stations; 'Repeater Weather Station' (M2) and 'Site 1 Weather Station' (M1). This allowed correlation of atmospheric parameters and measured noise levels. See Section 3.3 for further details on calculation method. Atmospheric condition measurement at ground level was also undertaken.

3.2 Attended Noise Monitoring

During this survey, attended monitoring was undertaken at three locations during night period, once at each location, were the duration of each measurement was 15 minutes.

Attended monitoring is preferred to the use of noise loggers when determining compliance with prescribed limits as it allows the most accurate determination of the contribution, if any, to measured noise levels by the source of interest, in this case ACP.

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 levels, for example L_{A10}, L_{A50} or L_{A90}. 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 or 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).

To avoid disturbance to residents, particularly during the night period, monitoring locations have been used to represent multiple residences. Suitable monitoring locations where noise levels are likely to be higher than those measured at the residence are chosen to take a conservative approach, as the direct measurement of noise 1 metre from the dwelling facades or within 30 metres of the residence is often impractical due to access requirements and the presence of dogs, air conditioners and other noise sources at the residences.

Received levels from various noise sources were noted during attended monitoring and particular attention was paid to the extent of ACP's contribution, if any, to measured levels. At each receptor location, the $L_{Aeq,15minute}$ for ACP (in the absence of any other noise) was measured directly, where possible, or determined by frequency analysis. Time variations of noise sources in each measurement, their temporal characteristics, are taken into account via statistical descriptors.

3.3 Vertical Temperature Gradient Estimation

Temperature inversion conditions have been determined using the direct measurement method outlined in Fact Sheet D of the NPfI.

Inversion strength based on the temperature differential between the two weather stations was calculated using the following formula:

Inversion strength = (upper height temp – lower height temp) x (100/[upper height – lower height]),

Where:

- Upper height temperature is the temperature measured at 10 metres above ground level at M2;
- Lower height temperature is the temperature measured at 10 metres above ground level at M1; and
- Upper height – lower height is the vertical difference between M2 and M1 (which is 73 metres).

Other meteorological data, such as wind speed, was sourced from M2.

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 ACP 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 ACP 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 ACP 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
- ACP 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 Noise Monitoring Equipment

Equipment used to measure environmental noise levels is detailed 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	30131882	14/03/2019
Pulsar 105 acoustic calibrator	78226	14/03/2019

4 RESULTS

4.1 Total Measured Noise Levels

Noise levels measured at each location during attended surveys are provided in Table 4.1. These noise levels are the result of many sounds reaching the sound level meter microphone during monitoring.

Table 4.1: MEASURED NOISE LEVELS – JANUARY 2019

Location	Start Date and Time	L_{Amax} dB	L_{A1} dB	L_{A10} dB	L_{A50} dB	L_{Aeq} dB	L_{A90} dB	L_{Amin} dB	L_{Ceq} dB
N2	14/01/2019 22:39	60	54	51	43	46	38	35	59
N3	14/01/2019 22:22	55	49	45	40	42	37	33	59
N4	14/01/2019 22:00	53	45	41	38	39	36	33	60

Notes:

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

4.2 Modifying Factors

Measured ACP only levels were assessed for the applicability of modifying factors in accordance with the EPA's 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.

4.3 Attended Noise Monitoring

Table 4.2 compares measured $L_{Aeq,15minute}$ levels from ACP with impact assessment criteria.

Table 4.2: $L_{Aeq,15minute}$ GENERATED BY ACP AGAINST IMPACT ASSESSMENT CRITERIA – JANUARY 2019

Location	Start Date and Time	Wind Speed m/s	VTG °C/100m	Criterion dB	Criterion Applies?[1,2]	ACP L_{Aeq} dB[3]	Exceedance[4]
N2	14/01/2019 22:39	2.4	-0.7	36	Yes	IA	Nil
N3	14/01/2019 22:22	2.5	-0.5	36	Yes	IA	Nil
N4	14/01/2019 22:00	2.8	-1.1	36	Yes	IA	Nil

Notes:

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

Table 4.3 compares measured $L_{A1,1minute}$ levels from ACP with impact assessment criteria.

Table 4.3: $L_{A1,1minute}$ GENERATED BY ACP AGAINST IMPACT ASSESSMENT CRITERIA – JANUARY 2019

Location	Start Date and Time	Wind Speed m/s	VTG °C/100m	Criterion dB	Criterion Applies?[1,2]	ACP $L_{A1,1min}$ dB[3]	Exceedance[4]
N2	14/01/2019 22:39	2.4	-0.7	46	Yes	IA	Nil
N3	14/01/2019 22:22	2.5	-0.5	46	Yes	IA	Nil
N4	14/01/2019 22:00	2.8	-1.1	46	Yes	IA	Nil

Notes:

1. *Criterion may or may not apply due to rounding of meteorological data values;*
2. *Noise emission limits do not apply during the following meteorological conditions: periods of rain or hail, wind speeds greater than 3 metres per second (at a height of 10 metres); or temperature inversion conditions greater than 3°C/100m;*
3. *Estimated or measured $L_{A1,1minute}$ attributed to ACP; and*
4. *NA in exceedance column means atmospheric conditions outside conditions specified in development consent and so criterion is not applicable.*

4.4 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 or hail.

Table 4.4: MEASURED ATMOSPHERIC CONDITIONS – JANUARY 2019

Location	Start Date and Time	Temperature Degrees	Wind Speed m/s	Wind Direction Degrees[1]	Cloud Cover Eighths
N2	14/01/2019 22:39	28	0.0	-	0
N3	14/01/2019 22:22	28	0.7	140	0
N4	14/01/2019 22:00	28	0.6	120	0

Notes:

1. *"-" indicates calm conditions at 1.8 metres.*

Meteorological data sourced from both ACP weather stations was used to determine compliance with specified noise criteria.

5 SUMMARY OF COMPLIANCE

Global Acoustics was engaged by Ashton Coal Operations to conduct noise monitoring for the Ashton Coal Project in accordance with Project Approval, EPL and NMP.

The following summaries apply to attended noise monitoring conducted during the night period on 14 January 2019.

Activities from ACP complied with the relevant development consent noise limits during attended noise monitoring for January 2019 at all monitoring locations. Criteria may not always be applicable due to meteorological conditions at the time of monitoring.

Global Acoustics Pty Ltd

APPENDIX

A STATUTORY REQUIREMENTS

A.1 ASHTON COAL OPERATIONS PROJECT APPROVAL

Relevant sections of Project Approval (modification 5) are reproduced below.

APPENDIX 6
ALTERNATE NOISE CONDITIONS

NOISE

Application

1. Conditions 2 to 3 below have effect during times when open cut mining operations are not being undertaken at the Ashton Mine Complex, in the opinion of the Secretary.

Noise Criteria

2. Except for the noise-affected land in Table 1 of Schedule 3, the Applicant must ensure that the noise generated by the development does not exceed the criteria in Table 1 at any residence on privately-owned land or on more than 25 per cent of any privately-owned land.

Table 1: Noise Criteria dB(A)

Receiver No.	Receiver	Day ($L_{Aeq\ (15min)}$)	Evening ($L_{Aeq\ (15min)}$)	Night ($L_{Aeq\ (15min)}$)	Night ($L_{A1\ (1\ min)}$)
-	All privately-owned land	38	38	36	46

Noise generated by the development is to be measured in accordance with the relevant requirements of the *NSW Industrial Noise Policy*. Appendix 8 sets out the requirements for evaluating compliance with these criteria.

However, these noise criteria do not apply if the Applicant has an agreement with the relevant owner/s of the residence/land to generate higher noise levels, and the Applicant has advised the Department in writing of the terms of this agreement.

Additional Noise Mitigation Measures

3. Upon receiving a written request from the owner of any residence on any privately-owned land where subsequent operational noise monitoring shows the noise generated by the development exceeds the noise limits in Table 2, the Applicant must implement additional reasonable and feasible noise mitigation measures (such as double glazing, insulation, and/or air conditioning) at the residence in consultation with the owner.

If within 3 months of receiving this request from the landowner, the Applicant and the landowner cannot agree on the measures to be implemented, or there is a dispute about the implementation of these measures, then either party may refer the matter to the Secretary for resolution.

Table 2: Additional Noise Mitigation Criteria dB(A) $L_{Aeq\ (15min)}$

Receiver No.	Receiver	Day ($L_{Aeq\ (15min)}$)	Evening ($L_{Aeq\ (15min)}$)	Night ($L_{Aeq\ (15min)}$)
-	All privately-owned land	38	38	38

Notes:

- *Noise generated by the development is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.*
- *For this condition to apply, the exceedance of the criteria must be systemic.*

APPENDIX 8
NOISE COMPLIANCE ASSESSMENT

Compliance Monitoring

1. Attended monitoring is to be used to evaluate compliance with the relevant conditions of this approval.

2. Data collected for the purposes of determining compliance with the relevant conditions of this approval is to be excluded under the following meteorological conditions:
   a) during periods of rain or hail;
   b) average wind speed at microphone height exceeds 5 m/s;
   c) wind speeds greater than 3 m/s measures at 10 m above ground level; and
   d) temperature inversion conditions greater than 3°C/100m.

3. Unless otherwise agreed with the Secretary, this monitoring is to be carried out in accordance with the relevant requirements relating for reviewing performance set out in the NSW Industrial Noise Policy (as amended from time to time), in particular the requirements relating to:
   a) monitoring locations for the collection of representative noise data;
   b) equipment used to collect noise data, and conformity with Australian Standards relevant to such equipment; and
   c) modifications to noise data collected, including for the exclusion of extraneous noise and/or penalties for modifying factors apart from adjustments for duration.

4. To the extent that there is any inconsistency between the Industrial Noise Policy and the requirements set out in this Appendix, the Appendix prevails to the extent of the inconsistency.

Determination of Meteorological Conditions

5. Except for wind speed at microphone height, the data to be used for determining meteorological conditions shall be that recorded by the meteorological station located in the vicinity of the site (as required by condition 18 of Schedule 3).

A.2 ASHTON COAL OPERATIONS ENVIRONMENT PROTECTION LICENCE

Relevant sections of EPL 11879 are reproduced below.

L2 Noise limits

L2.1 Noise from the premises must not exceed the limits specified in the table below:

Location	Day LAeq(15 minute)	Evening LAeq(15 minute)	Night LAeq(15 minute)	Night LAeq(1 minute)
Any residence not owned by the licensee or not subject to an agreement between the licensee and the residence owner as to an alternative noise limit.	38	38	36	46

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

L2.3 Noise from the premises must be measured at the most affected point on or within the residential boundary or at the most affected point within 30m of the dwelling where the dwelling is more than 30m from boundary to determine compliance with the LAeq(15 minute) noise limits in condition L2.1. Where it can be demonstrated that direct measurement of noise from the premises is impractical, the EPA may accept alternative means of determining compliance. See Chapter 11 of the NSW Industrial Noise Policy. The modification factors presented in Section 4 of the NSW Industrial Noise Policy shall also be applied to the measured noise level where applicable.

L2.4 Noise from the premises is to be measured or computed at 1m from the dwelling facade to determine compliance with condition L2.1 (LA1 (1 minute) noise limit).

L2.5 The noise emission limits identified in condition L2.1 apply under the following meteorological conditions:

a) wind speeds up to 3m/s at 10m above ground level; and
b) temperature inversion conditions up to 3oC/100m.

L2.6 Open cut mining activities must only be carried out between the hours of 0700 and 2200 Monday to Saturday, and 0800 and 2200 on Sundays and Public Holidays.

APPENDIX

B CALIBRATION CERTIFICATES

Acoustic Research Labs Pty Ltd
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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 C17126

Client Details	Global Acoustics Pty Ltd 12/16 Huntingdale Drive Thornton NSW 2322
Equipment Tested/ Model Number :	Rion NA-28
Instrument Serial Number :	30131882
Microphone Serial Number :	04739
Pre-amplifier Serial Number :	11942

Pre-Test Atmospheric Conditions		Post-Test Atmospheric Conditions	
Ambient Temperature :	22.4°C	**Ambient Temperature :**	22.6°C
Relative Humidity :	55.6%	**Relative Humidity :**	58.1%
Barometric Pressure :	99.91kPa	**Barometric Pressure :**	99.85kPa

Calibration Technician :	Vicky Jaiswal	**Secondary Check:**	Riley Cooper
Calibration Date :	14/03/2017	**Report Issue Date :**	15/03/2017

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 61672-3:2006, for the environmental conditions under which the tests were performed.

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

Least Uncertainties of Measurement -

Acoustic Tests		Environmental Conditions	
31.5 Hz to 8kHz	*±0.16dB*	*Temperature*	*±0.05°C*
12.5kHz	*±0.2dB*	*Relative Humidity*	*±0.46%*
16kHz	*±0.29dB*	*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.

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

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

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.

PAGE 1 OF 1

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Sound Calibrator

IEC 60942-2004

Calibration Certificate

Calibration Number C17127

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

Equipment Tested/ Model Number : Pulsar 105
Instrument Serial Number : 78226

Atmospheric Conditions
Ambient Temperature : 22.3°C
Relative Humidity : 55.6%
Barometric Pressure : 99.9kPa

Calibration Technician : Vicky Jaiswal
Calibration Date : 14/03/2017
Secondary Check: Riley Cooper
Report Issue Date : 15/03/2017

Approved Signatory : Ken Williams

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

	Nominal Level	Nominal Frequency	Measured Level	Measured Frequency
Measured Output	94.0	1000.0	94.1	1000.32

The sound calibrator has been shown to conform to the class 1 requirements for periodic testing, described in Annex B of IEC 60942:2004 for the sound pressure level(s) and frequency(ies) stated, for the environmental conditions under which the tests were performed.

Least Uncertainties of Measurement -

Specific Tests		Environmental Conditions	
Generated SPL	*±0.11dB*	*Temperature*	*±0.05°C*
Short Term Fluct.	*±0.02dB*	*Relative Humidity*	*±0.46%*
Frequency	*±0.01%*	*Barometric Pressure*	*±0.017kPa*
Distortion	*±0.5%*		

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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PAGE 1 OF 1

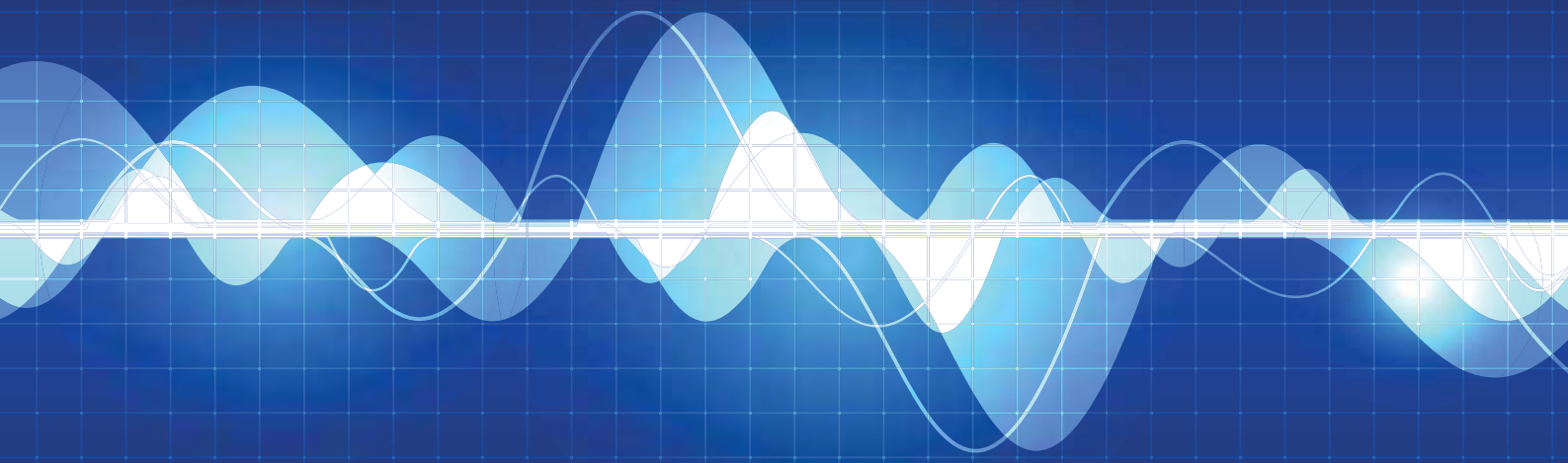
Appendix B

Monthly attended noise monitoring report - February 2019

Ashton Coal

Monthly attended noise monitoring
February 2019

Prepared for Ashton Coal Operations Pty Ltd
March 2019



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Ashton Coal

Monthly attended noise monitoring - February 2019

Prepared for Ashton Coal Operations Pty Ltd
March 2019

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Ashton Coal

Monthly attended noise monitoring - February 2019

Report Number

H190081 RP2

Client

Ashton Coal Operations Pty Ltd

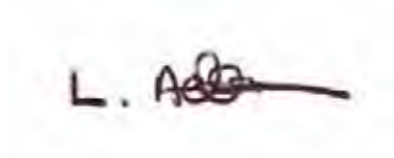
Date

20 March 2019

Version

v1-0 Final

Prepared by



Lucas Adamson
Acoustic Consultant
20 March 2019

Approved by

Najah Ishac
Director
20 March 2019

This report has been prepared in accordance with the brief provided by the client and has relied upon the information collected at the time and under the conditions specified in the report. All findings, conclusions or recommendations contained in the report are based on the aforementioned circumstances. The report is for the use of the client and no responsibility will be taken for its use by other parties. The client may, at its discretion, use the report to inform regulators and the public.

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Table of Contents

Figures

1 Introduction

EMM Consulting Pty Limited (EMM) was engaged to complete monthly attended noise surveys on behalf of Ashton Coal Operations Pty Ltd (Ashton Coal).

The purpose of the monitoring was to address requirements of the Ashton Coal Noise Management Plan (NMP), prepared to satisfy the requirements of the development consent DA 309-11-2001-I (DC) and Environment Protection License (EPL) 11879.

This report presents the results and findings of attended noise monitoring conducted on 25 February 2019.

The following material was referenced as part of this assessment:

- Department of Planning and Environment (DPE), Development Consent 309-11-2001-I, as modified on 20 June 2016 (current as of 20 March 2019);
- Environment Protection Authority (EPA), Environment Protection License 11879, as varied on 17 August 2017 (current as of 20 March 2019);
- Ashton Coal Project Noise Management Plan (NMP), approved by DPE on 10 October 2017;
- NSW EPA, Industrial Noise Policy (INP), 2000;
- NSW EPA, Industrial Noise Policy Application notes, 2017; and
- NSW EPA, Noise Policy for Industry (NPfI), 2017.

2 Glossary of acoustic terms

Several technical terms are discussed in this report. These are explained in Table 2.1.

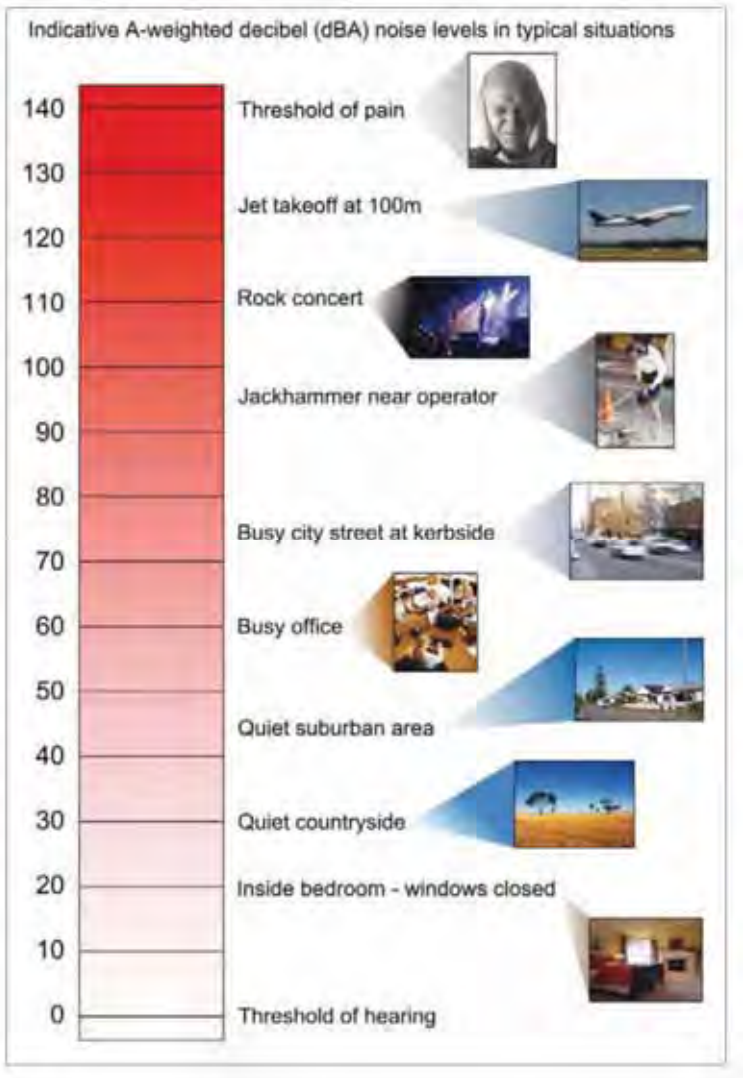
Table 2.1 Glossary of acoustic terms

Term	Description
dB	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.
L_{A1}	The 'A-weighted' noise level which is exceeded 1% of the time.
$L_{A1,1\ minute}$	The 'A-weighted' noise level exceeded for 1% of the specified time period of 1 minute.
L_{A10}	The 'A-weighted' noise level which is exceeded 10% of the time. It is approximately equivalent to the average of maximum noise level.
L_{A90}	Commonly referred to as the background noise level. The 'A-weighted' noise level exceeded 90% of the time.
L_{Aeq}	The energy average noise from a source. This is the equivalent continuous 'A-weighted' sound pressure level over a given period. The $L_{Aeq,15\ minute}$ descriptor refers to an L_{Aeq} noise level measured over a 15-minute period.
L_{Amin}	The minimum 'A-weighted' noise level received during a measuring interval.
L_{Amax}	The maximum root mean squared 'A-weighted' sound pressure level (or maximum noise level) received during a measuring interval.
L_{Ceq}	The equivalent continuous 'C-weighted' sound pressure level over a given period. The $L_{Ceq,15\ minute}$ descriptor refers to an L_{Ceq} noise level measured over a 15 minute period. C-weighting can be used to measure low frequency noise.
Day period	Monday – Saturday: 7 am to 6 pm, on Sundays and Public Holidays: 8 am to 6 pm.
Evening period	Monday – Saturday: 6 pm to 10 pm, on Sundays and Public Holidays: 6 pm to 10 pm.
Night period	Monday – Saturday: 10 pm to 7 am, on Sundays and Public Holidays: 10 pm to 8 am.
Temperature inversion	A meteorological condition where the atmospheric temperature increases with altitude.

It is useful to have an appreciation of decibels (dB), the unit of noise measurement. Table 2.2 gives an indication as to what an average person perceives about changes in noise levels. Examples of common noise levels are provided in Figure 2.1.

Table 2.2 Perceived change in noise

Change in sound pressure level (dB)	Perceived change in noise in surrounding environment
up to 2	not perceptible
3	just perceptible
5	noticeable difference
10	twice (or half) as loud
15	large change
20	four times (or quarter) as loud



Source: Road Noise Policy (Department of Environment, Climate Change and Water 2011)

Figure 2.1 Common noise levels

3 Noise limits

3.1 Operational and sleep disturbance noise limits

Ashton Coal noise limits are provided in Table 1, Condition 2 of Appendix 6 of the Development Consent (DC) and Condition L2.1 of the EPL. Extracts of the relevant sections of the DC and EPL pertaining to noise are provided in Appendix A and B, respectively. The approved NMP adopts three attended noise monitoring locations that are representative of residences outlined in the DC. The noise monitoring locations and relevant criteria are summarised in Table 3.1.

Table 3.1 Noise impact assessment criteria

Monitoring location	Day $L_{Aeq,15\ minute}$, dB	Evening $L_{Aeq,15\ minute}$, dB	Night $L_{Aeq,15\ minute}$, dB	Night $L_{A1,1\ minute}$, dB
N2	38	38	36	46
N3	38	38	36	46
N4	38	38	36	46

The DC specifies the following meteorological conditions under which noise limits do not apply which are also consistent with those provided in the EPL:

- during period of rain or hail;
- average wind speed at microphone height exceeds 5 m/s;
- wind speeds greater than 3 m/s at 10 metres above ground level; and
- temperature inversion conditions greater than 3°C/100m.

For this assessment, the recorded L_{Amax} has been used as a conservative estimate of the $L_{A1,1\ minute}$. The INP application notes state that the EPA accepts sleep disturbance analysis based on either the $L_{A1,1\ minute}$ or L_{Amax} metrics (EPA 2013), with use of L_{Amax} resulting in a more conservative assessment.

The DC and EPL state that modification factor corrections in the application notes to the INP (2017) shall be applied to the measured mine noise levels where applicable. The application notes to the INP state that Fact Sheet C of the NPfI (EPA 2017) now applies regarding the application of modifying factors.

3.2 Cumulative noise criteria

Ashton Coal cumulative noise limits are provided in Condition 5 and Condition 6 of Schedule 3 of the DC. An extract of the conditions relevant to cumulative noise criteria is provided here.

> 5. The Applicant must implement all reasonable and feasible measures to ensure that the noise generated by the Ashton Mine Complex combined with the noise generated by other mines in the vicinity does not exceed the criteria in Table 4 at any residence on any privately-owned land or on more than 25 per cent of any privately-owned land (except for the noise affected residential receivers in Table 1

Table 4: Cumulative Noise Criteria dB(A) $L_{Aeq\ (period)}$

Location	Day	Evening	Night
Camberwell Village	55	45	40
All other privately-owned land	50	45	40

Cumulative noise is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.

6. If the cumulative noise generated by the Ashton Mine Complex combined with the noise generated by other coal mines in the vicinity exceeds the criteria in Table 5 at any residence on privately-owned land or more than 25 per cent of any privately-owned land (except for the noise-affected residential receivers ion Table 1), then upon receiving a written request from the landowner, the Applicant must, together with the relevant mines, acquire the land on as equitable basis as possible, in accordance with the procedures in conditions 7 and 8 of schedule 4.

Table 5: Cumulative Noise Acquisition Criteria dB(A) $L_{Aeq\ (period)}$

Location	Day	Evening	Night
Camberwell Village	60	50	45
All other privately-owned land	55	50	45

Cumulative noise is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.

3.3 Low frequency noise criteria

Condition 3 of Appendix 8 of the DC and L2.3 of the EPL state that noise generated by Ashton Coal is to be measured in accordance with the relevant requirements of the INP. The INP application notes state that Section 4 of the INP has been withdrawn and the modifying factor adjustments outlined in Fact Sheet C of the NPfI are to be used when assessing the characteristics of a noise source.

Fact sheet C of the NPfI (EPA 2017) provides guidelines for applying modifying factor corrections to account for low frequency noise emissions. The NPfI specifies that a difference of 15 dB or more between site 'C-weighted' and site 'A-weighted' noise emission levels identifies the potential for an unbalanced spectrum and potential increased annoyance.

Where a difference of 15 dB or more between site 'C-weighted' and site 'A-weighted' noise emission levels is identified, the one-third octave noise levels recorded should be compared to the values in Table C2 of the NPfI (EPA 2017), which has been reproduced in Table 3.2 below.

Table 3.2 One-third octave low-frequency noise thresholds

	One-third octave $L_{Zeq,15\ minute}$ 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

The following modifying factor correction is to be applied where the site ‘C-weighted' and site ‘A-weighted' noise emission level is 15 dB or more and:

- where any of the one-third octave noise levels in Table 3.2 are exceeded by up to and including 5 dB and cannot be mitigated, a 2 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period; or

- where any of the one-third octave noise levels in Table 3.2 are exceeded by more than 5 dB and cannot be mitigated, a 5 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period.

Hence, where possible throughout each survey the operator has estimated the difference between site ‘C-weighted' and site ‘A-weighted' noise emission levels by matching audible sounds with the response of the analyser (L_{Ceq}-L_{Aeq}). Where this was deemed to be 15 dB or greater, the measured one-third octave frequencies have been compared to the values in Table 3.2 to identify the relevant modifying factor correction (if applicable). This method has been applied to this assessment as presented in Section 5.

It is of note that the NPfI (EPA 2017) states that low-frequency noise corrections only apply under the standard or noise-enhancing (i.e. applicable) meteorological conditions.

4 Assessment methodology

4.1 Attended noise monitoring

To quantify noise emissions from Ashton Coal, 15-minute attended noise monitoring surveys were completed at representative locations as per the approved NMP.

Noise monitoring locations as per the NMP and their coordinates are listed in Table 4.1 and are shown in Figure 4.1.

Table 4.1 Attended noise monitoring locations

Monitoring location	Description	MGA56	
		Easting	Northing
N2	Camberwell Village (west)	320297	6405670
N3	Camberwell Village (north east)	320554	6405839
N4	South of New England Highway	319776	6404101

Attended noise monitoring is scheduled to be “unannounced” and is completed without Ashton Coal’s knowledge to be completely independent of the site. Notwithstanding, noise monitoring is avoided during any scheduled down-time or major maintenance. Regular operations were occurring during this round of noise monitoring.

Where possible throughout each survey, the operator has quantified the contribution of each significant noise source. This was done by matching audible sounds with the response of the analyser (where applicable) and/or via post-analysis of data (e.g. low pass filtering).

4.2 Instrumentation

A Brüel & Kjær 2250 Type 1 sound analyser (s/n 2759405) was used to conduct 15-minute attended measurements and record 1/3 octave frequency and statistical noise indices. The sound analysers were calibrated before and on completion of the survey using a Brüel & Kjær Type 4230 calibrator (s/n 1276091). The instrumentation’s calibration certificates are provided in Appendix C.

Source: EMM (2019); DFSI (2017); GA (2011)

0 1 2 km

GDA 1994 MGA Zone 56

N

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KEY

- Site boundary
- Noise monitoring location
- Meteorological station
- Rail line
- Main road
- Local road
- Watercourse/drainage line
- Cadastral boundary

Noise monitoring locations and Ashton colliery boundary

Ashton Coal
Monthly attended noise monitoring
Figure 4.1

EMM
creating opportunities

4.3 Attended monitoring exceedance procedure

Ashton Coal has developed an attended monitoring exceedance procedure that is to be implemented if measurements show Ashton Coal noise emissions are above the relevant noise criteria. The following section describes the general approach of the exceedance procedure and whether the meteorological conditions were suitable or unsuitable at the time of the attended measurement.

This response plan is implemented if site noise levels are determined to be above the relevant noise criteria and when noise limits are applicable due to suitable meteorological conditions. The following noise management initiatives are implemented:

- Consultant will record the reading and advise Ashton Coal of the exceedance. Ashton Coal will implement remedial action as required;
- A follow up measurement is to be conducted (within 75 minutes after the first measurement and no earlier than 10 pm)
- If the follow up measurement indicates that site noise levels are above the relevant noise criteria and when noise limits are applicable, the consultant will record the result, note the site has failed and is deemed a 'noise affected night' at that location. An additional monitoring test should be scheduled to be undertaken at the same location within one week and move on to the next monitoring location.
- If the follow up measurement indicates that site noise levels are below the relevant noise criteria and when noise limits are applicable, the consultant will record the result, note the site has passed, schedule an additional monitoring test to be undertaken at the location within one week and move on to the next monitoring location.

4.4 Determination of stability category

This assessment determined the stability categories throughout the attended monitoring period using the direct measurement method as per Fact Sheet D of the NPfI (EPA 2017).

The temperature lapse rate between the two weather stations (M1 – Sentinex Unit 40 located in Camberwell Village and M2 – Ashton Coal 'repeater' meteorological station located in the north eastern open cut (NEOC) area) was calculated using the following formula:

$$\textit{Temperature lapse rate} = (\Delta T) \times (100/(\Delta H))$$

Where:

- ΔT = temperature measured at M2 (at 10 metres above ground level) minus temperature measured at M1 (at 10 metres above ground level); and
- ΔH = the vertical height difference between M2 and M1 (equal to 73 metres).

Table D2 of the NPfI (EPA 2017 is reproduced in Table 4.2 and presents the stability categories and associated ranges in temperature lapse rates.

Table 4.2 Stability categories and temperature lapse rates

Stability category	Temperature lapse rate (ΔT) (°C/100 m)
A	$\Delta T < -1.9$
B	$-1.9 \leq \Delta T < -1.7$
C	$-1.7 \leq \Delta T < -1.5$
D	$-1.5 \leq \Delta T < -0.5$
E	$-0.5 \leq \Delta T < 1.5$
F	$1.5 \leq \Delta T < 4.0$
G	$\Delta T \geq 4.0$

Source: NPfI (EPA 2017).

Other meteorological data, such as wind speed, has been sourced directly from meteorological station M2.

5 Review of data and discussion

5.1 Summary

Results of attended noise measurements are summarised in Table 5.1. Ashton Coal contribution and total mine noise were determined for each survey using in-field observations and post-analysis of data as required (e.g. removing higher frequencies that are not mine related i.e. above 630 Hz). Attended monitoring was completed on 25 February 2019.

The meteorological data for the monitoring period was sourced from Ashton Coal's two weather stations (M1 and M2) to determine applicability of criteria in accordance with the DC and EPL. Noise limits were applicable during all of the three measurements.

Low frequency noise was conservatively assessed by comparison of the total measured one-third octave L_{Aeq} noise levels to the NPfI one-third octave low-frequency noise thresholds. Measured noise levels did not exceed the relevant LFN thresholds during any of the measurements. Therefore, in accordance with the NPfI, LFN modifying factors were found to be not relevant and hence were not applied to estimated site noise levels at any of the locations.

Monitoring identified that site noise was inaudible at all three monitoring locations. Typically, when a particular source is not audible above local ambient noise levels, the likely contribution of that source is generally at least 10 dB below the measured background (L_{A90}) level.

Table 5.1 Ashton Coal attended noise monitoring results – February 2019

Location	Date	Start time	Total noise levels, dB							Site contributions, dB			Noise limits, dB		Meteorological conditions[3] limits apply (Y/N)	Exceedance, dB	Comments
			L_{Amin}	L_{A90}	L_{Aeq}	L_{A10}	L_{A1}	L_{Amax}	L_{Ceq}	LFN mod. factor[1]	L_{Aeq}	L_{Amax}[2]	L_{Aeq}	L_{Amax}[2]			
N2	25/2	22:00	33	35	47	51	56	59	55	Nil	IA	IA	36	46	2.8 m/s @ 126 D class stability -1.2°C/100m VTG Y	Nil	Site noise inaudible. Neighbouring mines and insects consistently audible. Traffic on the New England Highway frequently audible. Nearby animals, train horns and a train on the main line (unrelated to Ashton Coal) occasionally audible.
N3	25/2	22:19	29	33	38	41	43	51	54	Nil	IA	IA	36	46	2.5 m/s @ 125 D class stability -1.2°C/100m VTG Y	Nil	Site noise inaudible. Neighbouring mines and insects consistently audible. Traffic on the New England Highway frequently audible. Nearby animals, wind in foliage, resident noise, distant dogs barking, train horns and a train on the main line (unrelated to Ashton Coal) occasionally audible.
N4	25/2	22:42	28	32	39	42	47	54	59	Nil	IA	IA	36	46	2.4 m/s @ 117 D class stability -1.1°C/100m VTG Y	Nil	Site noise inaudible. Neighbouring mine and powerline hum consistently audible. Traffic on the New England Highway frequently audible. Nearby animals, wind in foliage, resident noise, train and distant dogs barking occasionally audible.

Notes:
1. Modifying factor correction for low frequency noise in accordance with fact sheet C of the NPfI (refer Section 3.3).
2. For assessment purposes the L_{Amax} and the $L_{A1,1\ minute}$ are interchangeable.
3. Meteorological data were taken as an average over 15 minutes from the Ashton Coal weather station M2 (Refer to Section 5.1).
4. IA = inaudible.
5. N/A = not applicable.

5.2 N2 — Camberwell Village (west)

Ashton Coal operations were inaudible during the whole of the operator-attended noise survey. Given this and the measured background noise level of L_{A90} 35 dB, Ashton Coal $L_{Aeq,15\ minute}$ noise contributions complied with the noise limits. Other ambient noise sources included neighbouring mines, insects, traffic on the New England Highway, nearby animals, train horns and a train on the main line (unrelated to Ashton Coal).

Neighbouring mining operations were consistently audible during the operator-attended noise survey at monitoring location N2. The total cumulative mine noise contribution was estimated to be $L_{Aeq,15\ minute}$ <31 dB which is below the cumulative mine night-time noise criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was likely to be below the cumulative mine noise criterion.

5.3 N3 – Camberwell Village (north east)

Ashton Coal operations were inaudible during the whole of the operator-attended noise survey. Given this and the measured background noise level of L_{A90} 33 dB, Ashton Coal $L_{Aeq,15\ minute}$ noise contributions complied with the noise limits. Other ambient noise sources included neighbouring mines, insects, traffic on the New England Highway, nearby animals, resident noise, wind in foliage, distant dogs barking, train horns and a train on the main line (unrelated to Ashton Coal).

Neighbouring mining operations were consistently audible during the operator-attended noise survey at monitoring location N3. The total cumulative mine noise contribution was estimated to be $L_{Aeq,15\ minute}$ <30 dB which is below the cumulative mine night-time noise criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was likely to be below the cumulative mine noise criterion.

5.4 N4 – South of New England Highway

Ashton Coal operations were inaudible during the whole of the operator-attended noise survey. Given this and the measured background noise level of L_{A90} 32 dB, Ashton Coal $L_{Aeq,15\ minute}$ noise contributions complied with the noise limits. Other ambient noise sources included a neighbouring mine, traffic on the New England Highway, power line hum, nearby animals and distant dogs barking.

Neighbouring mining operations were occasionally audible during the operator-attended noise survey at monitoring location N4. The total cumulative mine noise contribution was estimated to be $L_{Aeq,15\ minute}$ <30 dB which is below the cumulative mine night-time noise criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was likely to be below the cumulative mine noise criterion.

6 Conclusion

EMM has completed a review of mine noise from Ashton Coal within the surrounding community based on attended measurements conducted on 25 February 2019.

The applicability of noise limits was assessed with reference to Ashton Coal's two meteorological stations (M1 and M2) located to the east of the site. In accordance with the DC and EPL, noise limits were applicable during all three measurements.

The assessment of noise contributions from site included consideration of modifying factors for noise characteristics where relevant and in accordance with the INP.

Ashton Coal noise contributions and cumulative mine noise contributions were below (satisfied) the relevant noise limits at all monitoring locations for this round of monitoring.

References

Ashton Coal Noise Management Plan, 2017.

NSW Department of Planning and Environment, Development Consent DA309-11-2001I, 2016).

NSW Environment Protection Authority, Environment Protection License 11879.

NSW Environment Protection Authority, Industrial Noise Policy, 2000.

NSW Environment Protection Authority, Industrial Noise Policy Application notes, 2017.

NSW Environment Protection Authority, Noise Policy for Industry, 2017.

Appendix A

Project approval extract

APPENDIX 6
ALTERNATE NOISE CONDITIONS

NOISE

Application

1. Conditions 2 to 3 below have effect during times when open cut mining operations are not being undertaken at the Ashton Mine Complex, in the opinion of the Secretary.

Noise Criteria

2. Except for the noise-affected land in Table 1 of Schedule 3, the Applicant must ensure that the noise generated by the development does not exceed the criteria in Table 1 at any residence on privately-owned land or on more than 25 per cent of any privately-owned land.

Table 1: Noise Criteria dB(A)

Receiver No.	Receiver	Day ($L_{Aeq\ (15min)}$)	Evening ($L_{Aeq\ (15min)}$)	Night ($L_{Aeq\ (15min)}$)	Night ($L_{A1\ (1\ min)}$)
-	All privately-owned land	38	38	36	46

Noise generated by the development is to be measured in accordance with the relevant requirements of the *NSW Industrial Noise Policy*. Appendix 3 sets out the requirements for evaluating compliance with these criteria.

However, these noise criteria do not apply if the Applicant has an agreement with the relevant owner/s of the residence/land to generate higher noise levels, and the Applicant has advised the Department in writing of the terms of this agreement.

Additional Noise Mitigation Measures

3. Upon receiving a written request from the owner of any residence on any privately-owned land where subsequent operational noise monitoring shows the noise generated by the development exceeds the noise limits in Table 2, the Applicant must implement additional reasonable and feasible noise mitigation measures (such as double glazing, insulation, and/or air conditioning) at the residence in consultation with the owner.

If within 3 months of receiving this request from the landowner, the Applicant and the landowner cannot agree on the measures to be implemented, or there is a dispute about the implementation of these measures, then either party may refer the matter to the Secretary for resolution.

Table 2: Additional Noise Mitigation Criteria dB(A) $L_{Aeq\ (15min)}$

Receiver No.	Receiver	Day ($L_{Aeq\ (15min)}$)	Evening ($L_{Aeq\ (15min)}$)	Night ($L_{Aeq\ (15min)}$)
-	All privately-owned land	38	38	38

Notes:

- *Noise generated by the development is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.*
- *For this condition to apply, the exceedance of the criteria must be systemic.*

APPENDIX 8
NOISE COMPLIANCE ASSESSMENT

Compliance Monitoring

1. Attended monitoring is to be used to evaluate compliance with the relevant conditions of this approval.

2. Data collected for the purposes of determining compliance with the relevant conditions of this approval is to be excluded under the following meteorological conditions:
   a) during periods of rain or hail;
   b) average wind speed at microphone height exceeds 5 m/s;
   c) wind speeds greater than 3 m/s measures at 10 m above ground level; and
   d) temperature inversion conditions greater than 3°C/100m.

3. Unless otherwise agreed with the Secretary, this monitoring is to be carried out in accordance with the relevant requirements relating for reviewing performance set out in the NSW Industrial Noise Policy (as amended from time to time), in particular the requirements relating to:
   a) monitoring locations for the collection of representative noise data;
   b) equipment used to collect noise data, and conformity with Australian Standards relevant to such equipment; and
   c) modifications to noise data collected, including for the exclusion of extraneous noise and/or penalties for modifying factors apart from adjustments for duration.

4. To the extent that there is any inconsistency between the Industrial Noise Policy and the requirements set out in this Appendix, the Appendix prevails to the extent of the inconsistency.

Determination of Meteorological Conditions

5. Except for wind speed at microphone height, the data to be used for determining meteorological conditions shall be that recorded by the meteorological station located in the vicinity of the site (as required by condition 18 of Schedule 3).

Appendix B

EPL extract

Environment Protection Licence

Licence - 11879

3	Ambient surface water monitoring	In Bowmans Creek near the New England Highway shown as point SM4 in Figure 4 dated 8/8/03 titled "EPA Surface Water Monitoring Sites"
4	Ambient surface water monitoring.	In Bowmans Creek near the proposed longwall panels shown as point SM5 in Figure 4 dated 8/8/03 titled "EPA Surface Water Monitoring Sites"
5	Ambient surface water monitoring	In Bowmans Creek at the Hunter River confluence shown as point SM6 in Figure 4 dated 8/8/03 titled "EPA Surface Water Monitoring Sites"
6	Ambient surface water monitoring.	In the Hunter River upstream of Bowmans Creek shown as point SM9 on Figure 4 dated 8/8/03 titled "EPA Surface Water Monitoring Sites".
7	Ambient surface water monitoring	In the Hunter River downstream of Bowmans Creek confluence shown as point SM10 on Figure 4 dated 8/8/03 titled "EPA Surface Water Monitoring Sites".
8	Groundwater monitoring	Locations shown on Figure 1A titled "Groundwater Monitoring Piezometer Locations for EPL" dated 26/10/06.

3 Limit Conditions

L1 Pollution of waters

L1.1 Except as may be expressly provided in any other condition of this licence, the licensee must comply with section 120 of the Protection of the Environment Operations Act 1997.

L2 Noise limits

L2.1 Noise from the premises must not exceed the limits specified in the table below:

Location	Day LAeq(15 minute)	Evening LAeq(15 minute)	Night LAeq(15 minute)	Night LAeq(1 minute)

Any residence not owned by the licensee or not subject to an agreement between the licensee and the residence owner as to an alternative noise limit.	38	38	36	46

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

L2.3 Noise from the premises must be measured at the most affected point on or within the residential boundary or at the most affected point within 30m of the dwelling where the dwelling is more than 30m from boundary to determine compliance with the LAeq(15 minute) noise limits in condition L2.1. Where it can be demonstrated that direct measurement of noise from the premises is impractical, the EPA may accept alternative means of determining compliance. See Chapter 11 of the NSW Industrial Noise Policy. The modification factors presented in Section 4 of the NSW Industrial Noise Policy shall also be applied to the measured noise level where applicable.

L2.4 Noise from the premises is to be measured or computed at 1m from the dwelling facade to determine compliance with condition L2.1 (LA1 (1 minute) noise limit).

L2.5 The noise emission limits identified in condition L2.1 apply under the following meteorological conditions:

a) wind speeds up to 3m/s at 10m above ground level; and
b) temperature inversion conditions up to 30C/100m.

L2.6 Open cut mining activities must only be carried out between the hours of 0700 and 2200 Monday to Saturday, and 0800 and 2200 on Sundays and Public Holidays.

L3 Blasting

L3.1 Blasting in or on the premises must only be carried out between 0900 hours and 1700 hours, Monday to Saturday. Blasting in or on the premises must not take place on Sundays or Public Holidays without the prior approval of the EPA.

L3.2 The overpressure level from blasting operations carried out in or on the premises must not:

a) exceed 115 dB(L) for more than 5% of the total number of blasts carried out on the premises within the 12 months annual reporting period; and
b) exceed 120 dB(L) at any time
at any residence or noise sensitive location (such as a school or hospital) that is not owned by the licensee or subject to a private agreement between the owner of the residence or noise sensitive location

Appendix C

Calibration certificates

CERTIFICATE OF CALIBRATION

CERTIFICATE NO: 24152

EQUIPMENT TESTED: Sound Level Calibrator

Manufacturer: B & K
Type No: 4230 **Serial No:** 1276091
Owner: EMM Consulting
Level 1, 146 Hunter Street
Newcastle, NSW 2300

Tests Performed: Measured output pressure level was found to be:

Parameter	Pre-Adj	Adj Y/N	Output: (db re 20 µPa)	Frequency: (Hz)	THD&N (%)
Level 1:	NA	N	93.81	989.84	1.58
Level 2:	NA	N	NA	NA	NA
Uncertainty:			±0.11 dB	±0.05%	±0.20 %
Uncertainty (at 95% c.l.) k=2					

CONDITION OF TEST:
Ambient Pressure: 1004 hPa ±1.5 hPa **Relative Humidity:** 47% ±5%
Temperature: 20 °C ±2° C
Date of Calibration: 14/02/2019 **Issue Date:** 15/02/2019
Acu-Vib Test Procedure: AVP02 (Calibrators)
Test Method: AS IEC 60942 - 2017
CHECKED BY: ..... **AUTHORISED SIGNATURE:** .....
Jack Kidt

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.
The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

NATA
ACCREDITATION
Accredited Lab. 9262
Acoustic and Vibration Measurements

ACU-VIB
ELECTRONICS
HEAD OFFICE
Unit 14, 22 Hudson Ave. Castle Hill NSW 2154
Tel: (02) 96808133 Fax: (02)96808233
Mobile: 0413 809806
Web site: www.acu-vib.com.au

CERTIFICATE OF CALIBRATION

CERTIFICATE NO.: **SLM 22129 & FILT 4384**

Equipment Description:	Sound Level Meter		
Manufacturer:	B & K		
Model No:	2250	**Serial No:**	2759405
Microphone Type:	4189	**Serial No:**	2888134
Filter Type:	1/3 Octave	**Serial No:**	2759405
Comments:	All tests passed for class 1. (See over for details)		
Owner:	EMGA Mitchell Mclennan Ground Floor, Suite 01, 20 Chandos St St Leonards NSW 2065		
Ambient Pressure:	1008 hPa ±1.5 hPa		
Temperature:	25 °C ±2° C	**Relative Humidity:**	48% ±5%
Date of Calibration:	07/02/2018	**Issue Date:**	09/02/2018

Acu-Vib Test Procedure: AVP10 (SLM) & AVP06 (Filters)

CHECKED BY: ..... **AUTHORISED SIGNATURE:** .....

Jack Kott

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.

NATA
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Accredited Lab. No. 9262
Acoustic and Vibration Measurements

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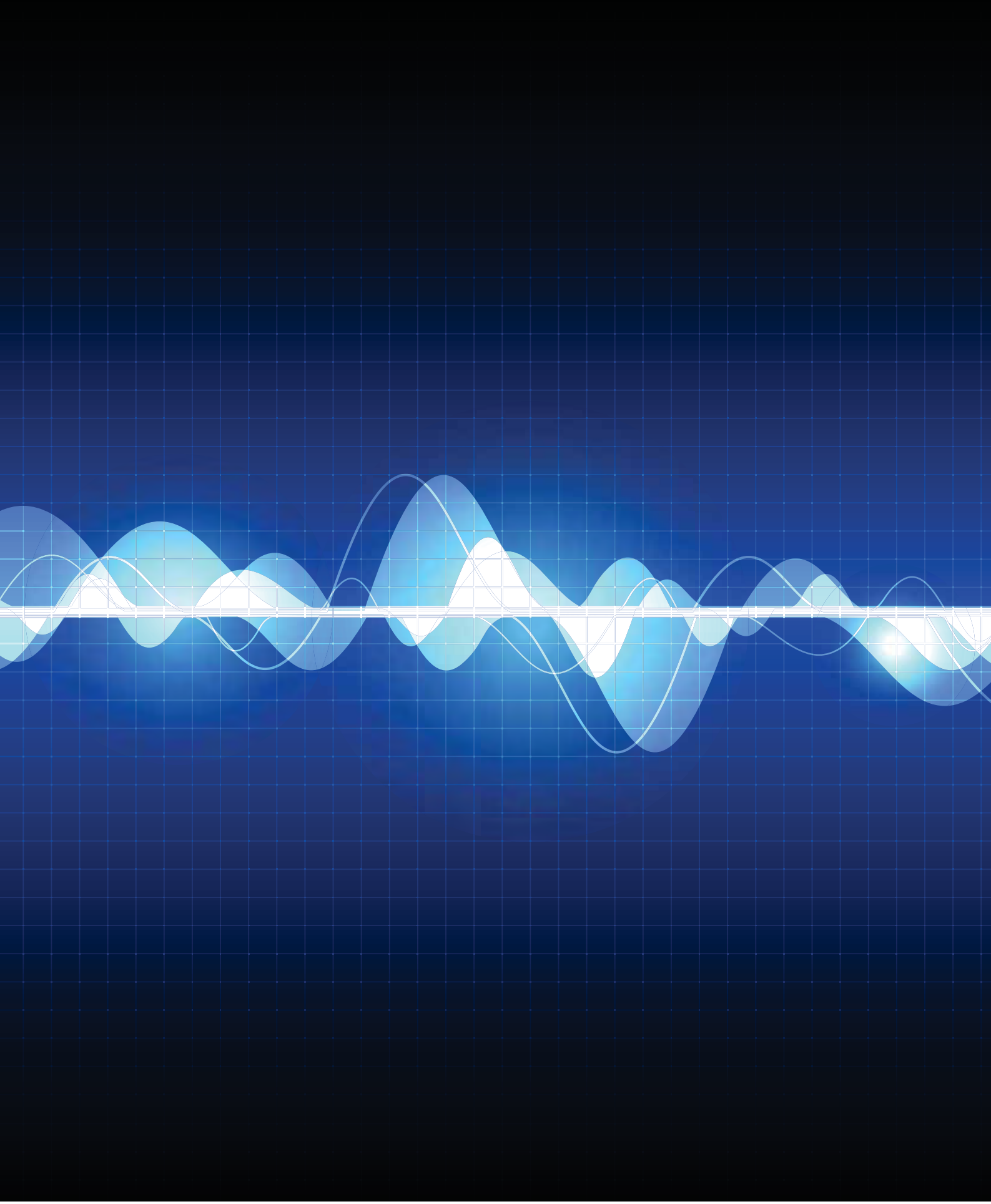


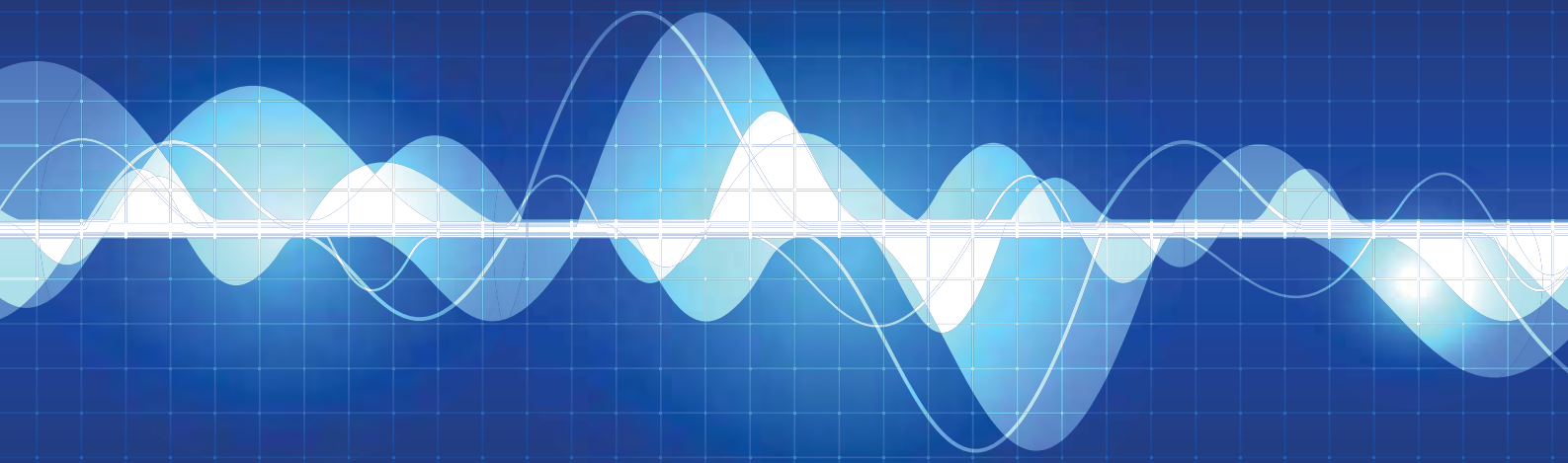
Appendix C

Monthly attended noise monitoring report - March 2019

Ashton Coal

Monthly attended noise monitoring
March 2019

Prepared for Ashton Coal Operations Pty Ltd
March 2019



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Ashton Coal

Monthly attended noise monitoring - March 2019

Prepared for Ashton Coal Operations Pty Ltd
March 2019

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Ashton Coal

Monthly attended noise monitoring - March 2019

Report Number

H190081 RP3

Client

Ashton Coal Operations Pty Ltd

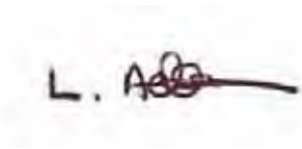
Date

22 March 2019

Version

v1-0 Final

Prepared by



Lucas Adamson
Acoustic Consultant
22 March 2019

Approved by

Najah Ishac
Director
22 March 2019

This report has been prepared in accordance with the brief provided by the client and has relied upon the information collected at the time and under the conditions specified in the report. All findings, conclusions or recommendations contained in the report are based on the aforementioned circumstances. The report is for the use of the client and no responsibility will be taken for its use by other parties. The client may, at its discretion, use the report to inform regulators and the public.

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Table of Contents

Appendices

Tables

Figures

1 Introduction

EMM Consulting Pty Limited (EMM) was engaged to complete monthly attended noise surveys on behalf of Ashton Coal Operations Pty Ltd (Ashton Coal).

The purpose of the monitoring was to address requirements of the approved Ashton Coal Noise Management Plan (NMP), prepared to satisfy the requirements of the Development Consent DA 309-11-2001-I (DC) and Environment Protection License (EPL) 11879.

This report presents the results and findings of attended noise monitoring conducted on 14 March 2019.

The following material was referenced as part of this assessment:

- Department of Planning and Environment (DPE), Development Consent 309-11-2001-I, as modified on 20 June 2016 (current as of 22 March 2019);
- Environment Protection Authority (EPA), Environment Protection License 11879, as varied on 17 August 2017 (current as of 22 March 2019);
- Ashton Coal Project Noise Management Plan (NMP), approved by DPE on 10 October 2017;
- NSW EPA, Industrial Noise Policy (INP), 2000;
- NSW EPA, Industrial Noise Policy Application notes, 2017; and
- NSW EPA, Noise Policy for Industry (NPfI), 2017.

2 Glossary of acoustic terms

Several technical terms are discussed in this report. These are explained in Table 2.1.

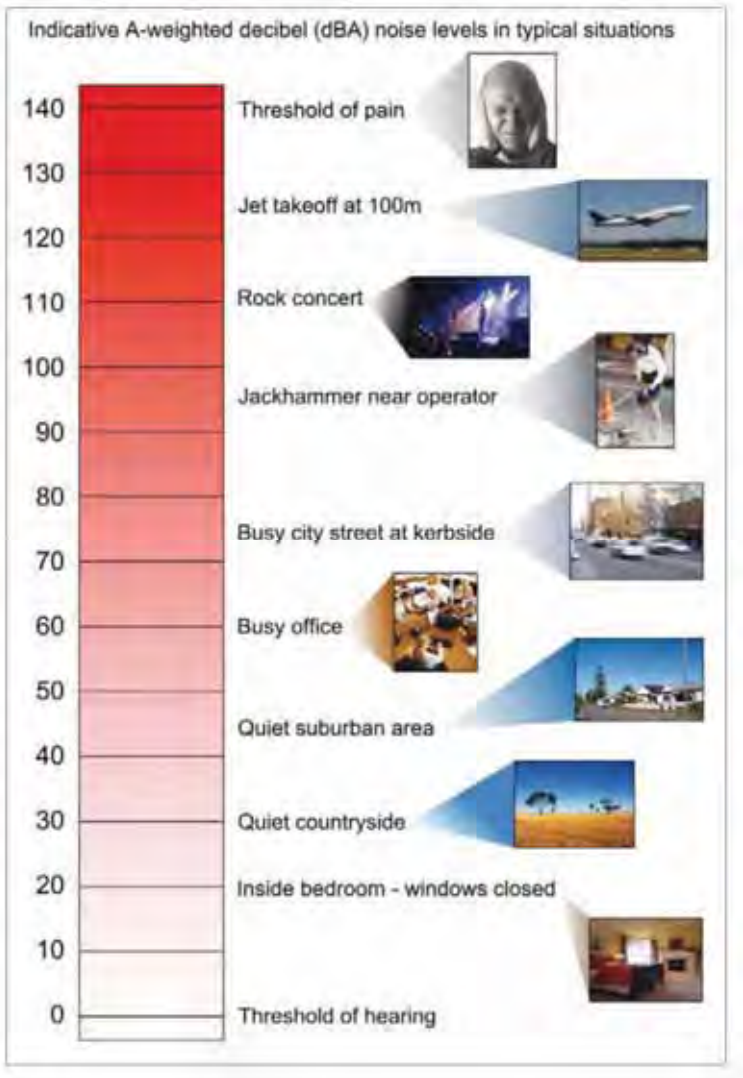
Table 2.1 Glossary of acoustic terms

Term	Description
dB	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.
L_{A1}	The 'A-weighted' noise level which is exceeded 1% of the time.
$L_{A1,1\ minute}$	The 'A-weighted' noise level exceeded for 1% of the specified time period of 1 minute.
L_{A10}	The 'A-weighted' noise level which is exceeded 10% of the time. It is approximately equivalent to the average of maximum noise level.
L_{A90}	Commonly referred to as the background noise level. The 'A-weighted' noise level exceeded 90% of the time.
L_{Aeq}	The energy average noise from a source. This is the equivalent continuous 'A-weighted' sound pressure level over a given period. The $L_{Aeq,15\ minute}$ descriptor refers to an L_{Aeq} noise level measured over a 15-minute period.
L_{Amin}	The minimum 'A-weighted' noise level received during a measuring interval.
L_{Amax}	The maximum root mean squared 'A-weighted' sound pressure level (or maximum noise level) received during a measuring interval.
L_{Ceq}	The equivalent continuous 'C-weighted' sound pressure level over a given period. The $L_{Ceq,15\ minute}$ descriptor refers to an L_{Ceq} noise level measured over a 15 minute period. C-weighting can be used to measure low frequency noise.
Day period	Monday – Saturday: 7 am to 6 pm, on Sundays and Public Holidays: 8 am to 6 pm.
Evening period	Monday – Saturday: 6 pm to 10 pm, on Sundays and Public Holidays: 6 pm to 10 pm.
Night period	Monday – Saturday: 10 pm to 7 am, on Sundays and Public Holidays: 10 pm to 8 am.
Temperature inversion	A meteorological condition where the atmospheric temperature increases with altitude.

It is useful to have an appreciation of decibels (dB), the unit of noise measurement. Table 2.2 gives an indication as to what an average person perceives about changes in noise levels. Examples of common noise levels are provided in Figure 2.1.

Table 2.2 Perceived change in noise

Change in sound pressure level (dB)	Perceived change in noise in surrounding environment
up to 2	not perceptible
3	just perceptible
5	noticeable difference
10	twice (or half) as loud
15	large change
20	four times (or quarter) as loud



Source: Road Noise Policy (Department of Environment, Climate Change and Water 2011)

Figure 2.1 Common noise levels

3 Noise limits

3.1 Operational and sleep disturbance noise limits

Ashton Coal noise limits are provided in Table 1, Condition 2 of Appendix 6 of the DC and Condition L2.1 of the EPL. Extracts of the relevant sections of the DC and EPL pertaining to noise are provided in Appendix A and B, respectively. The approved NMP adopts three attended noise monitoring locations that are representative of residences outlined in the DC. The noise monitoring locations and relevant criteria are summarised in Table 3.1.

Table 3.1 Noise impact assessment criteria

Monitoring location	Day $L_{Aeq,15\ minute}$, dB	Evening $L_{Aeq,15\ minute}$, dB	Night $L_{Aeq,15\ minute}$, dB	Night $L_{A1,1\ minute}$, dB
N2	38	38	36	46
N3	38	38	36	46
N4	38	38	36	46

The DC specifies the following meteorological conditions under which noise limits do not apply which are also consistent with those provided in the EPL:

- during periods of rain or hail;
- average wind speed at microphone height exceeds 5 m/s;
- wind speeds greater than 3 m/s at 10 metres above ground level; and
- temperature inversion conditions greater than 3°C/100m.

For this assessment, the recorded L_{Amax} has been used as a conservative estimate of the $L_{A1,1\ minute}$. The INP application notes state that the EPA accepts sleep disturbance analysis based on either the $L_{A1,1\ minute}$ or L_{Amax} metrics (EPA 2013), with use of L_{Amax} resulting in a more conservative assessment.

The DC and EPL state that modification factor corrections in the application notes to the INP (2017) shall be applied to the measured mine noise levels where applicable. The application notes to the INP state that Fact Sheet C of the NPfI (EPA 2017) now applies regarding the application of modifying factors.

3.2 Cumulative noise criteria

Ashton Coal cumulative noise limits are provided in Condition 5 and Condition 6 of Schedule 3 of the DC. An extract of the conditions relevant to cumulative noise criteria is provided here.

> 5. The Applicant must implement all reasonable and feasible measures to ensure that the noise generated by the Ashton Mine Complex combined with the noise generated by other mines in the vicinity does not exceed the criteria in Table 4 at any residence on any privately-owned land or on more than 25 per cent of any privately-owned land (except for the noise affected residential receivers in Table 1).
>
> Table 4: Cumulative Noise Criteria dB(A) $L_{Aeq\ (period)}$

Location	Day	Evening	Night
Camberwell Village	55	45	40
All other privately-owned land	50	45	40

Cumulative noise is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.

6. If the cumulative noise generated by the Ashton Mine Complex combined with the noise generated by other coal mines in the vicinity exceeds the criteria in Table 5 at any residence on privately-owned land or more than 25 per cent of any privately-owned land (except for the noise-affected residential receivers ion Table 1), then upon receiving a written request from the landowner, the Applicant must, together with the relevant mines, acquire the land on as equitable basis as possible, in accordance with the procedures in conditions 7 and 8 of schedule 4.

Table 5: Cumulative Noise Acquisition Criteria dB(A) $L_{Aeq\ (period)}$

Location	Day	Evening	Night
Camberwell Village	60	50	45
All other privately-owned land	55	50	45

Cumulative noise is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.

3.3 Low frequency noise criteria

Condition 3 of Appendix 8 of the DC and L2.3 of the EPL state that noise generated by Ashton Coal is to be measured in accordance with the relevant requirements of the INP. The INP application notes state that Section 4 of the INP has been withdrawn and the modifying factor adjustments outlined in Fact Sheet C of the NPfI are to be used when assessing the characteristics of a noise source.

Fact sheet C of the NPfI (EPA 2017) provides guidelines for applying modifying factor corrections to account for low frequency noise emissions. The NPfI specifies that a difference of 15 dB or more between site 'C-weighted' and site 'A-weighted' noise emission levels identifies the potential for an unbalanced spectrum and potential increased annoyance.

Where a difference of 15 dB or more between site 'C-weighted' and site 'A-weighted' noise emission levels is identified, the one-third octave noise levels recorded should be compared to the values in Table C2 of the NPfI (EPA 2017), which has been reproduced in Table 3.2 below.

Table 3.2 One-third octave low-frequency noise thresholds

	One-third octave $L_{Zeq,15\ minute}$ 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

The following modifying factor correction is to be applied where the site 'C-weighted' and site 'A-weighted' noise emission level is 15 dB or more and:

- where any of the one-third octave noise levels in Table 3.2 are exceeded by up to and including 5 dB and cannot be mitigated, a 2 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period; or

- where any of the one-third octave noise levels in Table 3.2 are exceeded by more than 5 dB and cannot be mitigated, a 5 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period.

Hence, where relevant throughout each survey the operator has estimated the difference between site 'C-weighted' and site 'A-weighted' noise emission levels by matching audible sounds with the response of the analyser (L_{Ceq}-L_{Aeq}). Where this was deemed to be 15 dB or greater, the measured one-third octave frequencies have been compared to the values in Table 3.2 to identify the relevant modifying factor correction (if applicable). This method has been applied to this assessment as presented in Section 5.

It is of note that the NPfI (EPA 2017) states that low-frequency noise corrections only apply under the standard or noise-enhancing (i.e. applicable) meteorological conditions.

4 Assessment methodology

4.1 Attended noise monitoring

To quantify noise emissions from Ashton Coal, 15-minute attended noise monitoring surveys were completed at representative locations as per the approved NMP.

Noise monitoring locations as per the NMP and their coordinates are listed in Table 4.1 and are shown in Figure 4.1.

Table 4.1 Attended noise monitoring locations

Monitoring location	Description	MGA56	
		Easting	Northing
N2	Camberwell Village (west)	320297	6405670
N3	Camberwell Village (north east)	320554	6405839
N4	South of New England Highway	319776	6404101

Attended noise monitoring is scheduled to be "unannounced" and to EMM's knowledge Ashton Coal were not aware of the monitoring prior to its commencing. Noise monitoring is avoided during any scheduled down-time or major maintenance. To our knowledge, regular operations were occurring during this round of noise monitoring.

Where possible throughout each survey, the operator has quantified the contribution of each significant noise source. This was done by matching audible sounds with the response of the analyser (where applicable) and/or via post-analysis of data (e.g. low pass filtering).

4.2 Instrumentation

A Svantek 979 Type 1 sound analyser (s/n 21095) was used to conduct 15-minute attended measurements and record 1/3 octave frequency and statistical noise indices. The sound analyser was calibrated before and on completion of the survey using a Rion NC-74 calibrator (s/n 34372752). The instrumentation's calibration certificates are provided in Appendix C.

Source: EMM (2019); DFSI (2017); GA (2011)

0 1 2 km

GDA 1994 MGA Zone 56

N

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KEY

- Site boundary
- Noise monitoring location
- Meteorological station
- Rail line
- Main road
- Local road
- Watercourse/drainage line
- Cadastral boundary

Noise monitoring locations and Ashton colliery boundary

Ashton Coal
Monthly attended noise monitoring
Figure 4.1

EMM
creating opportunities

4.3 Attended noise monitoring exceedance procedure

Ashton Coal has developed an attended monitoring exceedance procedure that is to be implemented if measurements show Ashton Coal noise emissions are above the relevant noise criteria. This response plan is implemented if site noise levels are determined to be above the relevant noise criteria and when noise limits are applicable due to suitable meteorological conditions. The following noise management initiatives are implemented:

- Consultant will record the reading and advise Ashton Coal of the exceedance. Ashton Coal will implement remedial action as required;
- A follow up measurement is to be conducted (within 75 minutes after the first measurement and no earlier than 10 pm)
- If the follow up measurement indicates that site noise levels are above the relevant noise criteria and when noise limits are applicable, the consultant will record the result, note the site has failed and is deemed a 'noise affected night' at that location. An additional monitoring test should be scheduled to be undertaken at the same location within one week and move on to the next monitoring location.
- If the follow up measurement indicates that site noise levels are below the relevant noise criteria and when noise limits are applicable, the consultant will record the result, note the site has passed, schedule an additional monitoring test to be undertaken at the location within one week and move on to the next monitoring location.

4.4 Determination of stability category

This assessment determined the stability categories throughout the attended monitoring period using the direct measurement method as per Appendix E2 of the INP (EPA 2000).

The temperature lapse rate between the two weather stations (M1 – Sentinex Unit 40 located in Camberwell Village and M2 – Ashton Coal 'repeater' meteorological station located in the north eastern open cut (NEOC) area) was calculated using the following formula:

$$\textit{Temperature lapse rate} = (\Delta T) \times (100/(\Delta H))$$

Where:

- ΔT = temperature measured at M2 (at 10 metres above ground level) minus temperature measured at M1 (at 10 metres above ground level); and
- ΔH = the vertical height difference between M2 and M1 (equal to 73 metres).

Table E5 of the INP (EPA 2000) is reproduced in Table 4.2 and presents the stability categories and associated ranges in temperature lapse rates.

Table 4.2 Stability categories and temperature lapse rates

Stability category	Temperature lapse rate (ΔT) (°C/100 m)
A	$\Delta T < -1.9$
B	$-1.9 \leq \Delta T < -1.7$
C	$-1.7 \leq \Delta T < -1.5$
D	$-1.5 \leq \Delta T < -0.5$
E	$-0.5 \leq \Delta T < 1.5$
F	$1.5 \leq \Delta T < 4.0$
G	$\Delta T \geq 4.0$

Source: INP (EPA 2000).

Other meteorological data, such as wind speed, has been sourced directly from meteorological station M2.

5 Review of data and discussion

5.1 Summary

Results of attended noise measurements are summarised in Table 5.1. Ashton Coal contribution and total mine noise were determined for each survey using in-field observations and post-analysis of data as required (e.g. removing higher frequencies that are not mine related i.e. above 630 Hz). Attended monitoring was completed on 14 March 2019.

The meteorological data for the monitoring period was sourced from Ashton Coal's two weather stations (M1 and M2) to determine applicability of criteria in accordance with the DC and EPL. Noise limits were not applicable during one of the three measurements (at location N4) due to the presence of winds at speeds greater than 3 m/s at the time of the measurement.

Low frequency noise was conservatively assessed by comparison of the total measured one-third octave L_{Aeq} noise levels to the NPfI one-third octave low-frequency noise thresholds. Measured noise levels did not exceed the relevant LFN thresholds during any of the measurements. Therefore, in accordance with the NPfI, LFN modifying factors were found to be not relevant and hence were not applied to estimated site noise levels at any of the locations.

Monitoring identified that site noise was inaudible at all three monitoring locations. Typically, when a particular source is not audible above local ambient noise levels, the likely contribution of that source is generally at least 10 dB below the measured background (L_{A90}) level.

Table 5.1 Ashton Coal attended noise monitoring results – March 2019

Location	Date	Start time	Total noise levels, dB							Site contributions, dB			Noise limits, dB		Meteorological conditions[3] limits apply (Y/N)	Exceedance, dB	Comments
			L_{Amin}	L_{A90}	L_{Aeq}	L_{A10}	L_{A1}	L_{Amax}	L_{Ceq}	LFN mod. factor[1]	L_{Aeq}	$L_{Amax\ 2}$	L_{Aeq}	L_{Amax}[2]			
N2	14/3	22:00	34	38	54	52	66	79	60	Nil	IA	IA	36	46	2.1 m/s @ 149 D class stability -0.7°C/100m VTG Y	Nil	Site noise inaudible. Neighbouring mine, traffic on the New England Highway and insects consistently audible. Dog barking frequently audible. Livestock occasionally audible.
N3	14/3	22:17	33	37	43	47	51	54	58	Nil	IA	IA	36	46	2.4 m/s @ 181 E class stability -0.1°C/100m VTG Y	Nil	Site noise inaudible. Neighbouring mine, traffic on the New England Highway and insects consistently audible. Trains on the main line (unrelated to Ashton Coal) frequently audible. Bird noise and bat noise occasionally audible. Trains horns (unrelated to Ashton Coal) briefly audible.
N4	14/3	22:41	35	37	39	41	43	58	65	Nil	IA	IA	36	46	4.2 m/s @ 171 D class stability -1.2°C/100m VTG N	N/A	Site noise inaudible. Traffic on the New England Highway, insects and powerline hum consistently audible. Neighbouring mine, aircraft noise, wind in trees and distant dogs barking occasionally audible. Trains horns (unrelated to Ashton Coal) and livestock briefly audible.

Notes:
1. Modifying factor correction for low frequency noise in accordance with Fact Sheet C of the NPfI (refer Section 3.3).
2. For assessment purposes the L_{Amax} and the $L_{A1,1\ minute}$ are interchangeable.
3. Meteorological data were taken as an average over 15 minutes from the Ashton Coal weather station (Refer to Section 5.1).
4. IA = inaudible.
5. N/A = not applicable.

5.2 N2 - Camberwell Village (west)

Ashton Coal operations were inaudible during the whole of the operator-attended noise survey. Given this and the measured background noise level of L_{A90} 38 dB, Ashton Coal $L_{Aeq,15\ minute}$ noise contributions complied with the noise limits. Other ambient noise sources included neighbouring mines, insects, traffic on the New England Highway, dogs barking and livestock noise.

Neighbouring mining operations were consistently audible during the operator-attended noise survey at monitoring location N2. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ <28 dB ($L_{Aeq,15\ minute}$ <31 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was likely to be below the cumulative mine noise criterion.

5.3 N3 - Camberwell Village (north east)

Ashton Coal operations were inaudible during the whole of the operator-attended noise survey. Given this and the measured background noise level of L_{A90} 37 dB, Ashton Coal $L_{Aeq,15\ minute}$ noise contributions complied with the noise limits. Other ambient noise sources included neighbouring mines, insects, traffic on the New England Highway, bird noise, bat noise, livestock noise, train horns and trains on the main line (unrelated to Ashton Coal).

Neighbouring mining operations were consistently audible during the operator-attended noise survey at monitoring location N3. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ <29 dB ($L_{Aeq,15\ minute}$ <32 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was likely to be below the cumulative mine noise criterion.

5.4 N4 - South of New England Highway

Ashton Coal operations were inaudible during the whole of the operator-attended noise survey. Given this and the measured background noise level of L_{A90} 37 dB, Ashton Coal $L_{Aeq,15\ minute}$ noise contributions complied with the noise limits, had they applied. Other ambient noise sources included a neighbouring mine, traffic on the New England Highway, power line hum, livestock noise, aircraft noise, wind in trees, dogs barking and train horns (unrelated to Ashton Coal).

Neighbouring mining operations were occasionally audible during the operator-attended noise survey at monitoring location N4. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ <22 dB ($L_{Aeq,15\ minute}$ <25 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was likely to be below the cumulative mine noise criterion had it been applicable.

6 Conclusion

EMM has completed a review of mine noise from Ashton Coal within the surrounding community based on attended measurements conducted on 14 March 2019.

The applicability of noise limits was assessed with reference to Ashton Coal's two meteorological stations (M1 and M2) located to the east of the site. Noise limits were not applicable during one of the three measurements (at location N4) due to the presence of wind speeds greater than 3 m/s at the time of the measurement.

The assessment of noise contributions from site included consideration of modifying factors for noise characteristics where relevant and in accordance with the INP.

Ashton Coal noise contributions and cumulative mine noise contributions were below (satisfied) the relevant noise limits at all monitoring locations for this round of monitoring.

References

Ashton Coal Noise Management Plan, 2017.

NSW Department of Planning and Environment, Development Consent DA309-11-2001-I, 2016.

NSW Environment Protection Authority, Environment Protection License 11879.

NSW Environment Protection Authority, Industrial Noise Policy, 2000.

NSW Environment Protection Authority, Industrial Noise Policy Application notes, 2017.

NSW Environment Protection Authority, Noise Policy for Industry, 2017.

Appendix A

Project approval extract

APPENDIX 6
ALTERNATE NOISE CONDITIONS

NOISE

Application

1. Conditions 2 to 3 below have effect during times when open cut mining operations are not being undertaken at the Ashton Mine Complex, in the opinion of the Secretary.

Noise Criteria

2. Except for the noise-affected land in Table 1 of Schedule 3, the Applicant must ensure that the noise generated by the development does not exceed the criteria in Table 1 at any residence on privately-owned land or on more than 25 per cent of any privately-owned land.

Table 1: Noise Criteria dB(A)

Receiver No.	Receiver	Day ($L_{Aeq\ (15min)}$)	Evening ($L_{Aeq\ (15min)}$)	Night ($L_{Aeq\ (15min)}$)	Night ($L_{A1\ (1\ min)}$)
-	All privately-owned land	38	38	36	46

Noise generated by the development is to be measured in accordance with the relevant requirements of the *NSW Industrial Noise Policy*. Appendix 3 sets out the requirements for evaluating compliance with these criteria.

However, these noise criteria do not apply if the Applicant has an agreement with the relevant owner/s of the residence/land to generate higher noise levels, and the Applicant has advised the Department in writing of the terms of this agreement.

Additional Noise Mitigation Measures

3. Upon receiving a written request from the owner of any residence on any privately-owned land where subsequent operational noise monitoring shows the noise generated by the development exceeds the noise limits in Table 2, the Applicant must implement additional reasonable and feasible noise mitigation measures (such as double glazing, insulation, and/or air conditioning) at the residence in consultation with the owner.

If within 3 months of receiving this request from the landowner, the Applicant and the landowner cannot agree on the measures to be implemented, or there is a dispute about the implementation of these measures, then either party may refer the matter to the Secretary for resolution.

Table 2: Additional Noise Mitigation Criteria dB(A) $L_{Aeq\ (15min)}$

Receiver No.	Receiver	Day ($L_{Aeq\ (15min)}$)	Evening ($L_{Aeq\ (15min)}$)	Night ($L_{Aeq\ (15min)}$)
-	All privately-owned land	38	38	38

Notes:

- *Noise generated by the development is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.*
- *For this condition to apply, the exceedance of the criteria must be systemic.*

APPENDIX 8
NOISE COMPLIANCE ASSESSMENT

Compliance Monitoring

1. Attended monitoring is to be used to evaluate compliance with the relevant conditions of this approval.

2. Data collected for the purposes of determining compliance with the relevant conditions of this approval is to be excluded under the following meteorological conditions:
   a) during periods of rain or hail;
   b) average wind speed at microphone height exceeds 5 m/s;
   c) wind speeds greater than 3 m/s measures at 10 m above ground level; and
   d) temperature inversion conditions greater than 3°C/100m.

3. Unless otherwise agreed with the Secretary, this monitoring is to be carried out in accordance with the relevant requirements relating for reviewing performance set out in the NSW Industrial Noise Policy (as amended from time to time), in particular the requirements relating to:
   a) monitoring locations for the collection of representative noise data;
   b) equipment used to collect noise data, and conformity with Australian Standards relevant to such equipment; and
   c) modifications to noise data collected, including for the exclusion of extraneous noise and/or penalties for modifying factors apart from adjustments for duration.

4. To the extent that there is any inconsistency between the Industrial Noise Policy and the requirements set out in this Appendix, the Appendix prevails to the extent of the inconsistency.

Determination of Meteorological Conditions

5. Except for wind speed at microphone height, the data to be used for determining meteorological conditions shall be that recorded by the meteorological station located in the vicinity of the site (as required by condition 18 of Schedule 3).

Appendix B

EPL extract

Environment Protection Licence

Licence - 11879

3	Ambient surface water monitoring	In Bowmans Creek near the New England Highway shown as point SM4 in Figure 4 dated 8/8/03 titled "EPA Surface Water Monitoring Sites"
4	Ambient surface water monitoring.	In Bowmans Creek near the proposed longwall panels shown as point SM5 in Figure 4 dated 8/8/03 titled "EPA Surface Water Monitoring Sites"
5	Ambient surface water monitoring	In Bowmans Creek at the Hunter River confluence shown as point SM6 in Figure 4 dated 8/8/03 titled "EPA Surface Water Monitoring Sites"
6	Ambient surface water monitoring.	In the Hunter River upstream of Bowmans Creek shown as point SM9 on Figure 4 dated 8/8/03 titled "EPA Surface Water Monitoring Sites".
7	Ambient surface water monitoring	In the Hunter River downstream of Bowmans Creek confluence shown as point SM10 on Figure 4 dated 8/8/03 titled "EPA Surface Water Monitoring Sites".
8	Groundwater monitoring	Locations shown on Figure 1A titled "Groundwater Monitoring Piezometer Locations for EPL" dated 26/10/06.

3 Limit Conditions

L1 Pollution of waters

L1.1 Except as may be expressly provided in any other condition of this licence, the licensee must comply with section 120 of the Protection of the Environment Operations Act 1997.

L2 Noise limits

L2.1 Noise from the premises must not exceed the limits specified in the table below:

Location	Day LAeq(15 minute)	Evening LAeq(15 minute)	Night LAeq(15 minute)	Night LAeq(1 minute)

Any residence not owned by the licensee or not subject to an agreement between the licensee and the residence owner as to an alternative noise limit.	38	38	36	46

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

L2.3 Noise from the premises must be measured at the most affected point on or within the residential boundary or at the most affected point within 30m of the dwelling where the dwelling is more than 30m from boundary to determine compliance with the LAeq(15 minute) noise limits in condition L2.1. Where it can be demonstrated that direct measurement of noise from the premises is impractical, the EPA may accept alternative means of determining compliance. See Chapter 11 of the NSW Industrial Noise Policy. The modification factors presented in Section 4 of the NSW Industrial Noise Policy shall also be applied to the measured noise level where applicable.

L2.4 Noise from the premises is to be measured or computed at 1m from the dwelling facade to determine compliance with condition L2.1 (LA1 (1 minute) noise limit).

L2.5 The noise emission limits identified in condition L2.1 apply under the following meteorological conditions:

a) wind speeds up to 3m/s at 10m above ground level; and
b) temperature inversion conditions up to 30C/100m.

L2.6 Open cut mining activities must only be carried out between the hours of 0700 and 2200 Monday to Saturday, and 0800 and 2200 on Sundays and Public Holidays.

L3 Blasting

L3.1 Blasting in or on the premises must only be carried out between 0900 hours and 1700 hours, Monday to Saturday. Blasting in or on the premises must not take place on Sundays or Public Holidays without the prior approval of the EPA.

L3.2 The overpressure level from blasting operations carried out in or on the premises must not:

a) exceed 115 dB(L) for more than 5% of the total number of blasts carried out on the premises within the 12 months annual reporting period; and
b) exceed 120 dB(L) at any time
at any residence or noise sensitive location (such as a school or hospital) that is not owned by the licensee or subject to a private agreement between the owner of the residence or noise sensitive location

Appendix C

Calibration certificates

CERTIFICATE OF CALIBRATION

CERTIFICATE NO.: SLM 22926 & FILT 4696

Equipment Description:	Sound & Vibration Analyzer		
Manufacturer:	Svantek		
Model No:	Svan-979	**Serial No:**	21095
Microphone Type:	40AE	**Serial No:**	120711
Preamplifier Type:	SV17	**Serial No:**	25110
Filter Type:	1/3 Octave	**Serial No:**	21095
Comments:	All tests passed for class 1. (See over for details)		
Owner:	EMGA Mitchell Mclennan Ground Floor, Suite 01, 20 Chandos St St Leonards NSW 2065		
Ambient Pressure:	999 hPa ±1.5 hPa		
Temperature:	23 °C ±2° C	**Relative Humidity:**	35% ±5%
Date of Calibration:	14/06/2018	**Issue Date:**	15/06/2018
Acu-Vib Test Procedure:	AVP10 (SLM) & AVP06 (Filters)		

CHECKED BY: ..... **AUTHORISED SIGNATURE:** ..... Jack Rielt

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.

NATA
WORLD RECOGNISED ACCREDITATION

Accredited Lab. No. 9262
Acoustic and Vibration Measurements

ACU-VIB
ELECTRONICS
HEAD OFFICE
Unit 14, 22 Hudson Ave. Castle Hill NSW 2154
Tel: (02) 96808133 Fax: (02)96808233
Mobile: 0413 809806
web site: www.acu-vib.com.au

CERTIFICATE OF CALIBRATION

CERTIFICATE NO: 24147

EQUIPMENT TESTED: Sound Level Calibrator

Manufacturer: Rion
Type No: NC-74 **Serial No:** 34372752
Owner: EMM Consulting
20 Chandos Street
St Leonards NSW 2065

Tests Performed: Measured output pressure level was found to be:

Parameter	Pre-Adj	Adj Y/N	Output: (db re 20 µPa)	Frequency: (Hz)	THD&N (%)
Level 1:	NA	N	94.10	1002.70	2.24
Level 2:	NA	N	NA	NA	NA
Uncertainty:			±0.11 dB	±0.05%	±0.20 %
Uncertainty (at 95% c.l.) k=2					

CONDITION OF TEST:
Ambient Pressure: 991 hPa ±1.5 hPa **Relative Humidity:** 45% ±5%
Temperature: 23 °C ±2° C
Date of Calibration: 13/02/2019 **Issue Date:** 13/02/2019
Acu-Vib Test Procedure: AVP02 (Calibrators)
Test Method: AS IEC 60942 - 2017
CHECKED BY: ..... **AUTHORISED SIGNATURE:** .....
Jack Kielt

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.
The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

NATA
ACCREDITATION
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Acoustic and Vibration Measurements

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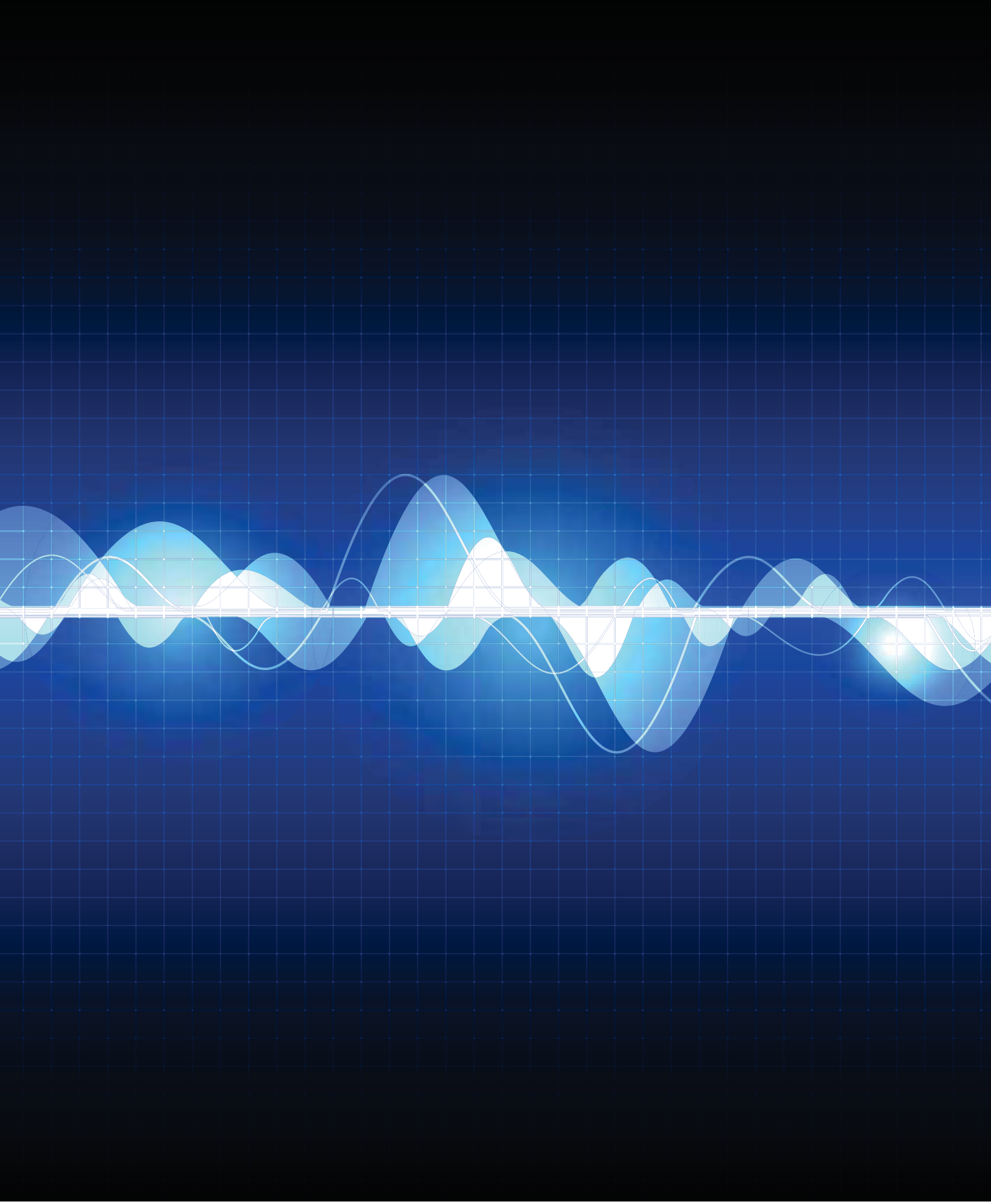


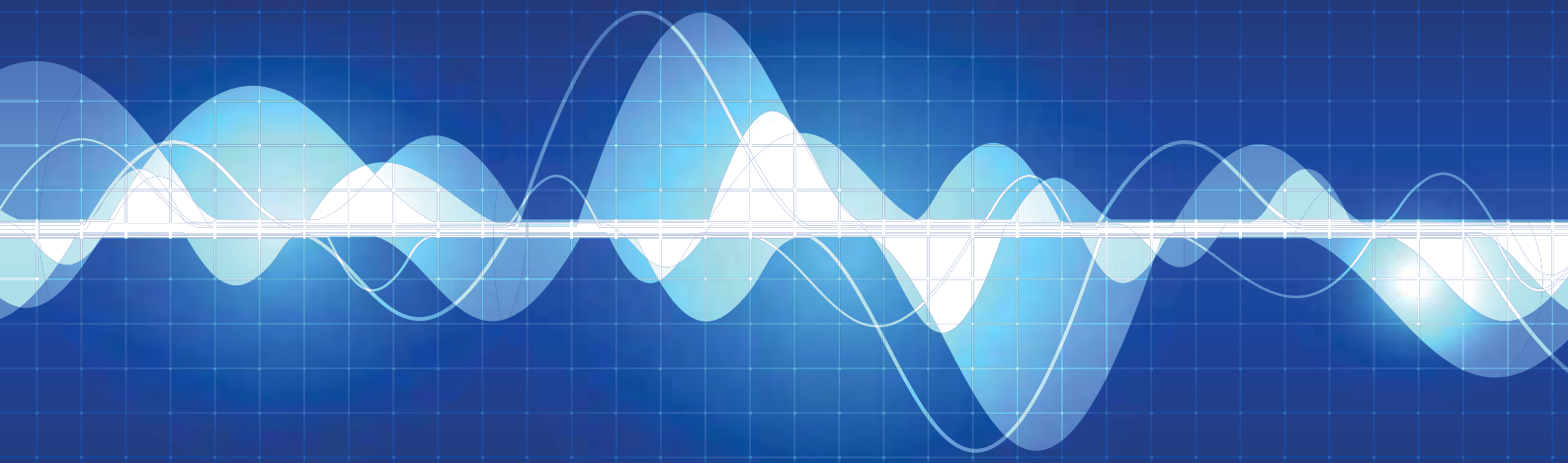
Appendix D

Monthly attended noise monitoring report - April 2019

Ashton Coal

Monthly attended noise monitoring
April 2019

Prepared for Ashton Coal Operations Pty Ltd
April 2019



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Ashton Coal

Monthly attended noise monitoring - April 2019

Prepared for Ashton Coal Operations Pty Ltd
April 2019

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Ashton Coal

Monthly attended noise monitoring - April 2019

Report Number

H190081 RP3

Client

Ashton Coal Operations Pty Ltd

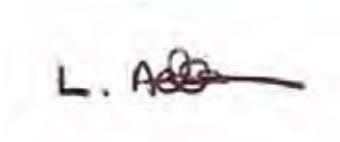
Date

30 April 2019

Version

v1-0 Final

Prepared by



Lucas Adamson
Acoustic Consultant
30 April 2019

Approved by

Najah Ishac
Director
30 April 2019

This report has been prepared in accordance with the brief provided by the client and has relied upon the information collected at the time and under the conditions specified in the report. All findings, conclusions or recommendations contained in the report are based on the aforementioned circumstances. The report is for the use of the client and no responsibility will be taken for its use by other parties. The client may, at its discretion, use the report to inform regulators and the public.

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Table of Contents

Appendices

Tables

Figures

1 Introduction

EMM Consulting Pty Limited (EMM) was engaged to complete monthly attended noise surveys on behalf of Ashton Coal Operations Pty Ltd (Ashton Coal).

The purpose of the monitoring was to address requirements of the approved Ashton Coal Noise Management Plan (NMP), prepared to satisfy the requirements of the Development Consent DA 309-11-2001-I (DC) and Environment Protection License (EPL) 11879.

This report presents the results and findings of attended noise monitoring conducted on 4 April 2019.

The following material was referenced as part of this assessment:

- Department of Planning and Environment (DPE), Development Consent 309-11-2001-I, as modified on 20 June 2016 (current as of 4 April 2019);
- Environment Protection Authority (EPA), Environment Protection License 11879, as varied on 17 August 2017 (current as of 4 April 2019);
- Ashton Coal Project Noise Management Plan (NMP), approved by DPE on 10 October 2017;
- NSW EPA, Industrial Noise Policy (INP), 2000;
- NSW EPA, Industrial Noise Policy Application notes, 2017; and
- NSW EPA, Noise Policy for Industry (NPfI), 2017.

2 Glossary of acoustic terms

Several technical terms are discussed in this report. These are explained in Table 2.1.

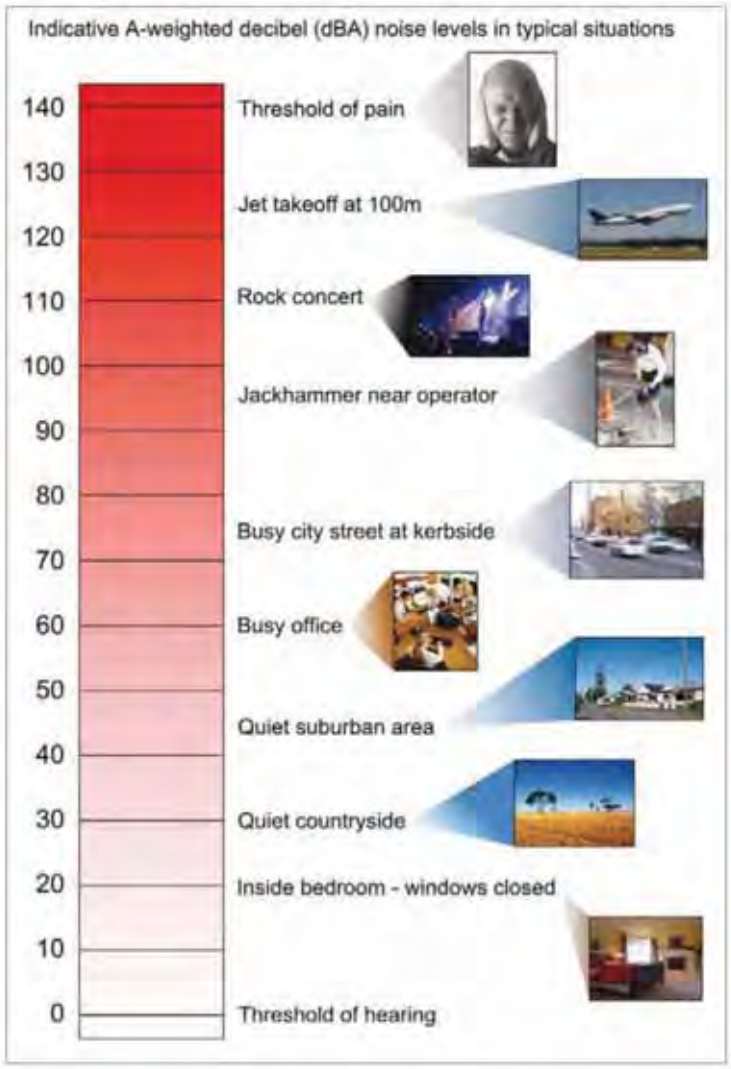
Table 2.1 Glossary of acoustic terms

Term	Description
dB	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.
L_{A1}	The 'A-weighted' noise level which is exceeded 1% of the time.
$L_{A1,1\ minute}$	The 'A-weighted' noise level exceeded for 1% of the specified time period of 1 minute.
L_{A10}	The 'A-weighted' noise level which is exceeded 10% of the time. It is approximately equivalent to the average of maximum noise level.
L_{A90}	Commonly referred to as the background noise level. The 'A-weighted' noise level exceeded 90% of the time.
L_{Aeq}	The energy average noise from a source. This is the equivalent continuous 'A-weighted' sound pressure level over a given period. The $L_{Aeq,15\ minute}$ descriptor refers to an L_{Aeq} noise level measured over a 15-minute period.
L_{Amin}	The minimum 'A-weighted' noise level received during a measuring interval.
L_{Amax}	The maximum root mean squared 'A-weighted' sound pressure level (or maximum noise level) received during a measuring interval.
L_{Ceq}	The equivalent continuous 'C-weighted' sound pressure level over a given period. The $L_{Ceq,15\ minute}$ descriptor refers to an L_{Ceq} noise level measured over a 15 minute period. C-weighting can be used to measure low frequency noise.
Day period	Monday – Saturday: 7 am to 6 pm, on Sundays and Public Holidays: 8 am to 6 pm.
Evening period	Monday – Saturday: 6 pm to 10 pm, on Sundays and Public Holidays: 6 pm to 10 pm.
Night period	Monday – Saturday: 10 pm to 7 am, on Sundays and Public Holidays: 10 pm to 8 am.
Temperature inversion	A meteorological condition where the atmospheric temperature increases with altitude.

It is useful to have an appreciation of decibels (dB), the unit of noise measurement. Table 2.2 gives an indication as to what an average person perceives about changes in noise levels. Examples of common noise levels are provided in Figure 2.1.

Table 2.2 Perceived change in noise

Change in sound pressure level (dB)	Perceived change in noise in surrounding environment
up to 2	not perceptible
3	just perceptible
5	noticeable difference
10	twice (or half) as loud
15	large change
20	four times (or quarter) as loud



Source: Road Noise Policy (Department of Environment, Climate Change and Water 2011)

Figure 2.1 Common noise levels

3 Noise limits

3.1 Operational and sleep disturbance noise limits

Ashton Coal noise limits are provided in Table 1, Condition 2 of Appendix 6 of the DC and Condition L2.1 of the EPL. Extracts of the relevant sections of the DC and EPL pertaining to noise are provided in Appendix A and B, respectively. The approved NMP adopts three attended noise monitoring locations that are representative of residences outlined in the DC. The noise monitoring locations and relevant criteria are summarised in Table 3.1.

Table 3.1 Noise impact assessment criteria

Monitoring location	Day $L_{Aeq,15\ minute}$, dB	Evening $L_{Aeq,15\ minute}$, dB	Night $L_{Aeq,15\ minute}$, dB	Night $L_{A1,1\ minute}$, dB
N2	38	38	36	46
N3	38	38	36	46
N4	38	38	36	46

The DC and the EPL specify the following meteorological conditions under which noise limits do not apply:

- during periods of rain or hail;
- average wind speed at microphone height exceeds 5 m/s;
- wind speeds greater than 3 m/s at 10 metres above ground level; and
- temperature inversion conditions greater than 3°C/100m.

For this assessment, the recorded L_{Amax} has been used as a conservative estimate of the $L_{A1,1\ minute}$. The INP application notes state that the EPA accepts sleep disturbance analysis based on either the $L_{A1,1\ minute}$ or L_{Amax} metrics (EPA 2013), with use of L_{Amax} resulting in a more conservative assessment.

The DC and EPL state that modification factor corrections in the application notes to the INP (2017) shall be applied to the measured mine noise levels where applicable. The application notes to the INP state that Fact Sheet C of the NPfI (EPA 2017) now applies regarding the application of modifying factors.

3.2 Cumulative noise criteria

Ashton Coal cumulative noise limits are provided in Condition 5 and Condition 6 of Schedule 3 of the DC. An extract of the conditions relevant to cumulative noise criteria is provided here.

> 5. The Applicant must implement all reasonable and feasible measures to ensure that the noise generated by the Ashton Mine Complex combined with the noise generated by other mines in the vicinity does not exceed the criteria in Table 4 at any residence on any privately-owned land or on more than 25 per cent of any privately-owned land (except for the noise affected residential receivers in Table 1).

Table 4: Cumulative Noise Criteria dB(A) $L_{Aeq\ (period)}$

Location	Day	Evening	Night
Camberwell Village	55	45	40
All other privately-owned land	50	45	40

> Cumulative noise is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.

> 6. If the cumulative noise generated by the Ashton Mine Complex combined with the noise generated by other coal mines in the vicinity exceeds the criteria in Table 5 at any residence on privately-owned land or more than 25 per cent of any privately-owned land (except for the noise-affected residential receivers ion Table 1), then upon receiving a written request from the landowner, the Applicant must, together with the relevant mines, acquire the land on as equitable basis as possible, in accordance with the procedures in conditions 7 and 8 of schedule 4.

Table 5: Cumulative Noise Acquisition Criteria dB(A) $L_{Aeq\ (period)}$

Location	Day	Evening	Night
Camberwell Village	60	50	45
All other privately-owned land	55	50	45

> Cumulative noise is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.

3.3 Low frequency noise criteria

Condition 3 of Appendix 8 of the DC and L2.3 of the EPL state that noise generated by Ashton Coal is to be measured in accordance with the relevant requirements of the INP. The INP application notes state that Section 4 of the INP has been withdrawn and the modifying factor adjustments outlined in Fact Sheet C of the NPfI are to be used when assessing the characteristics of a noise source.

Fact sheet C of the NPfI (EPA 2017) provides guidelines for applying modifying factor corrections to account for low frequency noise emissions. The NPfI specifies that a difference of 15 dB or more between site ‘C-weighted' and site ‘A-weighted' noise emission levels identifies the potential for an unbalanced spectrum and potential increased annoyance.

Where a difference of 15 dB or more between site ‘C-weighted' and site ‘A-weighted' noise emission levels is identified, the one-third octave noise levels recorded should be compared to the values in Table C2 of the NPfI (EPA 2017), which has been reproduced in Table 3.2 below.

Table 3.2 One-third octave low-frequency noise thresholds

	One-third octave $L_{Zeq,15\ minute}$ 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

The following modifying factor correction is to be applied where the site 'C-weighted' and site 'A-weighted' noise emission level is 15 dB or more and:

- where any of the one-third octave noise levels in Table 3.2 are exceeded by up to and including 5 dB and cannot be mitigated, a 2 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period; or

- where any of the one-third octave noise levels in Table 3.2 are exceeded by more than 5 dB and cannot be mitigated, a 5 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period.

Hence, where relevant throughout each survey the operator has estimated the difference between site 'C-weighted' and site 'A-weighted' noise emission levels by matching audible sounds with the response of the analyser (L_{Ceq}-L_{Aeq}). Where this was deemed to be 15 dB or greater, the measured one-third octave frequencies have been compared to the values in Table 3.2 to identify the relevant modifying factor correction (if applicable). This method has been applied to this assessment as presented in Section 5.

It is of note that the NPfI (EPA 2017) states that low-frequency noise corrections only apply under the standard or noise-enhancing (i.e. applicable) meteorological conditions.

4 Assessment methodology

4.1 Attended noise monitoring

To quantify noise emissions from Ashton Coal, 15-minute attended noise monitoring surveys were completed at representative locations as per the approved NMP. Noise monitoring locations and their coordinates are listed in Table 4.1 and are shown in Figure 4.1.

Table 4.1 Attended noise monitoring locations

Monitoring location	Description	MGA56	
		Easting	Northing
N2	Camberwell Village (west)	320297	6405670
N3	Camberwell Village (north east)	320554	6405839
N4	South of New England Highway	319776	6404101

Attended noise monitoring is scheduled to be "unannounced" and, to EMM's knowledge, Ashton Coal were not aware of the monitoring prior to its commencing. Noise monitoring is avoided during any scheduled down-time or major maintenance. To our knowledge, regular operations were occurring during this round of noise monitoring.

Where possible throughout each survey, the operator has quantified the contribution of each significant noise source. This was done by matching audible sounds with the response of the analyser (where applicable) and/or via post-analysis of data (e.g. low pass filtering).

4.2 Instrumentation

A Brüel & Kjær 2250 Type 1 sound analyser (s/n 2759405) was used to conduct 15-minute attended measurements and record 1/3 octave frequency and statistical noise indices. The sound analyser was calibrated before and on completion of the survey using a Brüel & Kjær type 4230 calibrator (s/n 1276091). The instrumentation's calibration certificates are provided in Appendix C.

Source: EMM (2019); DFSI (2017); GA (2011)

0 1 2 km

GDA 1994 MGA Zone 56

N

\\emmsvr1\EMM\Jobs\2019\H190081 - Ashton Coal Noise Monitoring\8 GIS\02_Maps\N001_NoiseMonitoring_20190312_02.mxd 12/03/2019

KEY

- Site boundary
- Noise monitoring location
- Meteorological station
- Rail line
- Main road
- Local road
- Watercourse/drainage line
- Cadastral boundary

Noise monitoring locations and Ashton colliery boundary

Ashton Coal
Monthly attended noise monitoring
Figure 4.1

EMM
creating opportunities

4.3 Attended noise monitoring exceedance procedure

Ashton Coal has developed an attended monitoring exceedance procedure that is to be implemented if measurements show Ashton Coal noise emissions are above the relevant noise criteria. This response plan is implemented if site noise levels are determined to be above the relevant noise criteria and when noise limits are applicable due to suitable meteorological conditions. The following noise management initiatives are implemented:

- Consultant will record the reading and advise Ashton Coal of the exceedance. Ashton Coal will implement remedial action as required.
- A follow up measurement is to be conducted (within 75 minutes after the first measurement and no earlier than 10 pm).
- If the follow up measurement indicates that site noise levels are above the relevant noise criteria and that noise limits are applicable, the consultant will record the result, note the site has failed and is deemed a 'noise affected night' at that location. An additional monitoring test should be scheduled to be undertaken at the same location within one week and move on to the next monitoring location.
- If the follow up measurement indicates that site noise levels are below the relevant noise criteria and that noise limits are applicable, the consultant will record the result, note the site has passed, schedule an additional monitoring test to be undertaken at the location within one week and move on to the next monitoring location.

4.4 Determination of stability category

This assessment determined the stability categories throughout the attended monitoring period using the direct measurement method as per Appendix E2 of the INP (EPA 2000).

The temperature lapse rate between the two weather stations (M1 – Sentinex Unit 40 located in Camberwell Village and M2 – Ashton Coal 'repeater' meteorological station located in the north eastern open cut (NEOC) area) was calculated using the following formula:

$$\text{Temperature lapse rate} = (\Delta T) \times (100/(\Delta H))$$

Where:

- ΔT = temperature measured at M2 (at 10 metres above ground level) minus temperature measured at M1 (at 10 metres above ground level); and
- ΔH = the vertical height difference between M2 and M1 (equal to 73 metres).

Table E5 of the INP (EPA 2000) is reproduced in Table 4.2 and presents the stability categories and associated ranges in temperature lapse rates.

Table 4.2 Stability categories and temperature lapse rates

Stability category	Temperature lapse rate (ΔT) (°C/100 m)
A	$\Delta T < -1.9$
B	$-1.9 \leq \Delta T < -1.7$
C	$-1.7 \leq \Delta T < -1.5$
D	$-1.5 \leq \Delta T < -0.5$
E	$-0.5 \leq \Delta T < 1.5$
F	$1.5 \leq \Delta T < 4.0$
G	$\Delta T \geq 4.0$

Source: INP (EPA 2000).

Other meteorological data, such as wind speed, has been sourced directly from meteorological station M2 since it is more representative of the weather conditions nearer to the noise sources.

5 Review of data and discussion

5.1 Summary

Results of attended noise measurements are summarised in Table 5.1. Ashton Coal contribution and total mine noise were determined for each survey using in-field observations and post-analysis of data as required (e.g. removing higher frequencies that are not mine related i.e. above 630 Hz). Attended monitoring was completed on 4 April 2019.

The meteorological data for the monitoring period was sourced from Ashton Coal's two weather stations (M1 and M2) to determine applicability of criteria in accordance with the DC and EPL. Noise limits were applicable during all three measurements.

Low frequency noise was conservatively assessed by comparison of the total measured one-third octave L_{Aeq} noise levels to the NPfI one-third octave low-frequency noise thresholds. As Ashton Coal was found to be inaudible at all monitoring locations, LFN modifying factors were not relevant and hence were not applied to estimated site noise levels at any of the locations.

Monitoring identified that site noise was inaudible at all three monitoring locations. Typically, when a particular source is not audible above local ambient noise levels, the likely contribution of that source is generally at least 10 dB below the measured background (L_{A90}) level.

Table 5.1 Ashton Coal attended noise monitoring results – April 2019

Location	Date	Start time	Total noise levels, dB							Site contributions, dB			Noise limits, dB		Meteorological conditions[3] limits apply (Y/N)	Exceedance, dB	Comments
			L_{Amin}	L_{A90}	L_{Aeq}	L_{A10}	L_{A1}	L_{Amax}	L_{Ceq}	LFN mod. factor[1]	L_{Aeq}	L_{Amax}[2]	L_{Aeq}	L_{Amax}[2]			
N2	4/4	22:00	33	39	50	55	59	63	60	Nil	IA	IA	36	46	1.7 m/s @ 137 D class stability -0.8°C/100m VTG Y	Nil	**Site noise inaudible.** Traffic on the New England Highway and insects consistently audible. Wind in trees occasionally audible.
N3	4/4	22:18	29	33	40	43	48	55	54	Nil	IA	IA	36	46	1.6 m/s @ 143 E class stability -0.5°C/100m VTG Y	Nil	**Site noise inaudible.** Traffic on the New England Highway, insects and frogs consistently audible. Resident noise and a nearby animal occasionally audible.
N4	4/4	22:40	28	32	37	39	41	63	54	Nil	IA	IA	36	46	1.8 m/s @ 145 D class stability -0.7°C/100m VTG Y	Nil	**Site noise inaudible.** Traffic on the New England Highway, insects and frogs consistently audible. Neighbouring mine, frequently audible. Livestock occasionally audible.

Notes:
1. Modifying factor correction for low frequency noise in accordance with Fact Sheet C of the NPfI (refer Section 3.3).
2. For assessment purposes the L_{Amax} and the $L_{A1,1\ minute}$ are interchangeable.
3. Meteorological data were taken as an average over 15 minutes from the Ashton Coal weather station (Refer to Section 5.1).
4. IA = inaudible.
5. N/A = not applicable.

5.2 N2 - Camberwell Village (west)

Ashton Coal operations were inaudible during the whole of the operator-attended noise survey. Given this and the measured background noise level of L_{A90} 39 dB, Ashton Coal $L_{Aeq,15\ minute}$ noise contributions complied with the noise limits. Other ambient noise sources included insects, traffic on the New England Highway and wind in trees.

Neighbouring mining operations were also inaudible during the operator-attended noise survey at monitoring location N2. Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was likely to be below the cumulative mine noise criterion.

5.3 N3 - Camberwell Village (north east)

Ashton Coal operations were inaudible during the whole of the operator-attended noise survey. Given this and the measured background noise level of L_{A90} 33 dB, Ashton Coal $L_{Aeq,15\ minute}$ noise contributions complied with the noise limits. Other ambient noise sources included insects, frogs, traffic on the New England Highway, resident noise and a nearby animal.

Neighbouring mining operations were also inaudible during the operator-attended noise survey at monitoring location N3. Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was likely to be below the cumulative mine noise criterion.

5.4 N4 - South of New England Highway

Ashton Coal operations were inaudible during the whole of the operator-attended noise survey. Given this and the measured background noise level of L_{A90} 32 dB, Ashton Coal $L_{Aeq,15\ minute}$ noise contributions complied with the noise limits. Other ambient noise sources included a neighbouring mine, traffic on the New England Highway, insects, frogs and livestock.

Neighbouring mining operations were frequently audible during the operator-attended noise survey at monitoring location N4. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ 22 dB ($L_{Aeq,15\ minute}$ 25 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion .

6 Conclusion

EMM has completed a review of mine noise from Ashton Coal within the surrounding community based on attended measurements conducted on 4 April 2019.

The applicability of noise limits was assessed with reference to Ashton Coal's two meteorological stations (M1 and M2) located to the east of the site. Noise limits were applicable during all three measurements.

The assessment of noise contributions from site included consideration of modifying factors for noise characteristics where relevant and in accordance with the INP.

Ashton Coal noise contributions and cumulative mine noise contributions were below (satisfied) the relevant noise limits at all monitoring locations for this round of monitoring.

References

Ashton Coal Noise Management Plan, 2017.

NSW Department of Planning and Environment, Development Consent DA309-11-2001-I, 2016.

NSW Environment Protection Authority, Environment Protection License 11879.

NSW Environment Protection Authority, Industrial Noise Policy, 2000.

NSW Environment Protection Authority, Industrial Noise Policy Application notes, 2017.

NSW Environment Protection Authority, Noise Policy for Industry, 2017.

Appendix A

Project approval extract

APPENDIX 6
ALTERNATE NOISE CONDITIONS

NOISE

Application

1. Conditions 2 to 3 below have effect during times when open cut mining operations are not being undertaken at the Ashton Mine Complex, in the opinion of the Secretary.

Noise Criteria

2. Except for the noise-affected land in Table 1 of Schedule 3, the Applicant must ensure that the noise generated by the development does not exceed the criteria in Table 1 at any residence on privately-owned land or on more than 25 per cent of any privately-owned land.

Table 1: Noise Criteria dB(A)

Receiver No.	Receiver	Day ($L_{Aeq\ (15min)}$)	Evening ($L_{Aeq\ (15min)}$)	Night ($L_{Aeq\ (15min)}$)	Night ($L_{A1\ (1\ min)}$)
-	All privately-owned land	38	38	36	46

Noise generated by the development is to be measured in accordance with the relevant requirements of the *NSW Industrial Noise Policy*. Appendix 3 sets out the requirements for evaluating compliance with these criteria.

However, these noise criteria do not apply if the Applicant has an agreement with the relevant owner/s of the residence/land to generate higher noise levels, and the Applicant has advised the Department in writing of the terms of this agreement.

Additional Noise Mitigation Measures

3. Upon receiving a written request from the owner of any residence on any privately-owned land where subsequent operational noise monitoring shows the noise generated by the development exceeds the noise limits in Table 2, the Applicant must implement additional reasonable and feasible noise mitigation measures (such as double glazing, insulation, and/or air conditioning) at the residence in consultation with the owner.

If within 3 months of receiving this request from the landowner, the Applicant and the landowner cannot agree on the measures to be implemented, or there is a dispute about the implementation of these measures, then either party may refer the matter to the Secretary for resolution.

Table 2: Additional Noise Mitigation Criteria dB(A) $L_{Aeq\ (15min)}$

Receiver No.	Receiver	Day ($L_{Aeq\ (15min)}$)	Evening ($L_{Aeq\ (15min)}$)	Night ($L_{Aeq\ (15min)}$)
-	All privately-owned land	38	38	38

Notes:

- *Noise generated by the development is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.*
- *For this condition to apply, the exceedance of the criteria must be systemic.*

APPENDIX 8
NOISE COMPLIANCE ASSESSMENT

Compliance Monitoring

1. Attended monitoring is to be used to evaluate compliance with the relevant conditions of this approval.

2. Data collected for the purposes of determining compliance with the relevant conditions of this approval is to be excluded under the following meteorological conditions:
   a) during periods of rain or hail;
   b) average wind speed at microphone height exceeds 5 m/s;
   c) wind speeds greater than 3 m/s measures at 10 m above ground level; and
   d) temperature inversion conditions greater than 3°C/100m.

3. Unless otherwise agreed with the Secretary, this monitoring is to be carried out in accordance with the relevant requirements relating for reviewing performance set out in the NSW Industrial Noise Policy (as amended from time to time), in particular the requirements relating to:
   a) monitoring locations for the collection of representative noise data;
   b) equipment used to collect noise data, and conformity with Australian Standards relevant to such equipment; and
   c) modifications to noise data collected, including for the exclusion of extraneous noise and/or penalties for modifying factors apart from adjustments for duration.

4. To the extent that there is any inconsistency between the Industrial Noise Policy and the requirements set out in this Appendix, the Appendix prevails to the extent of the inconsistency.

Determination of Meteorological Conditions

5. Except for wind speed at microphone height, the data to be used for determining meteorological conditions shall be that recorded by the meteorological station located in the vicinity of the site (as required by condition 18 of Schedule 3).

Appendix B

EPL extract

Environment Protection Licence

Licence - 11879

3	Ambient surface water monitoring	In Bowmans Creek near the New England Highway shown as point SM4 in Figure 4 dated 8/8/03 titled "EPA Surface Water Monitoring Sites"
4	Ambient surface water monitoring.	In Bowmans Creek near the proposed longwall panels shown as point SM5 in Figure 4 dated 8/8/03 titled "EPA Surface Water Monitoring Sites"
5	Ambient surface water monitoring	In Bowmans Creek at the Hunter River confluence shown as point SM6 in Figure 4 dated 8/8/03 titled "EPA Surface Water Monitoring Sites"
6	Ambient surface water monitoring.	In the Hunter River upstream of Bowmans Creek shown as point SM9 on Figure 4 dated 8/8/03 titled "EPA Surface Water Monitoring Sites".
7	Ambient surface water monitoring	In the Hunter River downstream of Bowmans Creek confluence shown as point SM10 on Figure 4 dated 8/8/03 titled "EPA Surface Water Monitoring Sites".
8	Groundwater monitoring	Locations shown on Figure 1A titled "Groundwater Monitoring Piezometer Locations for EPL" dated 26/10/06.

3 Limit Conditions

L1 Pollution of waters

L1.1 Except as may be expressly provided in any other condition of this licence, the licensee must comply with section 120 of the Protection of the Environment Operations Act 1997.

L2 Noise limits

L2.1 Noise from the premises must not exceed the limits specified in the table below:

Location	Day LAeq(15 minute)	Evening LAeq(15 minute)	Night LAeq(15 minute)	Night LAeq(1 minute)

Any residence not owned by the licensee or not subject to an agreement between the licensee and the residence owner as to an alternative noise limit.	38	38	36	46

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

L2.3 Noise from the premises must be measured at the most affected point on or within the residential boundary or at the most affected point within 30m of the dwelling where the dwelling is more than 30m from boundary to determine compliance with the LAeq(15 minute) noise limits in condition L2.1. Where it can be demonstrated that direct measurement of noise from the premises is impractical, the EPA may accept alternative means of determining compliance. See Chapter 11 of the NSW Industrial Noise Policy. The modification factors presented in Section 4 of the NSW Industrial Noise Policy shall also be applied to the measured noise level where applicable.

L2.4 Noise from the premises is to be measured or computed at 1m from the dwelling facade to determine compliance with condition L2.1 (LA1 (1 minute) noise limit).

L2.5 The noise emission limits identified in condition L2.1 apply under the following meteorological conditions:

a) wind speeds up to 3m/s at 10m above ground level; and
b) temperature inversion conditions up to 30C/100m.

L2.6 Open cut mining activities must only be carried out between the hours of 0700 and 2200 Monday to Saturday, and 0800 and 2200 on Sundays and Public Holidays.

L3 Blasting

L3.1 Blasting in or on the premises must only be carried out between 0900 hours and 1700 hours, Monday to Saturday. Blasting in or on the premises must not take place on Sundays or Public Holidays without the prior approval of the EPA.

L3.2 The overpressure level from blasting operations carried out in or on the premises must not:

a) exceed 115 dB(L) for more than 5% of the total number of blasts carried out on the premises within the 12 months annual reporting period; and
b) exceed 120 dB(L) at any time
at any residence or noise sensitive location (such as a school or hospital) that is not owned by the licensee or subject to a private agreement between the owner of the residence or noise sensitive location

Appendix C

Calibration certificates

CERTIFICATE OF CALIBRATION

CERTIFICATE NO: 24152

EQUIPMENT TESTED: Sound Level Calibrator

Manufacturer: B & K
Type No: 4230 **Serial No:** 1276091
Owner: EMM Consulting
Level 1, 146 Hunter Street
Newcastle, NSW 2300

Tests Performed: Measured output pressure level was found to be:

Parameter	Pre-Adj	Adj Y/N	Output: (db re 20 µPa)	Frequency: (Hz)	THD&N (%)
Level 1:	NA	N	93.81	989.84	1.58
Level 2:	NA	N	NA	NA	NA
Uncertainty:			±0.11 dB	±0.05%	±0.20 %
Uncertainty (at 95% c.l.) k=2					

CONDITION OF TEST:
Ambient Pressure: 1004 hPa ±1.5 hPa **Relative Humidity:** 47% ±5%
Temperature: 20 °C ±2° C
Date of Calibration: 14/02/2019 **Issue Date:** 15/02/2019
Acu-Vib Test Procedure: AVP02 (Calibrators)
Test Method: AS IEC 60942 - 2017
CHECKED BY: ..... **AUTHORISED SIGNATURE:** .....
Jack Kidt

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.
The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

NATA
ACCREDITATION
Accredited Lab. 9262
Acoustic and Vibration Measurements

ACU-VIB
ELECTRONICS
HEAD OFFICE
Unit 14, 22 Hudson Ave. Castle Hill NSW 2154
Tel: (02) 96808133 Fax: (02)96808233
Mobile: 0413 809806
Web site: www.acu-vib.com.au

CERTIFICATE OF CALIBRATION

CERTIFICATE NO.: **SLM 22129 & FILT 4384**

Equipment Description:	Sound Level Meter		
Manufacturer:	B & K		
Model No:	2250	**Serial No:**	2759405
Microphone Type:	4189	**Serial No:**	2888134
Filter Type:	1/3 Octave	**Serial No:**	2759405
Comments:	All tests passed for class 1. (See over for details)		
Owner:	EMGA Mitchell Mclennan Ground Floor, Suite 01, 20 Chandos St St Leonards NSW 2065		
Ambient Pressure:	1008 hPa ±1.5 hPa		
Temperature:	25 °C ±2° C	**Relative Humidity:**	48% ±5%
Date of Calibration:	07/02/2018	**Issue Date:**	09/02/2018

Acu-Vib Test Procedure: AVP10 (SLM) & AVP06 (Filters)

CHECKED BY: ..... **AUTHORISED SIGNATURE:** .....

Jack Kott

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

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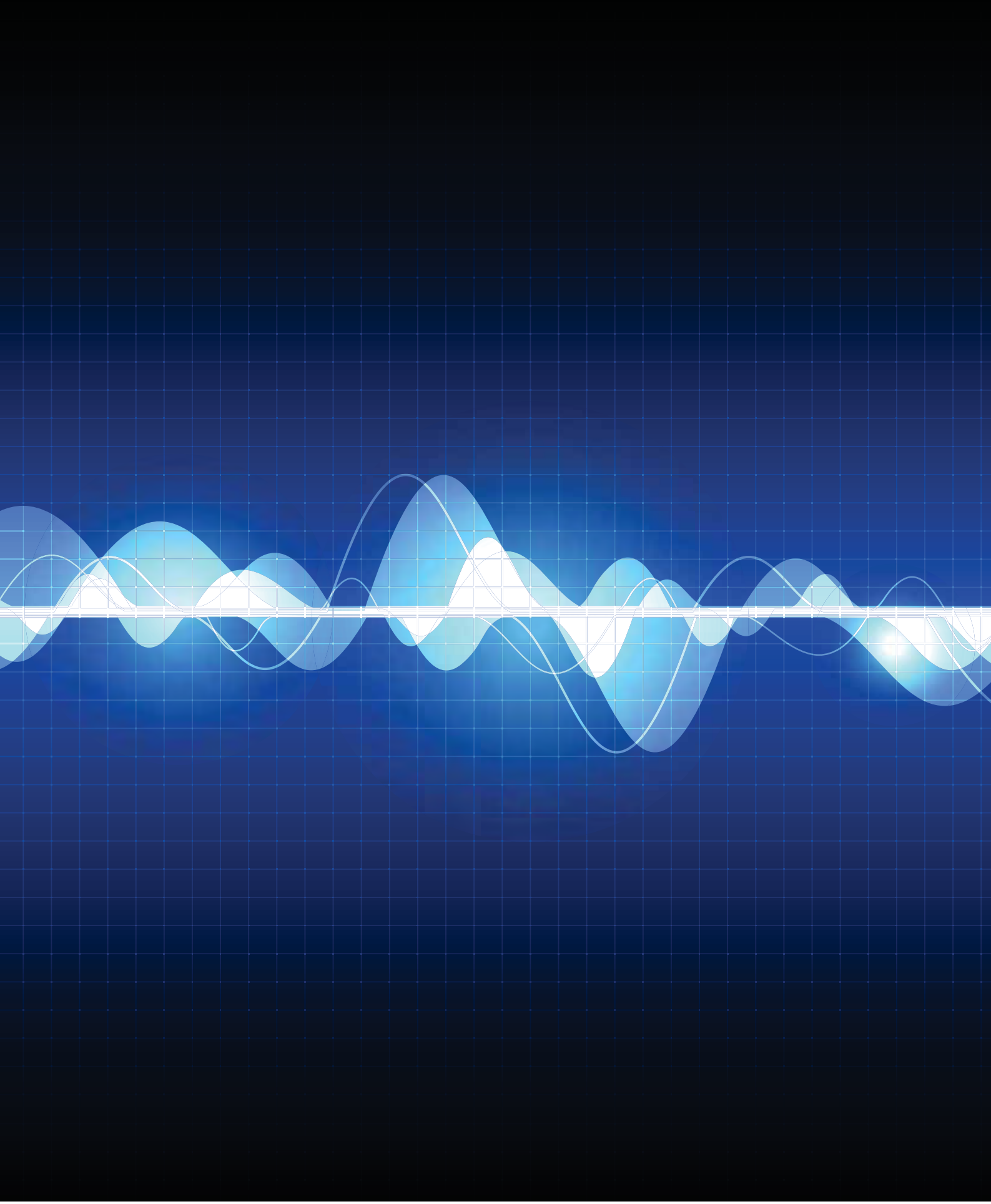


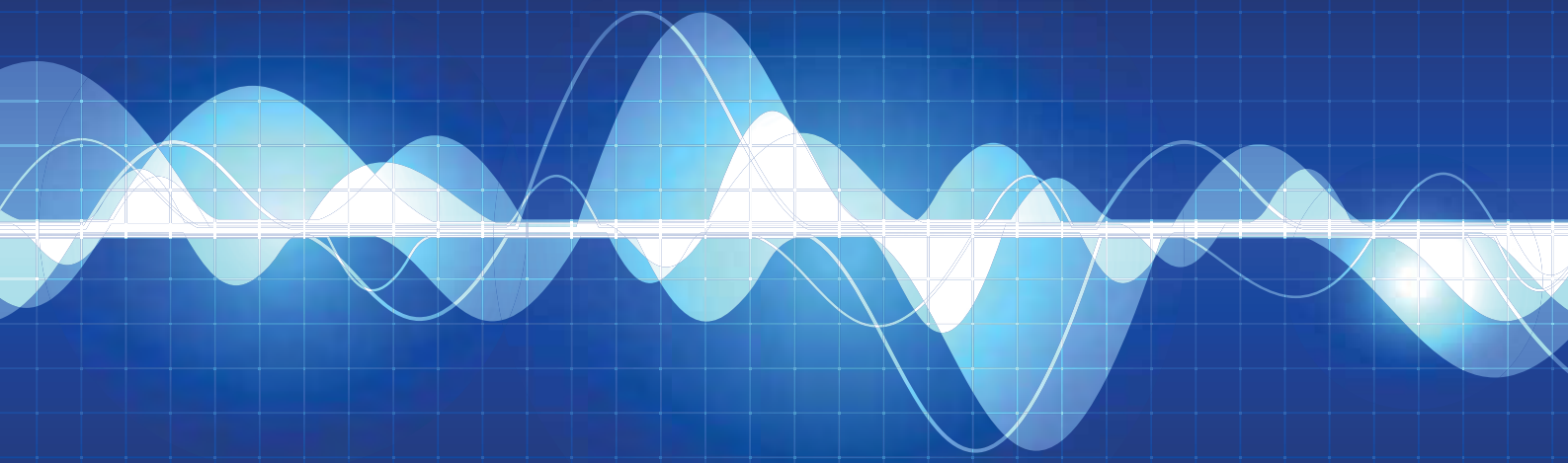
Appendix E

Monthly attended noise monitoring report - May 2019

Ashton Coal

Monthly attended noise monitoring
May 2019

Prepared for Ashton Coal Operations Pty Ltd
May 2019



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Ashton Coal

Monthly attended noise monitoring - May 2019

Prepared for Ashton Coal Operations Pty Ltd
May 2019

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Ashton Coal

Monthly attended noise monitoring - May 2019

Report Number

H190081 RP4

Client

Ashton Coal Operations Pty Ltd

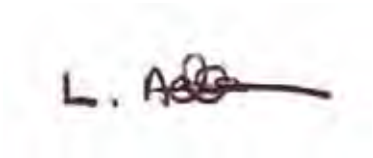
Date

28 May 2019

Version

v1-0 Final

Prepared by



Lucas Adamson
Acoustic Consultant
28 May 2019

Approved by

Najah Ishac
Director
28 May 2019

This report has been prepared in accordance with the brief provided by the client and has relied upon the information collected at the time and under the conditions specified in the report. All findings, conclusions or recommendations contained in the report are based on the aforementioned circumstances. The report is for the use of the client and no responsibility will be taken for its use by other parties. The client may, at its discretion, use the report to inform regulators and the public.

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Table of Contents

Appendices

Tables

Figures

1 Introduction

EMM Consulting Pty Limited (EMM) was engaged to complete monthly attended noise surveys on behalf of Ashton Coal Operations Pty Ltd (Ashton Coal).

The purpose of the monitoring was to address requirements of the approved Ashton Coal Noise Management Plan (NMP), prepared to satisfy the requirements of the Development Consent DA 309-11-2001-I (DC) and Environment Protection License (EPL) 11879.

This report presents the results and findings of attended noise monitoring conducted on 23 May 2019.

The following material was referenced as part of this assessment:

- Department of Planning and Environment (DPE), Development Consent 309-11-2001-I, as modified on 20 June 2016 (current as of 23 May 2019);
- Environment Protection Authority (EPA), Environment Protection License 11879, as varied on 27 March 2019 (current as of 23 May 2019);
- Ashton Coal Project Noise Management Plan (NMP), approved by DPE on 10 October 2017;
- NSW EPA, Industrial Noise Policy (INP), 2000;
- NSW EPA, Industrial Noise Policy Application notes, 2017; and
- NSW EPA, Noise Policy for Industry (NPfI), 2017.

2 Glossary of acoustic terms

Several technical terms are discussed in this report. These are explained in Table 2.1.

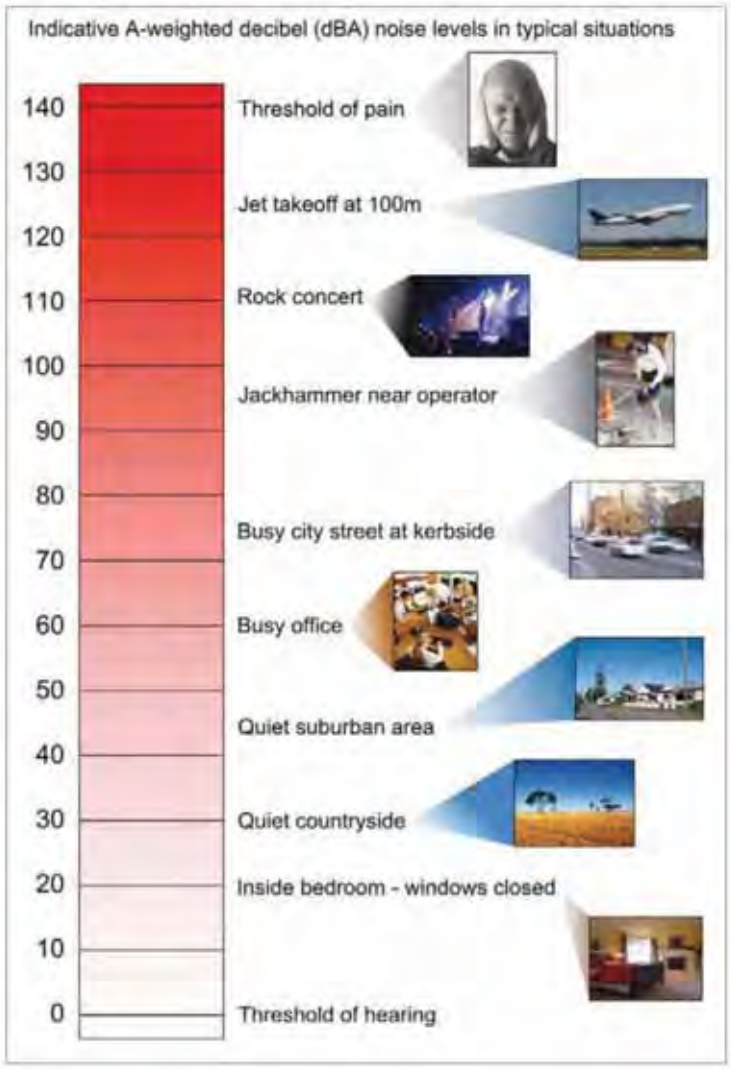
Table 2.1 Glossary of acoustic terms

Term	Description
dB	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.
L_{A1}	The 'A-weighted' noise level which is exceeded 1% of the time.
$L_{A1,1\ minute}$	The 'A-weighted' noise level exceeded for 1% of the specified time period of 1 minute.
L_{A10}	The 'A-weighted' noise level which is exceeded 10% of the time. It is approximately equivalent to the average of maximum noise level.
L_{A90}	Commonly referred to as the background noise level. The 'A-weighted' noise level exceeded 90% of the time.
L_{Aeq}	The energy average noise from a source. This is the equivalent continuous 'A-weighted' sound pressure level over a given period. The $L_{Aeq,15\ minute}$ descriptor refers to an L_{Aeq} noise level measured over a 15-minute period.
L_{Amin}	The minimum 'A-weighted' noise level received during a measuring interval.
L_{Amax}	The maximum root mean squared 'A-weighted' sound pressure level (or maximum noise level) received during a measuring interval.
L_{Ceq}	The equivalent continuous 'C-weighted' sound pressure level over a given period. The $L_{Ceq,15\ minute}$ descriptor refers to an L_{Ceq} noise level measured over a 15 minute period. C-weighting can be used to measure low frequency noise.
Day period	Monday – Saturday: 7 am to 6 pm, on Sundays and Public Holidays: 8 am to 6 pm.
Evening period	Monday – Saturday: 6 pm to 10 pm, on Sundays and Public Holidays: 6 pm to 10 pm.
Night period	Monday – Saturday: 10 pm to 7 am, on Sundays and Public Holidays: 10 pm to 8 am.
Temperature inversion	A meteorological condition where the atmospheric temperature increases with altitude.

It is useful to have an appreciation of decibels (dB), the unit of noise measurement. Table 2.2 gives an indication as to what an average person perceives about changes in noise levels. Examples of common noise levels are provided in Figure 2.1.

Table 2.2 Perceived change in noise

Change in sound pressure level (dB)	Perceived change in noise in surrounding environment
up to 2	not perceptible
3	just perceptible
5	noticeable difference
10	twice (or half) as loud
15	large change
20	four times (or quarter) as loud



Source: Road Noise Policy (Department of Environment, Climate Change and Water 2011)

Figure 2.1 Common noise levels

3 Noise limits

3.1 Operational and sleep disturbance noise limits

Ashton Coal noise limits are provided in Table 1, Condition 2 of Appendix 6 of the DC and Condition L4.1 of the EPL. Extracts of the relevant sections of the DC and EPL pertaining to noise are provided in Appendix A and B, respectively. The approved NMP adopts three attended noise monitoring locations that are representative of residences outlined in the DC. The noise monitoring locations and relevant criteria are summarised in Table 3.1.

Table 3.1 Noise impact assessment criteria

Monitoring location	Day $L_{Aeq,15\ minute}$, dB	Evening $L_{Aeq,15\ minute}$, dB	Night $L_{Aeq,15\ minute}$, dB	Night $L_{A1,1\ minute}$, dB
N2	38	38	36	46
N3	38	38	36	46
N4	38	38	36	46

The DC and the EPL specify the following meteorological conditions under which noise limits do not apply:

- during periods of rain or hail;
- average wind speed at microphone height exceeds 5 m/s;
- wind speeds greater than 3 m/s at 10 metres above ground level; and
- temperature inversion conditions greater than 3°C/100m.

For this assessment, the recorded L_{Amax} has been used as a conservative estimate of the $L_{A1,1\ minute}$. The INP application notes state that the EPA accepts sleep disturbance analysis based on either the $L_{A1,1\ minute}$ or L_{Amax} metrics (EPA 2013), with use of L_{Amax} resulting in a more conservative assessment.

The DC and EPL state that modification factor corrections in the application notes to the INP (2017) shall be applied to the measured mine noise levels where applicable. The application notes to the INP state that Fact Sheet C of the NPfI (EPA 2017) now applies regarding the application of modifying factors.

3.2 Cumulative noise criteria

Ashton Coal cumulative noise limits are provided in Condition 5 and Condition 6 of Schedule 3 of the DC. An extract of the conditions relevant to cumulative noise criteria is provided here.

> 5. The Applicant must implement all reasonable and feasible measures to ensure that the noise generated by the Ashton Mine Complex combined with the noise generated by other mines in the vicinity does not exceed the criteria in Table 4 at any residence on any privately-owned land or on more than 25 per cent of any privately-owned land (except for the noise affected residential receivers in Table 1).

Table 4: Cumulative Noise Criteria dB(A) $L_{Aeq\ (period)}$

Location	Day	Evening	Night
Camberwell Village	55	45	40
All other privately-owned land	50	45	40

> Cumulative noise is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.

> 6. If the cumulative noise generated by the Ashton Mine Complex combined with the noise generated by other coal mines in the vicinity exceeds the criteria in Table 5 at any residence on privately-owned land or more than 25 per cent of any privately-owned land (except for the noise-affected residential receivers ion Table 1), then upon receiving a written request from the landowner, the Applicant must, together with the relevant mines, acquire the land on as equitable basis as possible, in accordance with the procedures in conditions 7 and 8 of schedule 4.

Table 5: Cumulative Noise Acquisition Criteria dB(A) $L_{Aeq\ (period)}$

Location	Day	Evening	Night
Camberwell Village	60	50	45
All other privately-owned land	55	50	45

> Cumulative noise is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.

3.3 Low frequency noise criteria

Condition 3 of Appendix 8 of the DC and L4.3 of the EPL state that noise generated by Ashton Coal is to be measured in accordance with the relevant requirements of the INP. The INP application notes state that Section 4 of the INP has been withdrawn and the modifying factor adjustments outlined in Fact Sheet C of the NPfI are to be used when assessing the characteristics of a noise source.

Fact sheet C of the NPfI (EPA 2017) provides guidelines for applying modifying factor corrections to account for low frequency noise emissions. The NPfI specifies that a difference of 15 dB or more between site 'C-weighted' and site 'A-weighted' noise emission levels identifies the potential for an unbalanced spectrum and potential increased annoyance.

Where a difference of 15 dB or more between site 'C-weighted' and site 'A-weighted' noise emission levels is identified, the one-third octave noise levels recorded should be compared to the values in Table C2 of the NPfI (EPA 2017), which has been reproduced in Table 3.2 below.

Table 3.2 One-third octave low-frequency noise thresholds

	One-third octave $L_{Zeq,15\ minute}$ 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

The following modifying factor correction is to be applied where the site 'C-weighted' and site 'A-weighted' noise emission level is 15 dB or more and:

- where any of the one-third octave noise levels in Table 3.2 are exceeded by up to and including 5 dB and cannot be mitigated, a 2 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period; or

- where any of the one-third octave noise levels in Table 3.2 are exceeded by more than 5 dB and cannot be mitigated, a 5 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period.

Hence, where relevant throughout each survey the operator has estimated the difference between site 'C-weighted' and site 'A-weighted' noise emission levels by matching audible sounds with the response of the analyser (L_{Ceq}-L_{Aeq}). Where this was deemed to be 15 dB or greater, the measured one-third octave frequencies have been compared to the values in Table 3.2 to identify the relevant modifying factor correction (if applicable). This method has been applied to this assessment as presented in Section 5.

It is of note that the NPfI (EPA 2017) states that low-frequency noise corrections only apply under the standard or noise-enhancing (i.e. applicable) meteorological conditions.

4 Assessment methodology

4.1 Attended noise monitoring

To quantify noise emissions from Ashton Coal, 15-minute attended noise monitoring surveys were completed at representative locations as per the approved NMP. Noise monitoring locations and their coordinates are listed in Table 4.1 and are shown in Figure 4.1.

Table 4.1 Attended noise monitoring locations

Monitoring location	Description	MGA56	
		Easting	Northing
N2	Camberwell Village (west)	320297	6405670
N3	Camberwell Village (north east)	320554	6405839
N4	South of New England Highway	319776	6404101

Attended noise monitoring is scheduled to be "unannounced" and, to EMM's knowledge, Ashton Coal were not aware of the monitoring prior to its commencing. Noise monitoring is avoided during any scheduled down-time or major maintenance. To our knowledge, regular operations were occurring during this round of noise monitoring.

Where possible throughout each survey, the operator has quantified the contribution of each significant noise source. This was done by matching audible sounds with the response of the analyser (where applicable) and/or via post-analysis of data (e.g. low pass filtering).

4.2 Instrumentation

A Brüel & Kjær 2250 Type 1 sound analyser (s/n 2759405) was used to conduct 15-minute attended measurements and record 1/3 octave frequency and statistical noise indices. The sound analyser was calibrated before and on completion of the survey using a Brüel & Kjær type 4230 calibrator (s/n 1276091). The instrumentation's calibration certificates are provided in Appendix C.

Source: EMM (2019); DFSI (2017); GA (2011)

0 1 2 km

GDA 1994 MGA Zone 56

N

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KEY

- Site boundary
- Noise monitoring location
- Meteorological station
- Rail line
- Main road
- Local road
- Watercourse/drainage line
- Cadastral boundary

Noise monitoring locations and Ashton colliery boundary

Ashton Coal
Monthly attended noise monitoring
Figure 4.1

EMM
creating opportunities

4.3 Attended noise monitoring exceedance procedure

Ashton Coal has developed an attended monitoring exceedance procedure that is to be implemented if measurements show Ashton Coal noise emissions are above the relevant noise criteria. This response plan is implemented if site noise levels are determined to be above the relevant noise criteria and when noise limits are applicable due to suitable meteorological conditions. The following noise management initiatives are implemented:

- Consultant will record the reading and advise Ashton Coal of the exceedance. Ashton Coal will implement remedial action as required.
- A follow up measurement is to be conducted (within 75 minutes after the first measurement and no earlier than 10 pm).
- If the follow up measurement indicates that site noise levels are above the relevant noise criteria and that noise limits are applicable, the consultant will record the result, note the site has failed and is deemed a 'noise affected night' at that location. An additional monitoring test should be scheduled to be undertaken at the same location within one week and move on to the next monitoring location.
- If the follow up measurement indicates that site noise levels are below the relevant noise criteria and that noise limits are applicable, the consultant will record the result, note the site has passed, schedule an additional monitoring test to be undertaken at the location within one week and move on to the next monitoring location.

4.4 Determination of stability category

This assessment determined the stability categories throughout the attended monitoring period using the direct measurement method as per Appendix E2 of the INP (EPA 2000).

The temperature lapse rate between the two weather stations (M1 – Sentinex Unit 40 located in Camberwell Village and M2 – Ashton Coal 'repeater' meteorological station located in the north eastern open cut (NEOC) area) was calculated using the following formula:

$$\text{Temperature lapse rate} = (\Delta T) \times (100/(\Delta H))$$

Where:

- ΔT = temperature measured at M2 (at 10 metres above ground level) minus temperature measured at M1 (at 10 metres above ground level); and
- ΔH = the vertical height difference between M2 and M1 (equal to 73 metres).

Table E5 of the INP (EPA 2000) is reproduced in Table 4.2 and presents the stability categories and associated ranges in temperature lapse rates.

Table 4.2 Stability categories and temperature lapse rates

Stability category	Temperature lapse rate (ΔT) (°C/100 m)
A	$\Delta T < -1.9$
B	$-1.9 \leq \Delta T < -1.7$
C	$-1.7 \leq \Delta T < -1.5$
D	$-1.5 \leq \Delta T < -0.5$
E	$-0.5 \leq \Delta T < 1.5$
F	$1.5 \leq \Delta T < 4.0$
G	$\Delta T \geq 4.0$

Source: INP (EPA 2000).

Other meteorological data, such as wind speed, has been sourced directly from meteorological station M2 since it is more representative of the weather conditions nearer to the noise sources.

5 Review of data and discussion

5.1 Summary

Results of attended noise measurements are summarised in Table 5.1. Ashton Coal contribution and total mine noise were determined for each survey using in-field observations and post-analysis of data as required (e.g. removing higher frequencies that are not mine related i.e. above 630 Hz). Attended monitoring was completed on 23 May 2019.

The meteorological data for the monitoring period was sourced from Ashton Coal's two weather stations (M1 and M2) to determine applicability of criteria in accordance with the DC and EPL. Noise limits were not applicable during any of the measurements due to temperature inversion conditions greater than 3°C/100m.

Low frequency noise was conservatively assessed by comparison of the total measured one-third octave L_{Aeq} noise levels to the NPfI one-third octave low-frequency noise thresholds. As Ashton Coal was found to be inaudible at all monitoring locations, LFN modifying factors were not relevant and hence were not applied to estimated site noise levels at any of the locations.

Monitoring identified that site noise was inaudible at all three monitoring locations. Typically, when a particular source is not audible above local ambient noise levels, the likely contribution of that source is generally at least 10 dB below the measured background (L_{A90}) level.

Table 5.1 Ashton Coal attended noise monitoring results – May 2019

Location	Date	Start time	Total noise levels, dB							Site contributions, dB			Noise limits, dB		Meteorological conditions[3] limits apply (Y/N)	Exceedance, dB	Comments
			L_{Amin}	L_{A90}	L_{Aeq}	L_{A10}	L_{A1}	L_{Amax}	L_{Ceq}	LFN mod. factor[1]	L_{Aeq}	L_{Amax}[2]	L_{Aeq}	L_{Amax}[2]			
N2	23/5	22:01	32	38	52	56	60	66	60	Nil	IA	IA	36	46	2.2 m/s @ 159° F class stability 3.4°C/100m VTG N	N/A	**Site noise inaudible.** Traffic on the New England Highway, a neighbouring mine, insects and frogs consistently audible. Nearby animal occasionally audible.
N3	23/5	22:19	30	33	44	48	54	58	56	Nil	IA	IA	36	46	1.1 m/s @ 131° G class stability 4.0°C/100m VTG N	N/A	**Site noise inaudible.** Traffic on the New England Highway, a neighbouring mine, insects and frogs consistently audible. Train on the main line (unrelated to Ashton Coal) audible for approx. 12 minutes. Livestock and bird noise occasionally audible.
N4	23/5	22:40	28	31	40	42	47	64	55	Nil	IA	IA	36	46	0.8 m/s @ 89° G class stability 4.5°C/100m VTG N	N/A	**Site noise inaudible.** Traffic on the New England Highway, a neighbouring mine, powerline hum, insects and frogs consistently audible. Livestock occasionally audible.

Notes:
1. Modifying factor correction for low frequency noise in accordance with Fact Sheet C of the NPfI (refer Section 3.3).
2. For assessment purposes the L_{Amax} and the $L_{A1,1\ minute}$ are interchangeable.
3. Meteorological data were taken as an average over 15 minutes from the Ashton Coal weather station (Refer to Section 5.1). VTG assumes the temperature sensors on the two weather stations are in proper working order and calibrated to manufacturers requirements.
4. IA = inaudible.
5. N/A = not applicable.

5.2 N2 - Camberwell Village (west)

Ashton Coal operations were inaudible during the whole of the operator-attended noise survey. Given this and the measured background noise level of L_{A90} 38 dB, Ashton Coal $L_{Aeq,15\ minute}$ noise contributions were lower than the noise limits, and hence would have complied had limits applied. Other ambient noise sources included insects, frogs, nearby animals, traffic on the New England Highway and a neighbouring mine.

Neighbouring mining operations were consistently audible during the operator-attended noise survey at monitoring location N2. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ 28 dB ($L_{Aeq,15\ minute}$ 31 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

5.3 N3 - Camberwell Village (north east)

Ashton Coal operations were inaudible during the whole of the operator-attended noise survey. Given this and the measured background noise level of L_{A90} 33 dB, Ashton Coal $L_{Aeq,15\ minute}$ noise contributions were lower than the noise limits, and hence would have complied had limits applied. Other ambient noise sources included insects, frogs, traffic on the New England Highway, a neighbouring mine, livestock, bird noise and a train on the main line (unrelated to Ashton Coal).

Neighbouring mining operations were consistently audible during the operator-attended noise survey at monitoring location N3. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ 27 dB ($L_{Aeq,15\ minute}$ 30 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

5.4 N4 - South of New England Highway

Ashton Coal operations were inaudible during the whole of the operator-attended noise survey. Given this and the measured background noise level of L_{A90} 31 dB, Ashton Coal $L_{Aeq,15\ minute}$ noise contributions were lower than the noise limits, and hence would have complied had limits applied. Other ambient noise sources included a neighbouring mine, traffic on the New England Highway, powerline hum, insects, frogs and livestock.

Neighbouring mining operations were consistently audible during the operator-attended noise survey at monitoring location N4. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ 26 dB ($L_{Aeq,15\ minute}$ 29 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

6 Conclusion

EMM has completed a review of mine noise from Ashton Coal within the surrounding community based on attended measurements conducted on 23 May 2019.

The applicability of noise limits was assessed with reference to Ashton Coal's two meteorological stations (M1 and M2) located to the east of the site. Noise limits were not applicable during any of the measurements due to temperature inversion conditions greater than 3°C/100m.

The assessment of noise contributions from site included consideration of modifying factors for noise characteristics where relevant and in accordance with the INP.

Ashton Coal noise contributions and cumulative mine noise contributions were below (satisfied) the relevant noise limits (had they applied) at all monitoring locations for this round of monitoring.

References

Ashton Coal Noise Management Plan, 2017.

NSW Department of Planning and Environment, Development Consent DA309-11-2001-I, 2016.

NSW Environment Protection Authority, Environment Protection License 11879.

NSW Environment Protection Authority, Industrial Noise Policy, 2000.

NSW Environment Protection Authority, Industrial Noise Policy Application notes, 2017.

NSW Environment Protection Authority, Noise Policy for Industry, 2017.

Appendix A

Project approval extract

APPENDIX 6
ALTERNATE NOISE CONDITIONS

NOISE

Application

1. Conditions 2 to 3 below have effect during times when open cut mining operations are not being undertaken at the Ashton Mine Complex, in the opinion of the Secretary.

Noise Criteria

2. Except for the noise-affected land in Table 1 of Schedule 3, the Applicant must ensure that the noise generated by the development does not exceed the criteria in Table 1 at any residence on privately-owned land or on more than 25 per cent of any privately-owned land.

Table 1: Noise Criteria dB(A)

Receiver No.	Receiver	Day ($L_{Aeq\ (15min)}$)	Evening ($L_{Aeq\ (15min)}$)	Night ($L_{Aeq\ (15min)}$)	Night ($L_{A1\ (1\ min)}$)
-	All privately-owned land	38	38	36	46

Noise generated by the development is to be measured in accordance with the relevant requirements of the *NSW Industrial Noise Policy*. Appendix 3 sets out the requirements for evaluating compliance with these criteria.

However, these noise criteria do not apply if the Applicant has an agreement with the relevant owner/s of the residence/land to generate higher noise levels, and the Applicant has advised the Department in writing of the terms of this agreement.

Additional Noise Mitigation Measures

3. Upon receiving a written request from the owner of any residence on any privately-owned land where subsequent operational noise monitoring shows the noise generated by the development exceeds the noise limits in Table 2, the Applicant must implement additional reasonable and feasible noise mitigation measures (such as double glazing, insulation, and/or air conditioning) at the residence in consultation with the owner.

If within 3 months of receiving this request from the landowner, the Applicant and the landowner cannot agree on the measures to be implemented, or there is a dispute about the implementation of these measures, then either party may refer the matter to the Secretary for resolution.

Table 2: Additional Noise Mitigation Criteria dB(A) $L_{Aeq\ (15min)}$

Receiver No.	Receiver	Day ($L_{Aeq\ (15min)}$)	Evening ($L_{Aeq\ (15min)}$)	Night ($L_{Aeq\ (15min)}$)
-	All privately-owned land	38	38	38

Notes:

- *Noise generated by the development is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.*
- *For this condition to apply, the exceedance of the criteria must be systemic.*

APPENDIX 8
NOISE COMPLIANCE ASSESSMENT

Compliance Monitoring

1. Attended monitoring is to be used to evaluate compliance with the relevant conditions of this approval.

2. Data collected for the purposes of determining compliance with the relevant conditions of this approval is to be excluded under the following meteorological conditions:
   a) during periods of rain or hail;
   b) average wind speed at microphone height exceeds 5 m/s;
   c) wind speeds greater than 3 m/s measures at 10 m above ground level; and
   d) temperature inversion conditions greater than 3°C/100m.

3. Unless otherwise agreed with the Secretary, this monitoring is to be carried out in accordance with the relevant requirements relating for reviewing performance set out in the NSW Industrial Noise Policy (as amended from time to time), in particular the requirements relating to:
   a) monitoring locations for the collection of representative noise data;
   b) equipment used to collect noise data, and conformity with Australian Standards relevant to such equipment; and
   c) modifications to noise data collected, including for the exclusion of extraneous noise and/or penalties for modifying factors apart from adjustments for duration.

4. To the extent that there is any inconsistency between the Industrial Noise Policy and the requirements set out in this Appendix, the Appendix prevails to the extent of the inconsistency.

Determination of Meteorological Conditions

5. Except for wind speed at microphone height, the data to be used for determining meteorological conditions shall be that recorded by the meteorological station located in the vicinity of the site (as required by condition 18 of Schedule 3).

Appendix B

EPL extract

Environment Protection Licence

Licence - 11879

13	Noise monitoring	Attended noise monitoring at coordinates 320554, 6405839 (Easting, Northing) identified as N3 on Figure 1.
14	Noise monitoring	Attended noise monitoring at coordinates 320297, 6405670 (Easting, Northing) identified as N2 on Figure 1.
15	Noise monitoring	Attended noise monitoring at coordinates 319776, 6404101 (Easting, Northing) identified as N4 on Figure 1.

P1.5 For the purposes of condition P1.1, P1.3 and P1.4 Figure 1 refers to the plan titled *"Ashton Underground Mine Environment Protection Licence 11879 Premises Boundary, Monitoring & Infrastructure"* dated 1/6/17 EPA Ref DOC17/375653-02.

3 Limit Conditions

L1 Pollution of waters

L1.1 Except as may be expressly provided in any other condition of this licence, the licensee must comply with section 120 of the Protection of the Environment Operations Act 1997.

L2 Concentration limits

L2.1 Flares must be operated by the licensee such that there is no visible emission other than for a total period of no more than 5 minutes in any 2 hours, except for heat haze.

L3 Waste

L3.1 The licensee must not cause, permit or allow any waste to be received at the premises unless specified in this licence.

L4 Noise limits

L4.1 Noise from the premises must not exceed the limits specified in the table below:

Location	Day LAeq(15 minute)	Evening LAeq(15 minute)	Night LAeq(15 minute)	Night LAeq(1 minute)

Any residence not owned by the licensee or not subject to an agreement between the licensee and the residence owner as to an alternative noise limit.	38	38	36	46

L4.2 For the purpose of Condition L2.1:
a) Day is defined as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sundays and Public Holidays,
b) Evening is defined as the period from 6pm to 10pm, and
c) Night is defined as the period from 10pm to 7am Monday to Saturday and 10pm to 8am Sundays and Public Holidays

L4.3 Noise from the premises must be measured at the most affected point on or within the residential boundary or at the most affected point within 30m of the dwelling where the dwelling is more than 30m from boundary to determine compliance with the LAeq(15 minute) noise limits in condition L2.1. Where it can be demonstrated that direct measurement of noise from the premises is impractical, the EPA may accept alternative means of determining compliance. See Chapter 11 of the NSW Industrial Noise Policy. The modification factors presented in Section 4 of the NSW Industrial Noise Policy shall also be applied to the measured noise level where applicable.

L4.4 Noise from the premises is to be measured or computed at 1m from the dwelling facade to determine compliance with condition L2.1 (LA1 (1 minute) noise limit).

L4.5 The noise emission limits identified in condition L2.1 apply under the following meteorological conditions:

a) wind speeds up to 3m/s at 10m above ground level; and
b) temperature inversion conditions up to 3 degrees C/100m.

L4.6 Noise generated at the premises that is measured at each noise monitoring point established under this licence must not exceed the noise levels specified in Column 4 of the table below for that point during the corresponding time periods specified in Column 1 when measured using the corresponding measurement parameters listed in Column 2.

POINT 13,14,15

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
Day	Day-LAeq (15 minute)	-	38
Evening	Evening-LAeq (15 minute)	-	38
Night	Night-LAeq (15 minute)	-	36
Night	Night-LA1 (1 minute)	-	46

Appendix C

Calibration certificates

CERTIFICATE OF CALIBRATION

CERTIFICATE NO: 24152

EQUIPMENT TESTED: Sound Level Calibrator

Manufacturer: B & K
Type No: 4230 **Serial No:** 1276091
Owner: EMM Consulting
Level 1, 146 Hunter Street
Newcastle, NSW 2300

Tests Performed: Measured output pressure level was found to be:

Parameter	Pre-Adj	Adj Y/N	Output: (db re 20 µPa)	Frequency: (Hz)	THD&N (%)
Level 1:	NA	N	93.81	989.84	1.58
Level 2:	NA	N	NA	NA	NA
Uncertainty:			±0.11 dB	±0.05%	±0.20 %
Uncertainty (at 95% c.l.) k=2					

CONDITION OF TEST:
Ambient Pressure: 1004 hPa ±1.5 hPa **Relative Humidity:** 47% ±5%
Temperature: 20 °C ±2° C
Date of Calibration: 14/02/2019 **Issue Date:** 15/02/2019
Acu-Vib Test Procedure: AVP02 (Calibrators)
Test Method: AS IEC 60942 - 2017
CHECKED BY: ..... **AUTHORISED SIGNATURE:** .....
Jack Kidt

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.
The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

NATA
ACCREDITATION
Accredited Lab. 9262
Acoustic and Vibration Measurements

ACU-VIB
ELECTRONICS
HEAD OFFICE
Unit 14, 22 Hudson Ave. Castle Hill NSW 2154
Tel: (02) 96808133 Fax: (02)96808233
Mobile: 0413 809806
Web site: www.acu-vib.com.au

CERTIFICATE OF CALIBRATION

CERTIFICATE NO.: **SLM 22129 & FILT 4384**

Equipment Description:	Sound Level Meter		
Manufacturer:	B & K		
Model No:	2250	**Serial No:**	2759405
Microphone Type:	4189	**Serial No:**	2888134
Filter Type:	1/3 Octave	**Serial No:**	2759405
Comments:	All tests passed for class 1. (See over for details)		
Owner:	EMGA Mitchell Mclennan Ground Floor, Suite 01, 20 Chandos St St Leonards NSW 2065		
Ambient Pressure:	1008 hPa ±1.5 hPa		
Temperature:	25 °C ±2° C	**Relative Humidity:**	48% ±5%
Date of Calibration:	07/02/2018	**Issue Date:**	09/02/2018

Acu-Vib Test Procedure: AVP10 (SLM) & AVP06 (Filters)

CHECKED BY: ..... **AUTHORISED SIGNATURE:** .....

Jack Kott

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.

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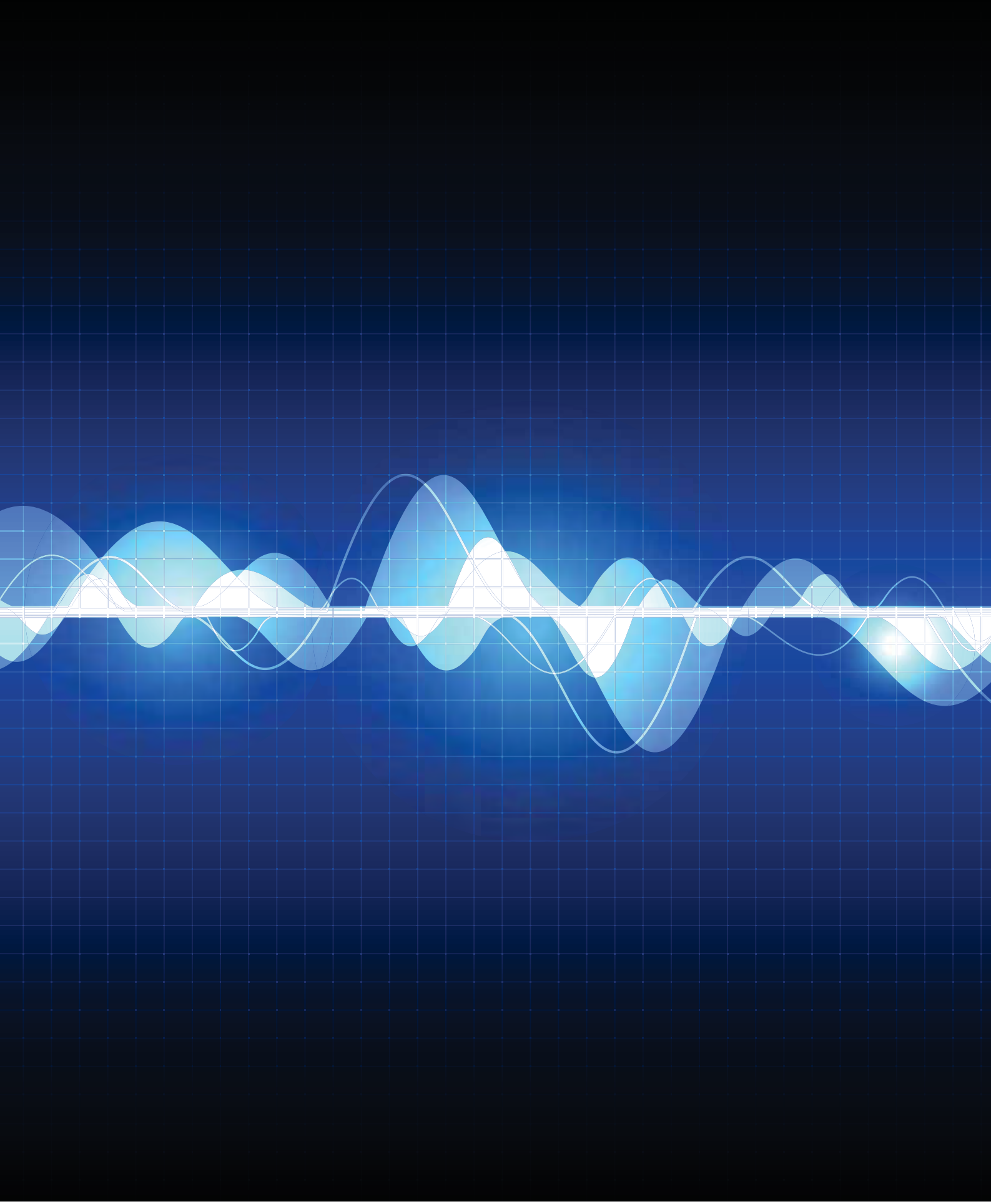


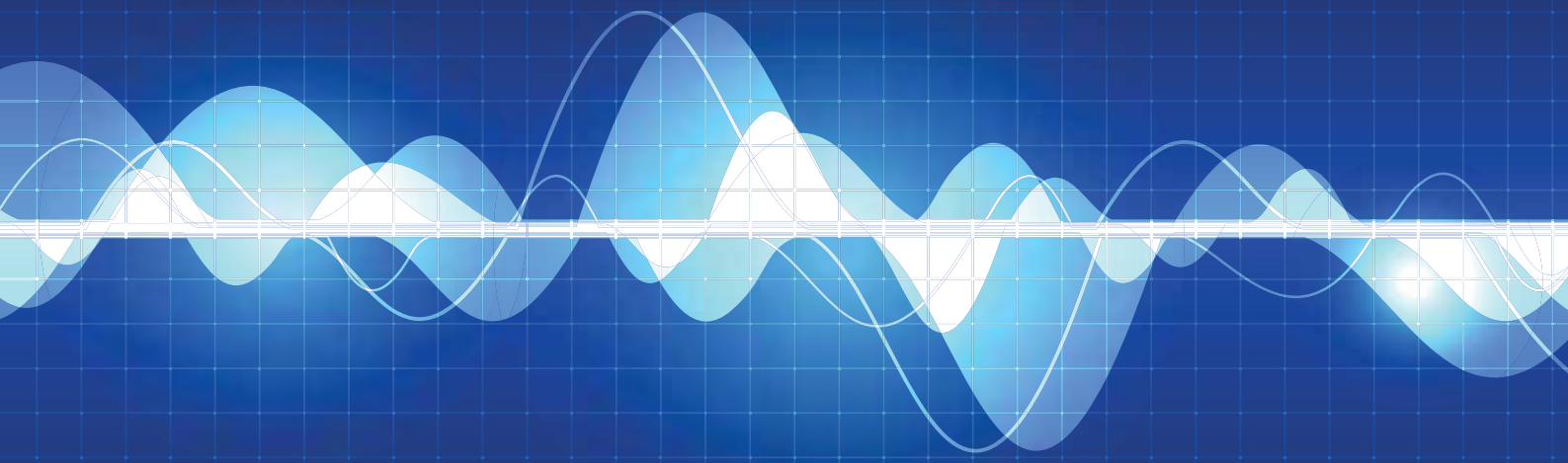
Appendix F

Monthly attended noise monitoring report - June 2019

Ashton Coal

Monthly attended noise monitoring
June 2019

Prepared for Ashton Coal Operations Pty Ltd
June 2019



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Ashton Coal

Monthly attended noise monitoring - June 2019

Prepared for Ashton Coal Operations Pty Ltd
June 2019

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Ashton Coal

Monthly attended noise monitoring - June 2019

Report Number

H190081 RP5

Client

Ashton Coal Operations Pty Ltd

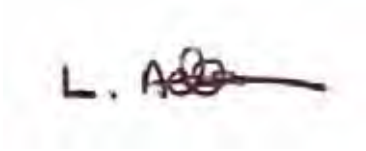
Date

25 June 2019

Version

v1-0 Final

Prepared by



Lucas Adamson
Acoustic Consultant
25 June 2019

Approved by

Katie Teyhan
Associate
25 June 2019

This report has been prepared in accordance with the brief provided by the client and has relied upon the information collected at the time and under the conditions specified in the report. All findings, conclusions or recommendations contained in the report are based on the aforementioned circumstances. The report is for the use of the client and no responsibility will be taken for its use by other parties. The client may, at its discretion, use the report to inform regulators and the public.

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Appendices

Tables

Figures

1 Introduction

EMM Consulting Pty Limited (EMM) was engaged to complete monthly attended noise surveys on behalf of Ashton Coal Operations Pty Ltd (Ashton Coal).

The purpose of the monitoring was to address requirements of the approved Ashton Coal Noise Management Plan (NMP), prepared to satisfy the requirements of the Development Consent DA 309-11-2001-I (DC) and Environment Protection License (EPL) 11879.

This report presents the results and findings of attended noise monitoring conducted on 7 June 2019.

The following material was referenced as part of this assessment:

- Department of Planning and Environment (DPE), Development Consent 309-11-2001-I, as modified on 20 June 2016 (current as of 7 June 2019);
- Environment Protection Authority (EPA), Environment Protection License 11879, as varied on 27 March 2019 (current as of 7 June 2019);
- Ashton Coal Project Noise Management Plan (NMP), approved by DPE on 10 October 2017;
- NSW EPA, Industrial Noise Policy (INP), 2000;
- NSW EPA, Industrial Noise Policy Application notes, 2017; and
- NSW EPA, Noise Policy for Industry (NPfI), 2017.

2 Glossary of acoustic terms

Several technical terms are discussed in this report. These are explained in Table 2.1.

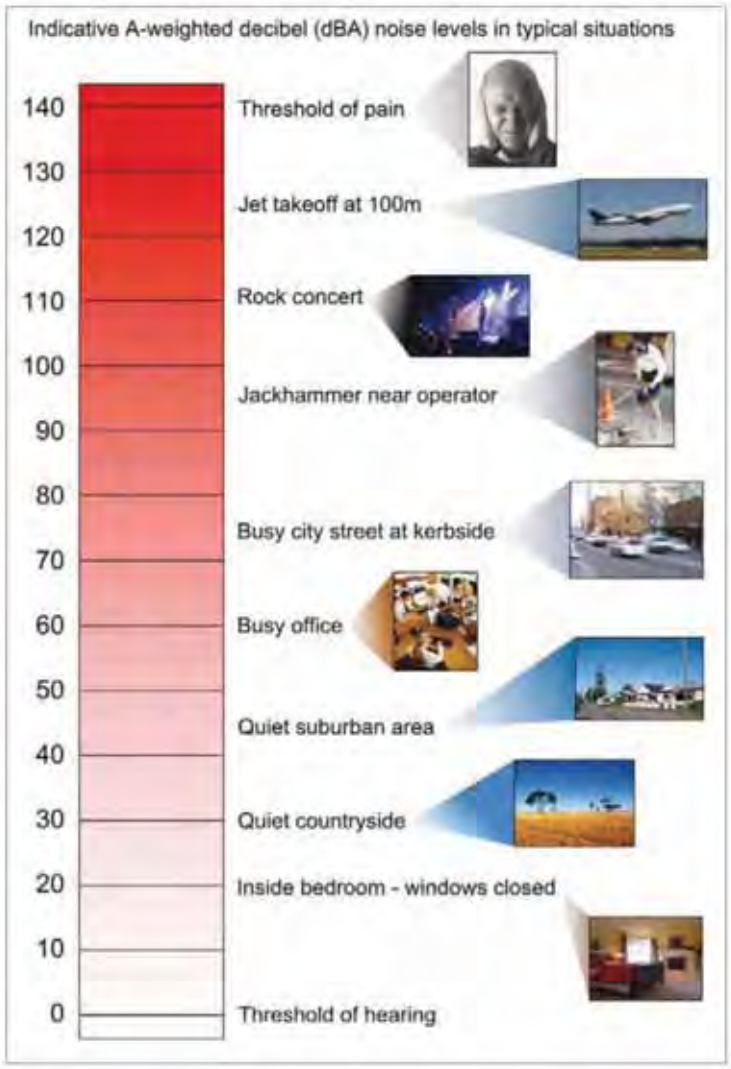
Table 2.1 Glossary of acoustic terms

Term	Description
dB	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.
L_{A1}	The 'A-weighted' noise level which is exceeded 1% of the time.
$L_{A1,1\ minute}$	The 'A-weighted' noise level exceeded for 1% of the specified time period of 1 minute.
L_{A10}	The 'A-weighted' noise level which is exceeded 10% of the time. It is approximately equivalent to the average of maximum noise level.
L_{A90}	Commonly referred to as the background noise level. The 'A-weighted' noise level exceeded 90% of the time.
L_{Aeq}	The energy average noise from a source. This is the equivalent continuous 'A-weighted' sound pressure level over a given period. The $L_{Aeq,15\ minute}$ descriptor refers to an L_{Aeq} noise level measured over a 15-minute period.
L_{Amin}	The minimum 'A-weighted' noise level received during a measuring interval.
L_{Amax}	The maximum root mean squared 'A-weighted' sound pressure level (or maximum noise level) received during a measuring interval.
L_{Ceq}	The equivalent continuous 'C-weighted' sound pressure level over a given period. The $L_{Ceq,15\ minute}$ descriptor refers to an L_{Ceq} noise level measured over a 15 minute period. C-weighting can be used to measure low frequency noise.
Day period	Monday – Saturday: 7 am to 6 pm, on Sundays and Public Holidays: 8 am to 6 pm.
Evening period	Monday – Saturday: 6 pm to 10 pm, on Sundays and Public Holidays: 6 pm to 10 pm.
Night period	Monday – Saturday: 10 pm to 7 am, on Sundays and Public Holidays: 10 pm to 8 am.
Temperature inversion	A meteorological condition where the atmospheric temperature increases with altitude.

It is useful to have an appreciation of decibels (dB), the unit of noise measurement. Table 2.2 gives an indication as to what an average person perceives about changes in noise levels. Examples of common noise levels are provided in Figure 2.1.

Table 2.2 Perceived change in noise

Change in sound pressure level (dB)	Perceived change in noise in surrounding environment
up to 2	not perceptible
3	just perceptible
5	noticeable difference
10	twice (or half) as loud
15	large change
20	four times (or quarter) as loud



Source: Road Noise Policy (Department of Environment, Climate Change and Water 2011)

Figure 2.1 Common noise levels

3 Noise limits

3.1 Operational and sleep disturbance noise limits

Ashton Coal noise limits are provided in Table 1, Condition 2 of Appendix 6 of the DC and Condition L4.1 of the EPL. Extracts of the relevant sections of the DC and EPL pertaining to noise are provided in Appendix A and B, respectively. The approved NMP adopts three attended noise monitoring locations that are representative of residences outlined in the DC. The noise monitoring locations and relevant criteria are summarised in Table 3.1.

Table 3.1 Noise impact assessment criteria

Monitoring location	Day $L_{Aeq,15\ minute}$, dB	Evening $L_{Aeq,15\ minute}$, dB	Night $L_{Aeq,15\ minute}$, dB	Night $L_{A1,1\ minute}$, dB
N2	38	38	36	46
N3	38	38	36	46
N4	38	38	36	46

The DC and the EPL specify the following meteorological conditions under which noise limits do not apply:

- during periods of rain or hail;
- average wind speed at microphone height exceeds 5 m/s;
- wind speeds greater than 3 m/s at 10 metres above ground level; and
- temperature inversion conditions greater than 3°C/100m.

For this assessment, the recorded L_{Amax} has been used as a conservative estimate of the $L_{A1,1\ minute}$. The INP application notes state that the EPA accepts sleep disturbance analysis based on either the $L_{A1,1\ minute}$ or L_{Amax} metrics (EPA 2013), with use of L_{Amax} resulting in a more conservative assessment.

The DC and EPL state that modification factor corrections in the application notes to the INP (2017) shall be applied to the measured mine noise levels where applicable. The application notes to the INP state that Fact Sheet C of the NPfI (EPA 2017) now applies regarding the application of modifying factors.

3.2 Cumulative noise criteria

Ashton Coal cumulative noise limits are provided in Condition 5 and Condition 6 of Schedule 3 of the DC. An extract of the conditions relevant to cumulative noise criteria is provided here.

> 5. The Applicant must implement all reasonable and feasible measures to ensure that the noise generated by the Ashton Mine Complex combined with the noise generated by other mines in the vicinity does not exceed the criteria in Table 4 at any residence on any privately-owned land or on more than 25 per cent of any privately-owned land (except for the noise affected residential receivers in Table 1).

Table 4: Cumulative Noise Criteria dB(A) $L_{Aeq\ (period)}$

Location	Day	Evening	Night
Camberwell Village	55	45	40
All other privately-owned land	50	45	40

> Cumulative noise is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.

> 6. If the cumulative noise generated by the Ashton Mine Complex combined with the noise generated by other coal mines in the vicinity exceeds the criteria in Table 5 at any residence on privately-owned land or more than 25 per cent of any privately-owned land (except for the noise-affected residential receivers ion Table 1), then upon receiving a written request from the landowner, the Applicant must, together with the relevant mines, acquire the land on as equitable basis as possible, in accordance with the procedures in conditions 7 and 8 of schedule 4.

Table 5: Cumulative Noise Acquisition Criteria dB(A) $L_{Aeq\ (period)}$

Location	Day	Evening	Night
Camberwell Village	60	50	45
All other privately-owned land	55	50	45

> Cumulative noise is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.

3.3 Low frequency noise criteria

Condition 3 of Appendix 8 of the DC and L4.3 of the EPL state that noise generated by Ashton Coal is to be measured in accordance with the relevant requirements of the INP. The INP application notes state that Section 4 of the INP has been withdrawn and the modifying factor adjustments outlined in Fact Sheet C of the NPfI are to be used when assessing the characteristics of a noise source.

Fact sheet C of the NPfI (EPA 2017) provides guidelines for applying modifying factor corrections to account for low frequency noise emissions. The NPfI specifies that a difference of 15 dB or more between site 'C-weighted' and site 'A-weighted' noise emission levels identifies the potential for an unbalanced spectrum and potential increased annoyance.

Where a difference of 15 dB or more between site 'C-weighted' and site 'A-weighted' noise emission levels is identified, the one-third octave noise levels recorded should be compared to the values in Table C2 of the NPfI (EPA 2017), which has been reproduced in Table 3.2 below.

Table 3.2 One-third octave low-frequency noise thresholds

	One-third octave $L_{Zeq,15\ minute}$ 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

The following modifying factor correction is to be applied where the site 'C-weighted' and site 'A-weighted' noise emission level is 15 dB or more and:

- where any of the one-third octave noise levels in Table 3.2 are exceeded by up to and including 5 dB and cannot be mitigated, a 2 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period; or

- where any of the one-third octave noise levels in Table 3.2 are exceeded by more than 5 dB and cannot be mitigated, a 5 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period.

Hence, where relevant throughout each survey the operator has estimated the difference between site 'C-weighted' and site 'A-weighted' noise emission levels by matching audible sounds with the response of the analyser (L_{Ceq}-L_{Aeq}). Where this was deemed to be 15 dB or greater, the measured one-third octave frequencies have been compared to the values in Table 3.2 to identify the relevant modifying factor correction (if applicable). This method has been applied to this assessment as presented in Section 5.

It is of note that the NPfI (EPA 2017) states that low-frequency noise corrections only apply under the standard or noise-enhancing (i.e. applicable) meteorological conditions.

4 Assessment methodology

4.1 Attended noise monitoring

To quantify noise emissions from Ashton Coal, 15-minute attended noise monitoring surveys were completed at representative locations as per the approved NMP. Noise monitoring locations and their coordinates are listed in Table 4.1 and are shown in Figure 4.1.

Table 4.1 Attended noise monitoring locations

Monitoring location	Description	MGA56	
		Easting	Northing
N2	Camberwell Village (west)	320297	6405670
N3	Camberwell Village (north east)	320554	6405839
N4	South of New England Highway	319776	6404101

Attended noise monitoring is scheduled to be "unannounced" and, to EMM's knowledge, Ashton Coal were not aware of the monitoring prior to its commencing. Noise monitoring is avoided during any scheduled down-time or major maintenance. To our knowledge, regular operations were occurring during this round of noise monitoring.

Where possible throughout each survey, the operator has quantified the contribution of each significant noise source. This was done by matching audible sounds with the response of the analyser (where applicable) and/or via post-analysis of data (e.g. low pass filtering).

4.2 Instrumentation

Brüel & Kjær 2250 and Brüel & Kjær 2270 Type 1 sound analysers (s/n 2759405 and 3027603) were used to conduct 15-minute attended measurements and record 1/3 octave frequency and statistical noise indices. The sound analysers were calibrated before and on completion of the survey using a Brüel & Kjær type 4230 calibrator (s/n 1276091). The instrumentation's calibration certificates are provided in Appendix C.

Source: EMM (2019); DFSI (2017); GA (2011)

0 1 2 km

GDA 1994 MGA Zone 56

N

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KEY

- Site boundary
- Noise monitoring location
- Meteorological station
- Rail line
- Main road
- Local road
- Watercourse/drainage line
- Cadastral boundary

Noise monitoring locations and Ashton colliery boundary

Ashton Coal
Monthly attended noise monitoring
Figure 4.1

EMM
creating opportunities

4.3 Attended noise monitoring exceedance procedure

Ashton Coal has developed an attended monitoring exceedance procedure that is to be implemented if measurements show Ashton Coal noise emissions are above the relevant noise criteria. This response plan is implemented if site noise levels are determined to be above the relevant noise criteria and when noise limits are applicable due to suitable meteorological conditions. The following noise management initiatives are implemented:

- Consultant will record the reading and advise Ashton Coal of the exceedance. Ashton Coal will implement remedial action as required.
- A follow up measurement is to be conducted (within 75 minutes after the first measurement and no earlier than 10 pm).
- If the follow up measurement indicates that site noise levels are above the relevant noise criteria and that noise limits are applicable, the consultant will record the result, note the site has failed and is deemed a 'noise affected night' at that location. An additional monitoring test should be scheduled to be undertaken at the same location within one week and move on to the next monitoring location.
- If the follow up measurement indicates that site noise levels are below the relevant noise criteria and that noise limits are applicable, the consultant will record the result, note the site has passed, schedule an additional monitoring test to be undertaken at the location within one week and move on to the next monitoring location.

4.4 Determination of stability category

This assessment determined the stability categories throughout the attended monitoring period using the direct measurement method as per Appendix E2 of the INP (EPA 2000).

The temperature lapse rate between the two weather stations (M1 – Sentinex Unit 40 located in Camberwell Village and M2 – Ashton Coal 'repeater' meteorological station located in the north eastern open cut (NEOC) area) was calculated using the following formula:

$$\text{Temperature lapse rate} = (\Delta T) \times (100/(\Delta H))$$

Where:

- ΔT = temperature measured at M2 (at 10 metres above ground level) minus temperature measured at M1 (at 10 metres above ground level); and
- ΔH = the vertical height difference between M2 and M1 (equal to 73 metres).

Table E5 of the INP (EPA 2000) is reproduced in Table 4.2 and presents the stability categories and associated ranges in temperature lapse rates.

Table 4.2 Stability categories and temperature lapse rates

Stability category	Temperature lapse rate (ΔT) (°C/100 m)
A	$\Delta T < -1.9$
B	$-1.9 \leq \Delta T < -1.7$
C	$-1.7 \leq \Delta T < -1.5$
D	$-1.5 \leq \Delta T < -0.5$
E	$-0.5 \leq \Delta T < 1.5$
F	$1.5 \leq \Delta T < 4.0$
G	$\Delta T \geq 4.0$

Source: INP (EPA 2000).

Other meteorological data, such as wind speed, has been sourced directly from meteorological station M2 since it is more representative of the weather conditions nearer to the noise sources.

5 Review of data and discussion

5.1 Summary

Results of attended noise measurements are summarised in Table 5.1. Ashton Coal contribution and total mine noise were determined for each survey using in-field observations and post-analysis of data as required (e.g. removing higher frequencies that are not mine related i.e. above 630 Hz). Attended monitoring was completed on 7 June 2019.

The meteorological data for the monitoring period was sourced from Ashton Coal's two weather stations (M1 and M2) to determine applicability of criteria in accordance with the DC and EPL. Noise limits were not applicable during any of the measurements due to temperature inversion conditions greater than 3°C/100m.

Low frequency noise was conservatively assessed by comparison of the total measured one-third octave L_{Aeq} noise levels to the NPfI one-third octave low-frequency noise thresholds. As Ashton Coal was found to be inaudible at all monitoring locations, LFN modifying factors were not relevant and hence were not applied to estimated site noise levels at any of the locations.

Monitoring identified that site noise was inaudible at all three monitoring locations. Typically, when a particular source is not audible above local ambient noise levels, the likely contribution of that source is generally at least 10 dB below the measured background (L_{A90}) level.

Table 5.1 Ashton Coal attended noise monitoring results –June 2019

Location	Date	Start time	Total noise levels, dB							Site contributions, dB			Noise limits, dB		Meteorological conditions[3] limits apply (Y/N)	Exceedance, dB	Comments
			L_{Amin}	L_{A90}	L_{Aeq}	L_{A10}	L_{A1}	L_{Amax}	L_{Ceq}	LFN mod. factor[1]	L_{Aeq}	L_{Amax}[2]	L_{Aeq}	L_{Amax}[2]			
N3	7/6	05:20	47	51	54	57	60	62	63	Nil	IA	IA	36	46	1.4 m/s @ 298° G class stability 5.6°C/100m VTG N	N/A	**Site noise inaudible.** Traffic on the New England Highway, another mine in the vicinity, insects and frogs consistently audible. Train on the main line (unrelated to Ashton Coal) audible for approx. 1 minute. Distant dogs barking and nearby animals occasionally audible.
N2	7/6	05:21	51	56	60	62	64	68	65	Nil	IA	IA	36	46	1.4 m/s @ 298° G class stability 5.6°C/100m VTG N	N/A	**Site noise inaudible.** Traffic on the New England Highway and another mine in the vicinity consistently audible. Car passby and a train on the main line (unrelated to Ashton Coal) occasionally audible.
N4	7/6	05:45	41	44	47	49	51	60	60	Nil	IA	IA	36	46	1.1 m/s @ 338° F class stability 3.2°C/100m VTG N	N/A	**Site noise inaudible.** Traffic on the New England Highway and another mine in the vicinity consistently audible.

Notes:
1. Modifying factor correction for low frequency noise in accordance with Fact Sheet C of the NPfI (refer Section 3.3).
2. For assessment purposes the L_{Amax} and the $L_{A1,1\ minute}$ are interchangeable.
3. Meteorological data were taken as an average over 15 minutes from the Ashton Coal weather station (Refer to Section 5.1). VTG assumes the temperature sensors on the two weather stations are in proper working order and calibrated to manufacturers requirements.
4. IA = inaudible.
5. N/A = not applicable.

5.2 N3 - Camberwell Village (north east)

Ashton Coal operations were inaudible during the whole of the operator-attended noise survey. Given this, Ashton Coal $L_{Aeq,15\ minute}$ noise contributions were likely lower than the noise limits, and hence would have complied had limits applied. Other ambient noise sources included insects, frogs, traffic on the New England Highway, another mine in the vicinity, distant dogs barking, nearby animals and a train on the main line (unrelated to Ashton Coal).

Mining operations in the vicinity were consistently audible during the operator-attended noise survey at monitoring location N3. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ <33 dB ($L_{Aeq,15\ minute}$ <36 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

5.3 N2 - Camberwell Village (west)

Ashton Coal operations were inaudible during the whole of the operator-attended noise survey. Given this, Ashton Coal $L_{Aeq,15\ minute}$ noise contributions were likely lower than the noise limits, and hence would have complied had limits applied. Other ambient noise sources included traffic on the New England Highway, another mine in the vicinity, a car passby and a train on the main line (unrelated to Ashton Coal).

Mining operations in the vicinity were consistently audible during the operator-attended noise survey at monitoring location N2. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ 32 dB ($L_{Aeq,15\ minute}$ 35 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

5.4 N4 - South of New England Highway

Ashton Coal operations were inaudible during the whole of the operator-attended noise survey. Given this and the measured background noise level of L_{A90} 44 dB, Ashton Coal $L_{Aeq,15\ minute}$ noise contributions were lower than the noise limits, and hence would have complied had limits applied. Other ambient noise sources included another mine in the vicinity and traffic on the New England Highway.

Mining operations in the vicinity were consistently audible during the operator-attended noise survey at monitoring location N4. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ <27 dB ($L_{Aeq,15\ minute}$ <30 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

6 Conclusion

EMM has completed a review of mine noise from Ashton Coal within the surrounding community based on attended measurements conducted on 7 June 2019.

The applicability of noise limits was assessed with reference to Ashton Coal's two meteorological stations (M1 and M2) located to the east of the site. Noise limits were not applicable during any of the measurements due to temperature inversion conditions greater than 3°C/100m.

The assessment of noise contributions from site included consideration of modifying factors for noise characteristics where relevant and in accordance with the INP.

Ashton Coal noise contributions and cumulative mine noise contributions were below (satisfied) the relevant noise limits (had they applied) at all monitoring locations for this round of monitoring.

References

Ashton Coal Noise Management Plan, 2017.

NSW Department of Planning and Environment, Development Consent DA309-11-2001-I, 2016.

NSW Environment Protection Authority, Environment Protection License 11879.

NSW Environment Protection Authority, Industrial Noise Policy, 2000.

NSW Environment Protection Authority, Industrial Noise Policy Application notes, 2017.

NSW Environment Protection Authority, Noise Policy for Industry, 2017.

Appendix A

Project approval extract

APPENDIX 6
ALTERNATE NOISE CONDITIONS

NOISE

Application

1. Conditions 2 to 3 below have effect during times when open cut mining operations are not being undertaken at the Ashton Mine Complex, in the opinion of the Secretary.

Noise Criteria

2. Except for the noise-affected land in Table 1 of Schedule 3, the Applicant must ensure that the noise generated by the development does not exceed the criteria in Table 1 at any residence on privately-owned land or on more than 25 per cent of any privately-owned land.

Table 1: Noise Criteria dB(A)

Receiver No.	Receiver	Day ($L_{Aeq\ (15min)}$)	Evening ($L_{Aeq\ (15min)}$)	Night ($L_{Aeq\ (15min)}$)	Night ($L_{A1\ (1\ min)}$)
-	All privately-owned land	38	38	36	46

Noise generated by the development is to be measured in accordance with the relevant requirements of the *NSW Industrial Noise Policy*. Appendix 3 sets out the requirements for evaluating compliance with these criteria.

However, these noise criteria do not apply if the Applicant has an agreement with the relevant owner/s of the residence/land to generate higher noise levels, and the Applicant has advised the Department in writing of the terms of this agreement.

Additional Noise Mitigation Measures

3. Upon receiving a written request from the owner of any residence on any privately-owned land where subsequent operational noise monitoring shows the noise generated by the development exceeds the noise limits in Table 2, the Applicant must implement additional reasonable and feasible noise mitigation measures (such as double glazing, insulation, and/or air conditioning) at the residence in consultation with the owner.

If within 3 months of receiving this request from the landowner, the Applicant and the landowner cannot agree on the measures to be implemented, or there is a dispute about the implementation of these measures, then either party may refer the matter to the Secretary for resolution.

Table 2: Additional Noise Mitigation Criteria dB(A) $L_{Aeq\ (15min)}$

Receiver No.	Receiver	Day ($L_{Aeq\ (15min)}$)	Evening ($L_{Aeq\ (15min)}$)	Night ($L_{Aeq\ (15min)}$)
-	All privately-owned land	38	38	38

Notes:

- *Noise generated by the development is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.*
- *For this condition to apply, the exceedance of the criteria must be systemic.*

APPENDIX 8
NOISE COMPLIANCE ASSESSMENT

Compliance Monitoring

1. Attended monitoring is to be used to evaluate compliance with the relevant conditions of this approval.

2. Data collected for the purposes of determining compliance with the relevant conditions of this approval is to be excluded under the following meteorological conditions:
   a) during periods of rain or hail;
   b) average wind speed at microphone height exceeds 5 m/s;
   c) wind speeds greater than 3 m/s measures at 10 m above ground level; and
   d) temperature inversion conditions greater than 3°C/100m.

3. Unless otherwise agreed with the Secretary, this monitoring is to be carried out in accordance with the relevant requirements relating for reviewing performance set out in the NSW Industrial Noise Policy (as amended from time to time), in particular the requirements relating to:
   a) monitoring locations for the collection of representative noise data;
   b) equipment used to collect noise data, and conformity with Australian Standards relevant to such equipment; and
   c) modifications to noise data collected, including for the exclusion of extraneous noise and/or penalties for modifying factors apart from adjustments for duration.

4. To the extent that there is any inconsistency between the Industrial Noise Policy and the requirements set out in this Appendix, the Appendix prevails to the extent of the inconsistency.

Determination of Meteorological Conditions

5. Except for wind speed at microphone height, the data to be used for determining meteorological conditions shall be that recorded by the meteorological station located in the vicinity of the site (as required by condition 18 of Schedule 3).

Appendix B

EPL extract

Environment Protection Licence

Licence - 11879

13	Noise monitoring	Attended noise monitoring at coordinates 320554, 6405839 (Easting, Northing) identified as N3 on Figure 1.
14	Noise monitoring	Attended noise monitoring at coordinates 320297, 6405670 (Easting, Northing) identified as N2 on Figure 1.
15	Noise monitoring	Attended noise monitoring at coordinates 319776, 6404101 (Easting, Northing) identified as N4 on Figure 1.

P1.5 For the purposes of condition P1.1, P1.3 and P1.4 Figure 1 refers to the plan titled *"Ashton Underground Mine Environment Protection Licence 11879 Premises Boundary, Monitoring & Infrastructure"* dated 1/6/17 EPA Ref DOC17/375653-02.

3 Limit Conditions

L1 Pollution of waters

L1.1 Except as may be expressly provided in any other condition of this licence, the licensee must comply with section 120 of the Protection of the Environment Operations Act 1997.

L2 Concentration limits

L2.1 Flares must be operated by the licensee such that there is no visible emission other than for a total period of no more than 5 minutes in any 2 hours, except for heat haze.

L3 Waste

L3.1 The licensee must not cause, permit or allow any waste to be received at the premises unless specified in this licence.

L4 Noise limits

L4.1 Noise from the premises must not exceed the limits specified in the table below:

Location	Day LAeq(15 minute)	Evening LAeq(15 minute)	Night LAeq(15 minute)	Night LAeq(1 minute)

Any residence not owned by the licensee or not subject to an agreement between the licensee and the residence owner as to an alternative noise limit.	38	38	36	46

L4.2 For the purpose of Condition L2.1:
a) Day is defined as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sundays and Public Holidays,
b) Evening is defined as the period from 6pm to 10pm, and
c) Night is defined as the period from 10pm to 7am Monday to Saturday and 10pm to 8am Sundays and Public Holidays

L4.3 Noise from the premises must be measured at the most affected point on or within the residential boundary or at the most affected point within 30m of the dwelling where the dwelling is more than 30m from boundary to determine compliance with the LAeq(15 minute) noise limits in condition L2.1. Where it can be demonstrated that direct measurement of noise from the premises is impractical, the EPA may accept alternative means of determining compliance. See Chapter 11 of the NSW Industrial Noise Policy. The modification factors presented in Section 4 of the NSW Industrial Noise Policy shall also be applied to the measured noise level where applicable.

L4.4 Noise from the premises is to be measured or computed at 1m from the dwelling facade to determine compliance with condition L2.1 (LA1 (1 minute) noise limit).

L4.5 The noise emission limits identified in condition L2.1 apply under the following meteorological conditions:

a) wind speeds up to 3m/s at 10m above ground level; and
b) temperature inversion conditions up to 3 degrees C/100m.

L4.6 Noise generated at the premises that is measured at each noise monitoring point established under this licence must not exceed the noise levels specified in Column 4 of the table below for that point during the corresponding time periods specified in Column 1 when measured using the corresponding measurement parameters listed in Column 2.

POINT 13,14,15

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
Day	Day-LAeq (15 minute)	-	38
Evening	Evening-LAeq (15 minute)	-	38
Night	Night-LAeq (15 minute)	-	36
Night	Night-LA1 (1 minute)	-	46

Appendix C

Calibration certificates

CERTIFICATE OF CALIBRATION

CERTIFICATE NO: 22117

EQUIPMENT TESTED: Sound Level Calibrator

Manufacturer: B & K
Type No: 4230 **Serial No:** 1276091
Owner: EMGA Mitchell Mclennan
Ground Floor, Suite 01, 20 Chandos St
St Leonards NSW 2065

Tests Performed: Measured output pressure level was found to be:

Parameter	Pre-Adj	Adj Y/N	Output: (db re 20 µPa)	Frequency: (Hz)	THD&N (%)
Level 1:	NA	N	93.96	990.33	1.12
Level 2:	NA	N	NA	NA	NA
Uncertainty:			±0.11 dB	±0.05%	±0.20 %
Uncertainty (at 95% c.l.) k=2					

CONDITION OF TEST:
Ambient Pressure: 1006 hPa ±1.5 hPa **Relative Humidity:** 50% ±5%
Temperature: 22 °C ±2° C
Date of Calibration: 05/02/2018 **Issue Date:** 09/02/2018
Acu-Vib Test Procedure: AVP02 (Calibrators)
Test Method: AS IEC 60942 - 2004
CHECKED BY: ..... **AUTHORISED SIGNATURE:** .....
Jack Kelt

.Accredited for compliance with ISO/IEC 17025 - Calibration
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NATA
ACCREDITATION
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Mobile: 0413 809806
Web site: www.acu-vib.com.au

Brüel & Kjær

The Calibration Laboratory
Skodsborgvej 307, DK-2850 Nærum, Denmark

ilac-MRA

DANAK
CAL Reg.No. 307
Member of EA MLA

CERTIFICATE OF CALIBRATION

No: CDK1902917

CALIBRATION OF

Sound Level Meter:	Brüel & Kjær Type 2270	No: 3027603	Id: -
Microphone:	Brüel & Kjær Type 4189	No: 3195772	
Preamplifier:	Brüel & Kjær Type ZC-0032	No: 28589	
Supplied Calibrator:	None		
Software version:	BZ7222 Version 4.7.5	Pattern Approval:	PTB1.63-4093056 / 1.63-4093058
Instruction manual:	BE1712-22		

CUSTOMER

EMM Consulting
Suite 1, Level 10, 87 Wickham Terrace
4000 Spring Hill
Queensland, Australia

CALIBRATION CONDITIONS

Preconditioning: 4 hours at 23°C ± 3°C

Environment conditions: *See actual values in **Environmental conditions** sections.*

SPECIFICATIONS

The Sound Level Meter Brüel & Kjær Type 2270 has been calibrated in accordance with the requirements as specified in IEC 61672-1:2013 class 1. Procedures from IEC 61672-3:2013 were used to perform the periodic tests. The accreditation assures the traceability to the international units system SI.

PROCEDURE

The measurements have been performed with the assistance of Brüel & Kjær Sound Level Meter Calibration System 3630 with application software type 7763 (version 8.0 - DB: 7.30) by using procedure B&K proc 2270, 4189 (IEC 61672:2013).

RESULTS

Calibration Mode: **Calibration as received.**

The reported expanded uncertainty is based on the standard uncertainty multiplied by a coverage factor $k = 2$ providing a level of confidence of approximately 95 %. The uncertainty evaluation has been carried out in accordance with EA-4/02 from elements originating from the standards, calibration method, effect of environmental conditions and any short time contribution from the device under calibration.

Date of calibration: 2019-04-12

Date of issue: 2019-04-12

Susanne Jørgensen
Calibration Technician

M. Önder
Mikail Önder
Approved Signatory

Reproduction of the complete certificate is allowed. Parts of the certificate may only be reproduced after written permission.

CERTIFICATE OF CALIBRATION

CERTIFICATE NO.: **SLM 22129 & FILT 4384**

Equipment Description:	Sound Level Meter		
Manufacturer:	B & K		
Model No:	2250	**Serial No:**	2759405
Microphone Type:	4189	**Serial No:**	2888134
Filter Type:	1/3 Octave	**Serial No:**	2759405
Comments:	All tests passed for class 1. (See over for details)		
Owner:	EMGA Mitchell Mclennan Ground Floor, Suite 01, 20 Chandos St St Leonards NSW 2065		
Ambient Pressure:	1008 hPa ±1.5 hPa		
Temperature:	25 °C ±2° C	**Relative Humidity:**	48% ±5%
Date of Calibration:	07/02/2018	**Issue Date:**	09/02/2018

Acu-Vib Test Procedure: AVP10 (SLM) & AVP06 (Filters)

CHECKED BY: ..... **AUTHORISED SIGNATURE:** .....

Jack Kott

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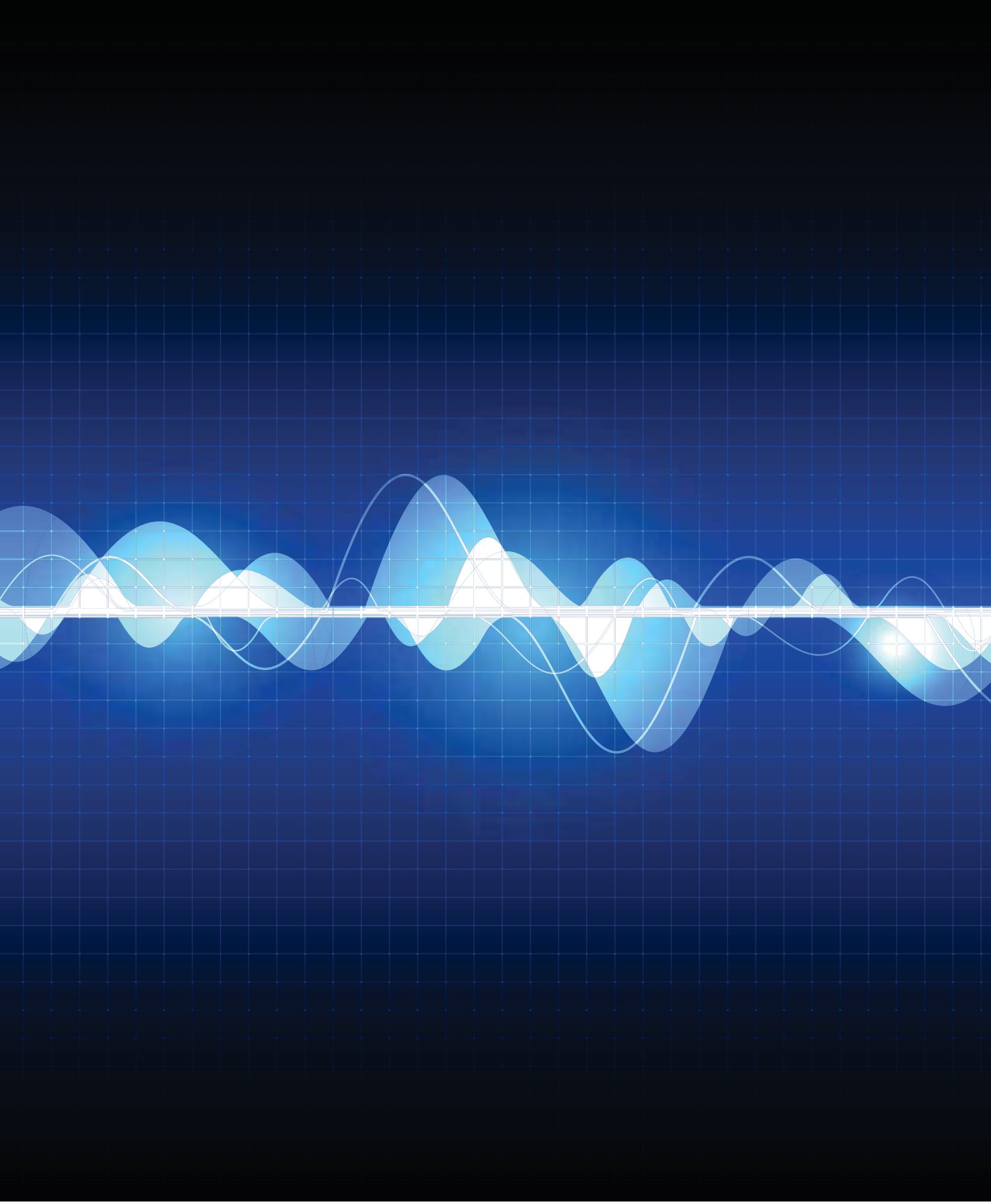


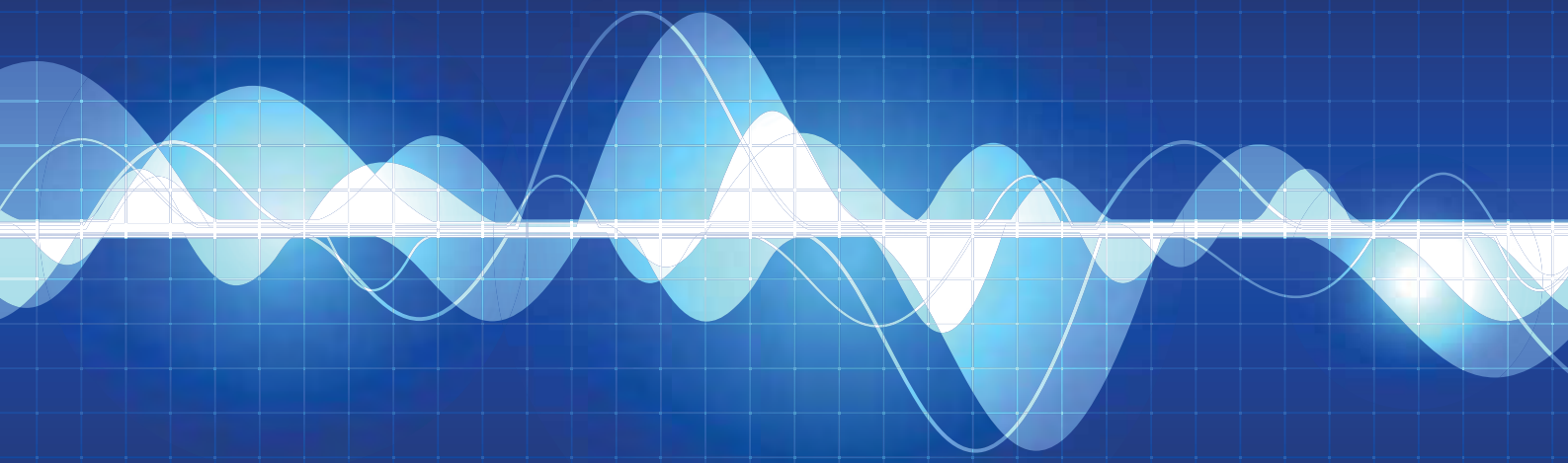
Appendix G

Monthly attended noise monitoring report - July 2019

Ashton Coal

Monthly attended noise monitoring
July 2019

Prepared for Ashton Coal Operations Pty Ltd
July 2019



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Deakin ACT 2600

Ashton Coal

Monthly attended noise monitoring - July 2019

Prepared for Ashton Coal Operations Pty Ltd
July 2019

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Level 1, 146 Hunter Street
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Ashton Coal

Monthly attended noise monitoring - July 2019

Report Number

H190081 RP6

Client

Ashton Coal Operations Pty Ltd

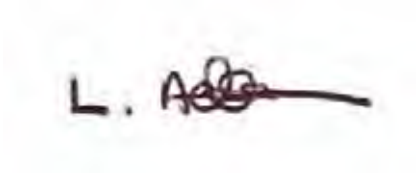
Date

26 July 2019

Version

v2-0 Final

Prepared by



Lucas Adamson
Acoustic Consultant
26 July 2019

Approved by

Katie Teyhan
Associate
26 July 2019

This report has been prepared in accordance with the brief provided by the client and has relied upon the information collected at the time and under the conditions specified in the report. All findings, conclusions or recommendations contained in the report are based on the aforementioned circumstances. The report is for the use of the client and no responsibility will be taken for its use by other parties. The client may, at its discretion, use the report to inform regulators and the public.

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Table of Contents

Appendices

Tables

Figures

1 Introduction

EMM Consulting Pty Limited (EMM) was engaged to complete monthly attended noise surveys on behalf of Ashton Coal Operations Pty Ltd (Ashton Coal).

The purpose of the monitoring was to address requirements of the approved Ashton Coal Noise Management Plan (NMP), prepared to satisfy the requirements of the Development Consent DA 309-11-2001-I (DC) and Environment Protection License (EPL) 11879.

This report presents the results and findings of attended noise monitoring conducted on 9 July 2019.

The following material was referenced as part of this assessment:

- Department of Planning and Environment (DPE), Development Consent 309-11-2001-I, as modified on 20 June 2016 (current as of 9 July 2019);
- Environment Protection Authority (EPA), Environment Protection License 11879, as varied on 27 March 2019 (current as of 9 July 2019);
- Ashton Coal Project Noise Management Plan (NMP), approved by DPE on 10 October 2017 (current as of 9 July 2019);
- NSW EPA, Industrial Noise Policy (INP), 2000;
- NSW EPA, Industrial Noise Policy Application notes, 2017; and
- NSW EPA, Noise Policy for Industry (NPfI), 2017.

2 Glossary of acoustic terms

Several technical terms are discussed in this report. These are explained in Table 2.1.

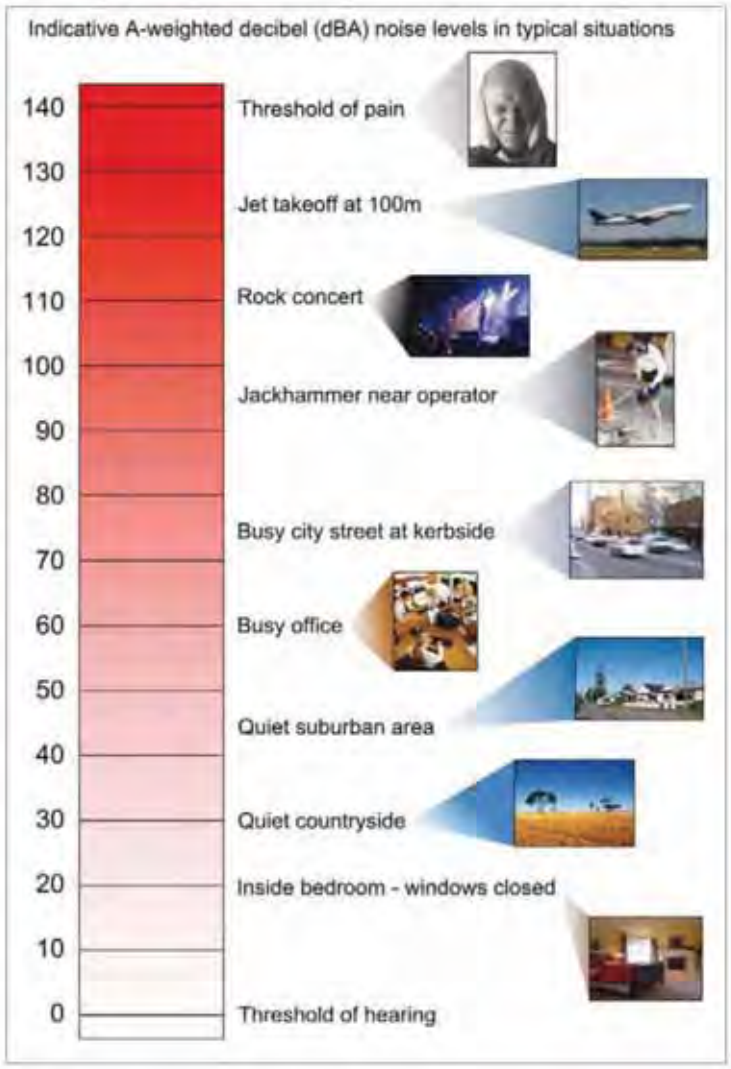
Table 2.1 Glossary of acoustic terms

Term	Description
dB	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.
L_{A1}	The 'A-weighted' noise level which is exceeded 1% of the time.
$L_{A1,1\ minute}$	The 'A-weighted' noise level exceeded for 1% of the specified time period of 1 minute.
L_{A10}	The 'A-weighted' noise level which is exceeded 10% of the time. It is approximately equivalent to the average of maximum noise level.
L_{A90}	Commonly referred to as the background noise level. The 'A-weighted' noise level exceeded 90% of the time.
L_{Aeq}	The energy average noise from a source. This is the equivalent continuous 'A-weighted' sound pressure level over a given period. The $L_{Aeq,15\ minute}$ descriptor refers to an L_{Aeq} noise level measured over a 15-minute period.
L_{Amin}	The minimum 'A-weighted' noise level received during a measuring interval.
L_{Amax}	The maximum root mean squared 'A-weighted' sound pressure level (or maximum noise level) received during a measuring interval.
L_{Ceq}	The equivalent continuous 'C-weighted' sound pressure level over a given period. The $L_{Ceq,15\ minute}$ descriptor refers to an L_{Ceq} noise level measured over a 15 minute period. C-weighting can be used to measure low frequency noise.
Day period	Monday – Saturday: 7 am to 6 pm, on Sundays and Public Holidays: 8 am to 6 pm.
Evening period	Monday – Saturday: 6 pm to 10 pm, on Sundays and Public Holidays: 6 pm to 10 pm.
Night period	Monday – Saturday: 10 pm to 7 am, on Sundays and Public Holidays: 10 pm to 8 am.
Temperature inversion	A meteorological condition where the atmospheric temperature increases with altitude.

It is useful to have an appreciation of decibels (dB), the unit of noise measurement. Table 2.2 gives an indication as to what an average person perceives about changes in noise levels. Examples of common noise levels are provided in Figure 2.1.

Table 2.2 Perceived change in noise

Change in sound pressure level (dB)	Perceived change in noise in surrounding environment
up to 2	not perceptible
3	just perceptible
5	noticeable difference
10	twice (or half) as loud
15	large change
20	four times (or quarter) as loud



Source: Road Noise Policy (Department of Environment, Climate Change and Water 2011)

Figure 2.1 Common noise levels

3 Noise limits

3.1 Operational and sleep disturbance noise limits

Ashton Coal noise limits are provided in Table 1, Condition 2 of Appendix 6 of the DC and Condition L4.1 of the EPL. Extracts of the relevant sections of the DC and EPL pertaining to noise are provided in Appendix A and B, respectively. The approved NMP adopts three attended noise monitoring locations that are representative of residences outlined in the DC. The noise monitoring locations and relevant criteria are summarised in Table 3.1.

Table 3.1 Noise impact assessment criteria

Monitoring location	Day $L_{Aeq,15\ minute}$, dB	Evening $L_{Aeq,15\ minute}$, dB	Night $L_{Aeq,15\ minute}$, dB	Night $L_{A1,1\ minute}$, dB
N2	38	38	36	46
N3	38	38	36	46
N4	38	38	36	46

The DC and the EPL specify the following meteorological conditions under which noise limits do not apply:

- during periods of rain or hail;
- average wind speed at microphone height exceeds 5 m/s;
- wind speeds greater than 3 m/s at 10 metres above ground level; and
- temperature inversion conditions greater than 3°C/100m.

For this assessment, the recorded L_{Amax} has been used as a conservative estimate of the $L_{A1,1\ minute}$. The INP application notes state that the EPA accepts sleep disturbance analysis based on either the $L_{A1,1\ minute}$ or L_{Amax} metrics (EPA 2013), with use of L_{Amax} resulting in a more conservative assessment.

The DC and EPL state that modification factor corrections in the application notes to the INP (2017) shall be applied to the measured mine noise levels where applicable. The application notes to the INP state that Fact Sheet C of the NPfI (EPA 2017) now applies regarding the application of modifying factors.

3.2 Cumulative noise criteria

Ashton Coal cumulative noise limits are provided in Condition 5 and Condition 6 of Schedule 3 of the DC. An extract of the conditions relevant to cumulative noise criteria is provided here.

> 5. The Applicant must implement all reasonable and feasible measures to ensure that the noise generated by the Ashton Mine Complex combined with the noise generated by other mines in the vicinity does not exceed the criteria in Table 4 at any residence on any privately-owned land or on more than 25 per cent of any privately-owned land (except for the noise affected residential receivers in Table 1).

Table 4: Cumulative Noise Criteria dB(A) $L_{Aeq\ (period)}$

Location	Day	Evening	Night
Camberwell Village	55	45	40
All other privately-owned land	50	45	40

> Cumulative noise is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.

> 6. If the cumulative noise generated by the Ashton Mine Complex combined with the noise generated by other coal mines in the vicinity exceeds the criteria in Table 5 at any residence on privately-owned land or more than 25 per cent of any privately-owned land (except for the noise-affected residential receivers ion Table 1), then upon receiving a written request from the landowner, the Applicant must, together with the relevant mines, acquire the land on as equitable basis as possible, in accordance with the procedures in conditions 7 and 8 of schedule 4.

Table 5: Cumulative Noise Acquisition Criteria dB(A) $L_{Aeq\ (period)}$

Location	Day	Evening	Night
Camberwell Village	60	50	45
All other privately-owned land	55	50	45

> Cumulative noise is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.

3.3 Low frequency noise criteria

Condition 3 of Appendix 8 of the DC and L4.3 of the EPL state that noise generated by Ashton Coal is to be measured in accordance with the relevant requirements of the INP. The INP application notes state that Section 4 of the INP has been withdrawn and the modifying factor adjustments outlined in Fact Sheet C of the NPfI are to be used when assessing the characteristics of a noise source.

Fact sheet C of the NPfI (EPA 2017) provides guidelines for applying modifying factor corrections to account for low frequency noise emissions. The NPfI specifies that a difference of 15 dB or more between site 'C-weighted' and site 'A-weighted' noise emission levels identifies the potential for an unbalanced spectrum and potential increased annoyance.

Where a difference of 15 dB or more between site 'C-weighted' and site 'A-weighted' noise emission levels is identified, the one-third octave noise levels recorded should be compared to the values in Table C2 of the NPfI (EPA 2017), which has been reproduced in Table 3.2 below.

Table 3.2 One-third octave low-frequency noise thresholds

	One-third octave $L_{Zeq,15\ minute}$ 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

The following modifying factor correction is to be applied where the site 'C-weighted' and site 'A-weighted' noise emission level is 15 dB or more and:

- where any of the one-third octave noise levels in Table 3.2 are exceeded by up to and including 5 dB and cannot be mitigated, a 2 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period; or

- where any of the one-third octave noise levels in Table 3.2 are exceeded by more than 5 dB and cannot be mitigated, a 5 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period.

Hence, where relevant throughout each survey the operator has estimated the difference between site 'C-weighted' and site 'A-weighted' noise emission levels by matching audible sounds with the response of the analyser (L_{Ceq}-L_{Aeq}). Where this was deemed to be 15 dB or greater, the measured one-third octave frequencies have been compared to the values in Table 3.2 to identify the relevant modifying factor correction (if applicable). This method has been applied to this assessment as presented in Section 5.

It is of note that the NPfI (EPA 2017) states that low-frequency noise corrections only apply under the standard or noise-enhancing (i.e. applicable) meteorological conditions.

4 Assessment methodology

4.1 Attended noise monitoring

To quantify noise emissions from Ashton Coal, 15-minute attended noise monitoring surveys were completed at representative locations as per the approved NMP. Noise monitoring locations and their coordinates are listed in Table 4.1 and are shown in Figure 4.1.

Table 4.1 Attended noise monitoring locations

Monitoring location	Description	MGA56	
		Easting	Northing
N2	Camberwell Village (west)	320297	6405670
N3	Camberwell Village (north east)	320554	6405839
N4	South of New England Highway	319776	6404101

Attended noise monitoring is scheduled to be "unannounced" and, to EMM's knowledge, Ashton Coal were not aware of the monitoring prior to its commencing. Noise monitoring is avoided during any scheduled downtime or major maintenance. Information provided by Ashton Coal after the noise monitoring was completed confirmed that regular operations were occurring during the monitoring period.

Where possible throughout each survey, the operator has quantified the contribution of each significant noise source. This was done by matching audible sounds with the response of the analyser (where applicable) and/or via post-analysis of data (e.g. low pass filtering).

4.2 Instrumentation

Brüel & Kjær 2250 and Brüel & Kjær 2270 Type 1 sound analysers (s/n 2759405 and 3027603) were used to conduct 15-minute attended measurements and record 1/3 octave frequency and statistical noise indices. The sound analysers were calibrated before and on completion of the survey using a Brüel & Kjær type 4230 calibrator (s/n 1276091). The instrumentation's calibration certificates are provided in Appendix C.

Source: EMM (2019); DFSI (2017); GA (2011)

0 1 2 km

GDA 1994 MGA Zone 56

N

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KEY

- Site boundary
- Noise monitoring location
- Meteorological station
- Rail line
- Main road
- Local road
- Watercourse/drainage line
- Cadastral boundary

Noise monitoring locations and Ashton colliery boundary

Ashton Coal
Monthly attended noise monitoring
Figure 4.1

EMM
creating opportunities

4.3 Attended noise monitoring exceedance procedure

Ashton Coal has developed an attended monitoring exceedance procedure that is to be implemented if measurements show Ashton Coal noise emissions are above the relevant noise criteria. This response plan is implemented if site noise levels are determined to be above the relevant noise criteria and when noise limits are applicable due to suitable meteorological conditions. The following noise management initiatives are implemented:

- Consultant will record the reading and advise Ashton Coal of the exceedance. Ashton Coal will implement remedial action as required.
- A follow up measurement is to be conducted (within 75 minutes after the first measurement and no earlier than 10 pm).
- If the follow up measurement indicates that site noise levels are above the relevant noise criteria and that noise limits are applicable, the consultant will record the result, note the site has failed and is deemed a 'noise affected night' at that location. An additional monitoring test should be scheduled to be undertaken at the same location within one week and move on to the next monitoring location.
- If the follow up measurement indicates that site noise levels are below the relevant noise criteria and that noise limits are applicable, the consultant will record the result, note the site has passed, schedule an additional monitoring test to be undertaken at the location within one week and move on to the next monitoring location.

4.4 Determination of stability category

This assessment determined the stability categories throughout the attended monitoring period using the direct measurement method as per Appendix E2 of the INP (EPA 2000).

The temperature lapse rate between the two weather stations (M1 – Sentinex Unit 40 located in Camberwell Village and M2 – Ashton Coal 'repeater' meteorological station located in the north eastern open cut (NEOC) area) was calculated using the following formula:

$$\text{Temperature lapse rate} = (\Delta T) \times (100/(\Delta H))$$

Where:

- ΔT = temperature measured at M2 (at 10 metres above ground level) minus temperature measured at M1 (at 10 metres above ground level); and
- ΔH = the vertical height difference between M2 and M1 (equal to 73 metres).

Table E5 of the INP (EPA 2000) is reproduced in Table 4.2 and presents the stability categories and associated ranges in temperature lapse rates.

Table 4.2 Stability categories and temperature lapse rates

Stability category	Temperature lapse rate (ΔT) (°C/100 m)
A	$\Delta T < -1.9$
B	$-1.9 \leq \Delta T < -1.7$
C	$-1.7 \leq \Delta T < -1.5$
D	$-1.5 \leq \Delta T < -0.5$
E	$-0.5 \leq \Delta T < 1.5$
F	$1.5 \leq \Delta T < 4.0$
G	$\Delta T \geq 4.0$

Source: INP (EPA 2000).

Other meteorological data, such as wind speed, has been sourced directly from meteorological station M2 since it is more representative of the weather conditions nearer to the noise sources.

5 Review of data and discussion

5.1 Summary

Results of attended noise measurements are summarised in Table 5.1. Ashton Coal contribution and total mine noise were determined for each survey using in-field observations and post-analysis of data as required (e.g. removing higher frequencies that are not mine related i.e. above 630 Hz). Attended monitoring was completed on 9 July 2019.

The meteorological data for the monitoring period was sourced from Ashton Coal's two weather stations (M1 and M2) to determine applicability of criteria in accordance with the DC and EPL. Noise limits were not applicable during the measurement at N4 due to temperature inversion conditions greater than 3°C/100m.

Low frequency noise was assessed by comparison of the measured Ashton Coal one-third octave L_{Aeq} noise levels to the NPfI one-third octave low-frequency noise thresholds, when the site was audible. Measured noise levels did not exceed the relevant LFN thresholds during any of the measurements where Ashton Coal was audible. Therefore, in accordance with the NPfI, LFN modifying factors were found to be not relevant and hence were not applied to estimated site noise levels at any of the locations.

At all locations where site noise was audible, Ashton Coal noise contributions and cumulative mine noise contributions were below (i.e. complied with) the relevant noise limits, where applicable.

Table 5.1 Ashton Coal attended noise monitoring results –July 2019

Location	Date	Start time	Total noise levels, dB							Site contributions, dB			Noise limits, dB		Meteorological conditions[3] limits apply (Y/N)	Exceedance, dB	Comments
			L_{Amin}	L_{A90}	L_{Aeq}	L_{A10}	L_{A1}	L_{Amax}	L_{Ceq}	LFN mod. factor[1]	L_{Aeq}	L_{Amax}[2]	L_{Aeq}	L_{Amax}[2]			
N2	9/7	23:38	39	41	57	52	72	80	61	Nil	≤36	37	36	46	2.7 m/s @ 289° E class stability 0.8°C/100m VTG Y	Nil	**Site noise consistently audible including conveyor noise.** Traffic on the New England Highway and another mine in the vicinity consistently audible. Dogs barking and a train on the main line (unrelated to Ashton Coal) occasionally audible.
N3	9/7	23:38	39	42	45	48	51	65	59	Nil	≤36	37	36	46	2.7 m/s @ 289° E class stability 0.8°C/100m VTG Y	Nil	**Site noise consistently audible including conveyor noise.** Traffic on the New England Highway, another mine in the vicinity and frogs consistently audible. Train on the main line (unrelated to Ashton Coal) audible for approx. 4 minutes. Distant dogs barking and bird noise occasionally audible.
N4	10/7	00:07	33	36	43	46	51	65	57	Nil	<25	35	36	46	2.8 m/s @ 268° F class stability 4.4°C/100m VTG N	N/A	**Site noise occasionally audible including engine revs.** Traffic on the New England Highway and frogs consistently audible. Other mines in the vicinity, distant dogs barking and livestock occasionally audible.

Notes:
1. Modifying factor correction for low frequency noise in accordance with Fact Sheet C of the NPfI (refer Section 3.3).
2. For assessment purposes the L_{Amax} and the $L_{A1,1\ minute}$ are interchangeable.
3. Meteorological data were taken as an average over 15 minutes from the Ashton Coal weather station (Refer to Section 5.1). VTG assumes the temperature sensors on the two weather stations are in proper working order and calibrated to manufacturers requirements.
4. IA = inaudible.
5. N/A = not applicable.

5.2 N2 - Camberwell Village (west)

Ashton Coal operations were consistently audible during the operator-attended noise survey including conveyor noise. The Ashton Coal mine noise contribution was estimated at up to $L_{Aeq,15\ minute}$ ≤36 dB. Conveyor noise from site generated an estimated L_{Amax} 37 dB. Ashton Coal noise contributions complied with the DC and EPL noise limits. Other ambient noise sources included another mine in the vicinity, traffic on the New England Highway, nearby dogs barking and a train on the main line (unrelated to Ashton Coal).

Mining operations in the vicinity were consistently audible during the operator-attended noise survey at monitoring location N2. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ 37 dB ($L_{Aeq,15\ minute}$ 40 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

5.3 N3 - Camberwell Village (north east)

Ashton Coal operations were consistently audible during the operator-attended noise survey including conveyor noise. The Ashton Coal mine noise contribution was estimated at up to $L_{Aeq,15\ minute}$ ≤36 dB. Conveyor noise from site generated an estimated L_{Amax} 37 dB. Ashton Coal noise contributions complied with the DC and EPL noise limits. Other ambient noise sources included another mine in the vicinity, traffic on the New England Highway, frogs, bird noise, distant dogs barking and a train on the main line (unrelated to Ashton Coal).

Mining operations in the vicinity were consistently audible during the operator-attended noise survey at monitoring location N3. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ 37 dB ($L_{Aeq,15\ minute}$ 40 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

5.4 N4 - South of New England Highway

Ashton Coal operations were occasionally audible during the operator-attended noise survey including engine revs from site. The Ashton Coal mine noise contribution was estimated at up to $L_{Aeq,15\ minute}$ <25 dB. Engine revs from site generated an estimated L_{Amax} 35 dB. Ashton Coal noise contributions complied with the DC and EPL noise limits. Other ambient noise sources included other mines in the vicinity, traffic on the New England Highway, frogs, distant dogs barking and livestock.

Mining operations in the vicinity were consistently audible during the operator-attended noise survey at monitoring location N4. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ <32 dB ($L_{Aeq,15\ minute}$ <35 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

6 Conclusion

EMM has completed a review of mine noise from Ashton Coal within the surrounding community based on attended measurements conducted on 9 July 2019.

The applicability of noise limits was assessed with reference to Ashton Coal's two meteorological stations (M1 and M2) located to the east of the site. Noise limits were not applicable during the measurement at N4 due to temperature inversion conditions greater than 3°C/100m.

The assessment of noise contributions from site included consideration of modifying factors for noise characteristics where relevant and in accordance with the INP.

Ashton Coal noise contributions and cumulative mine noise contributions were at or below (satisfied) the relevant noise limits (had they applied) at all monitoring locations for this round of monitoring.

References

Ashton Coal Noise Management Plan, 2017.

NSW Department of Planning and Environment, Development Consent DA309-11-2001-I, 2016.

NSW Environment Protection Authority, Environment Protection License 11879.

NSW Environment Protection Authority, Industrial Noise Policy, 2000.

NSW Environment Protection Authority, Industrial Noise Policy Application notes, 2017.

NSW Environment Protection Authority, Noise Policy for Industry, 2017.

Appendix A

Project approval extract

APPENDIX 6
ALTERNATE NOISE CONDITIONS

NOISE

Application

1. Conditions 2 to 3 below have effect during times when open cut mining operations are not being undertaken at the Ashton Mine Complex, in the opinion of the Secretary.

Noise Criteria

2. Except for the noise-affected land in Table 1 of Schedule 3, the Applicant must ensure that the noise generated by the development does not exceed the criteria in Table 1 at any residence on privately-owned land or on more than 25 per cent of any privately-owned land.

Table 1: Noise Criteria dB(A)

Receiver No.	Receiver	Day ($L_{Aeq\ (15min)}$)	Evening ($L_{Aeq\ (15min)}$)	Night ($L_{Aeq\ (15min)}$)	Night ($L_{A1\ (1\ min)}$)
-	All privately-owned land	38	38	36	46

Noise generated by the development is to be measured in accordance with the relevant requirements of the *NSW Industrial Noise Policy*. Appendix 3 sets out the requirements for evaluating compliance with these criteria.

However, these noise criteria do not apply if the Applicant has an agreement with the relevant owner/s of the residence/land to generate higher noise levels, and the Applicant has advised the Department in writing of the terms of this agreement.

Additional Noise Mitigation Measures

3. Upon receiving a written request from the owner of any residence on any privately-owned land where subsequent operational noise monitoring shows the noise generated by the development exceeds the noise limits in Table 2, the Applicant must implement additional reasonable and feasible noise mitigation measures (such as double glazing, insulation, and/or air conditioning) at the residence in consultation with the owner.

If within 3 months of receiving this request from the landowner, the Applicant and the landowner cannot agree on the measures to be implemented, or there is a dispute about the implementation of these measures, then either party may refer the matter to the Secretary for resolution.

Table 2: Additional Noise Mitigation Criteria dB(A) $L_{Aeq\ (15min)}$

Receiver No.	Receiver	Day ($L_{Aeq\ (15min)}$)	Evening ($L_{Aeq\ (15min)}$)	Night ($L_{Aeq\ (15min)}$)
-	All privately-owned land	38	38	38

Notes:

- *Noise generated by the development is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.*
- *For this condition to apply, the exceedance of the criteria must be systemic.*

APPENDIX 8
NOISE COMPLIANCE ASSESSMENT

Compliance Monitoring

1. Attended monitoring is to be used to evaluate compliance with the relevant conditions of this approval.

2. Data collected for the purposes of determining compliance with the relevant conditions of this approval is to be excluded under the following meteorological conditions:
   a) during periods of rain or hail;
   b) average wind speed at microphone height exceeds 5 m/s;
   c) wind speeds greater than 3 m/s measures at 10 m above ground level; and
   d) temperature inversion conditions greater than 3°C/100m.

3. Unless otherwise agreed with the Secretary, this monitoring is to be carried out in accordance with the relevant requirements relating for reviewing performance set out in the NSW Industrial Noise Policy (as amended from time to time), in particular the requirements relating to:
   a) monitoring locations for the collection of representative noise data;
   b) equipment used to collect noise data, and conformity with Australian Standards relevant to such equipment; and
   c) modifications to noise data collected, including for the exclusion of extraneous noise and/or penalties for modifying factors apart from adjustments for duration.

4. To the extent that there is any inconsistency between the Industrial Noise Policy and the requirements set out in this Appendix, the Appendix prevails to the extent of the inconsistency.

Determination of Meteorological Conditions

5. Except for wind speed at microphone height, the data to be used for determining meteorological conditions shall be that recorded by the meteorological station located in the vicinity of the site (as required by condition 18 of Schedule 3).

Appendix B

EPL extract

Environment Protection Licence

Licence - 11879

13	Noise monitoring	Attended noise monitoring at coordinates 320554, 6405839 (Easting, Northing) identified as N3 on Figure 1.
14	Noise monitoring	Attended noise monitoring at coordinates 320297, 6405670 (Easting, Northing) identified as N2 on Figure 1.
15	Noise monitoring	Attended noise monitoring at coordinates 319776, 6404101 (Easting, Northing) identified as N4 on Figure 1.

P1.5 For the purposes of condition P1.1, P1.3 and P1.4 Figure 1 refers to the plan titled *"Ashton Underground Mine Environment Protection Licence 11879 Premises Boundary, Monitoring & Infrastructure"* dated 1/6/17 EPA Ref DOC17/375653-02.

3 Limit Conditions

L1 Pollution of waters

L1.1 Except as may be expressly provided in any other condition of this licence, the licensee must comply with section 120 of the Protection of the Environment Operations Act 1997.

L2 Concentration limits

L2.1 Flares must be operated by the licensee such that there is no visible emission other than for a total period of no more than 5 minutes in any 2 hours, except for heat haze.

L3 Waste

L3.1 The licensee must not cause, permit or allow any waste to be received at the premises unless specified in this licence.

L4 Noise limits

L4.1 Noise from the premises must not exceed the limits specified in the table below:

Location	Day LAeq(15 minute)	Evening LAeq(15 minute)	Night LAeq(15 minute)	Night LAeq(1 minute)

Any residence not owned by the licensee or not subject to an agreement between the licensee and the residence owner as to an alternative noise limit.	38	38	36	46

L4.2 For the purpose of Condition L2.1:
a) Day is defined as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sundays and Public Holidays,
b) Evening is defined as the period from 6pm to 10pm, and
c) Night is defined as the period from 10pm to 7am Monday to Saturday and 10pm to 8am Sundays and Public Holidays

L4.3 Noise from the premises must be measured at the most affected point on or within the residential boundary or at the most affected point within 30m of the dwelling where the dwelling is more than 30m from boundary to determine compliance with the LAeq(15 minute) noise limits in condition L2.1. Where it can be demonstrated that direct measurement of noise from the premises is impractical, the EPA may accept alternative means of determining compliance. See Chapter 11 of the NSW Industrial Noise Policy. The modification factors presented in Section 4 of the NSW Industrial Noise Policy shall also be applied to the measured noise level where applicable.

L4.4 Noise from the premises is to be measured or computed at 1m from the dwelling facade to determine compliance with condition L2.1 (LA1 (1 minute) noise limit).

L4.5 The noise emission limits identified in condition L2.1 apply under the following meteorological conditions:

a) wind speeds up to 3m/s at 10m above ground level; and
b) temperature inversion conditions up to 3 degrees C/100m.

L4.6 Noise generated at the premises that is measured at each noise monitoring point established under this licence must not exceed the noise levels specified in Column 4 of the table below for that point during the corresponding time periods specified in Column 1 when measured using the corresponding measurement parameters listed in Column 2.

POINT 13,14,15

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
Day	Day-LAeq (15 minute)	-	38
Evening	Evening-LAeq (15 minute)	-	38
Night	Night-LAeq (15 minute)	-	36
Night	Night-LA1 (1 minute)	-	46

Appendix C

Calibration certificates

CERTIFICATE OF CALIBRATION

CERTIFICATE NO: 24152

EQUIPMENT TESTED: Sound Level Calibrator

Manufacturer: B & K
Type No: 4230 **Serial No:** 1276091
Owner: EMM Consulting
Level 1, 146 Hunter Street
Newcastle, NSW 2300

Tests Performed: Measured output pressure level was found to be:

Parameter	Pre-Adj	Adj Y/N	Output: (db re 20 µPa)	Frequency: (Hz)	THD&N (%)
Level 1:	NA	N	93.81	989.84	1.58
Level 2:	NA	N	NA	NA	NA
Uncertainty:			±0.11 dB	±0.05%	±0.20 %
Uncertainty (at 95% c.l.) k=2					

CONDITION OF TEST:
Ambient Pressure: 1004 hPa ±1.5 hPa **Relative Humidity:** 47% ±5%
Temperature: 20 °C ±2° C
Date of Calibration: 14/02/2019 **Issue Date:** 15/02/2019
Acu-Vib Test Procedure: AVP02 (Calibrators)
Test Method: AS IEC 60942 - 2017
CHECKED BY: ..... **AUTHORISED SIGNATURE:** .....
Jack Kidt

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.
The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

NATA
ACCREDITATION
Accredited Lab. 9262
Acoustic and Vibration Measurements

ACU-VIB
ELECTRONICS
HEAD OFFICE
Unit 14, 22 Hudson Ave. Castle Hill NSW 2154
Tel: (02) 96808133 Fax: (02)96808233
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Brüel & Kjær

The Calibration Laboratory
Skodsborgvej 307, DK-2850 Nærum, Denmark

ilac-MRA

DANAK
CAL Reg.No. 307
Member of EA MLA

CERTIFICATE OF CALIBRATION

No: CDK1902917

CALIBRATION OF

Sound Level Meter:	Brüel & Kjær Type 2270	No: 3027603	Id: -
Microphone:	Brüel & Kjær Type 4189	No: 3195772	
Preamplifier:	Brüel & Kjær Type ZC-0032	No: 28589	
Supplied Calibrator:	None		
Software version:	BZ7222 Version 4.7.5	Pattern Approval:	PTB1.63-4093056 / 1.63-4093058
Instruction manual:	BE1712-22		

CUSTOMER

EMM Consulting
Suite 1, Level 10, 87 Wickham Terrace
4000 Spring Hill
Queensland, Australia

CALIBRATION CONDITIONS

Preconditioning: 4 hours at 23°C ± 3°C

Environment conditions: *See actual values in **Environmental conditions** sections.*

SPECIFICATIONS

The Sound Level Meter Brüel & Kjær Type 2270 has been calibrated in accordance with the requirements as specified in IEC 61672-1:2013 class 1. Procedures from IEC 61672-3:2013 were used to perform the periodic tests. The accreditation assures the traceability to the international units system SI.

PROCEDURE

The measurements have been performed with the assistance of Brüel & Kjær Sound Level Meter Calibration System 3630 with application software type 7763 (version 8.0 - DB: 7.30) by using procedure B&K proc 2270, 4189 (IEC 61672:2013).

RESULTS

Calibration Mode: **Calibration as received.**

The reported expanded uncertainty is based on the standard uncertainty multiplied by a coverage factor $k = 2$ providing a level of confidence of approximately 95 %. The uncertainty evaluation has been carried out in accordance with EA-4/02 from elements originating from the standards, calibration method, effect of environmental conditions and any short time contribution from the device under calibration.

Date of calibration: 2019-04-12

Date of issue: 2019-04-12

Susanne Jørgensen
Calibration Technician

M. Önder
Mikail Önder
Approved Signatory

Reproduction of the complete certificate is allowed. Parts of the certificate may only be reproduced after written permission.

CERTIFICATE OF CALIBRATION

CERTIFICATE NO.: **SLM 22129 & FILT 4384**

Equipment Description:	Sound Level Meter		
Manufacturer:	B & K		
Model No:	2250	**Serial No:**	2759405
Microphone Type:	4189	**Serial No:**	2888134
Filter Type:	1/3 Octave	**Serial No:**	2759405
Comments:	All tests passed for class 1. (See over for details)		
Owner:	EMGA Mitchell Mclennan Ground Floor, Suite 01, 20 Chandos St St Leonards NSW 2065		
Ambient Pressure:	1008 hPa ±1.5 hPa		
Temperature:	25 °C ±2° C	**Relative Humidity:**	48% ±5%
Date of Calibration:	07/02/2018	**Issue Date:**	09/02/2018

Acu-Vib Test Procedure: AVP10 (SLM) & AVP06 (Filters)

CHECKED BY: ..... **AUTHORISED SIGNATURE:** .....

Jack Kott

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.

NATA
ACCREDITATION

Accredited Lab. No. 9262
Acoustic and Vibration Measurements

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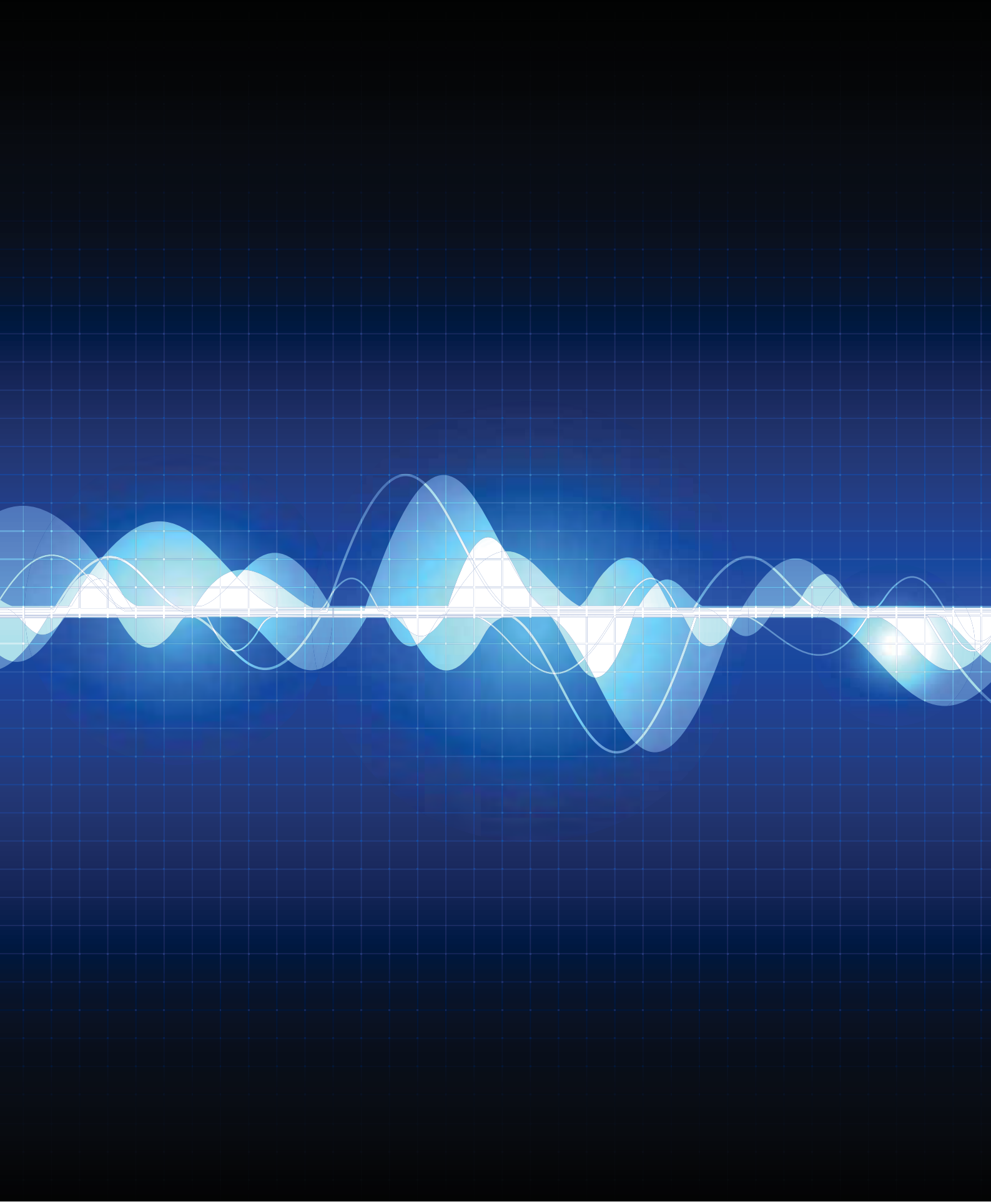


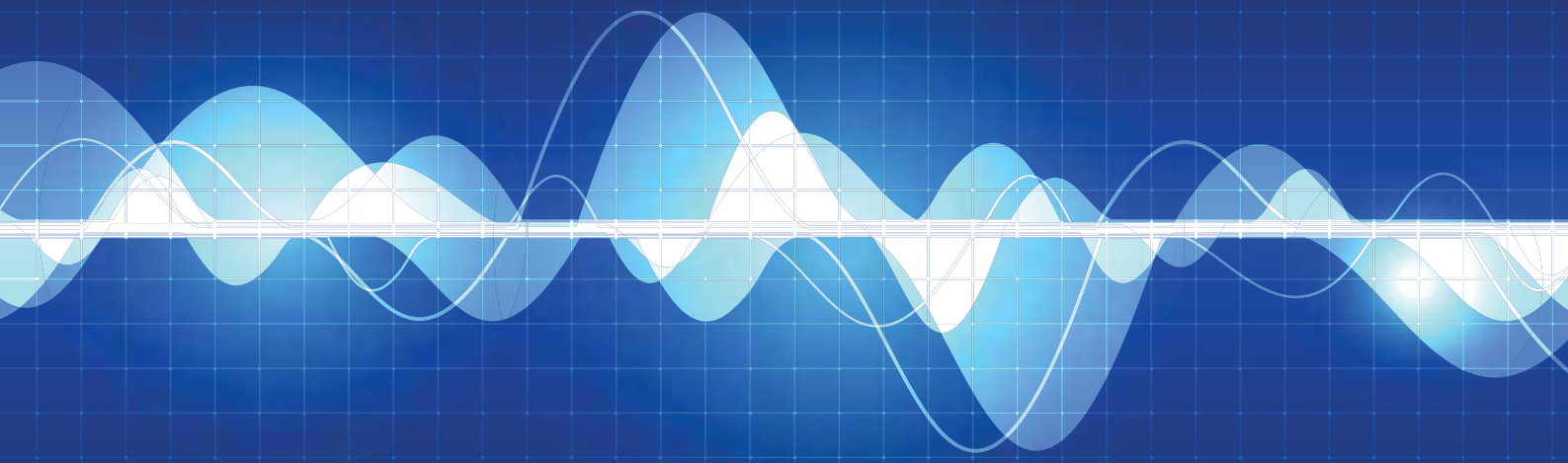
Appendix H

Monthly attended noise monitoring report - August 2019

Ashton Coal

Monthly attended noise monitoring
August 2019

Prepared for Ashton Coal Operations Pty Ltd
August 2019



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South Melbourne VIC 3205

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Fremantle WA 6160

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Deakin ACT 2600

Ashton Coal

Monthly attended noise monitoring - August 2019

Prepared for Ashton Coal Operations Pty Ltd
August 2019

EMM Newcastle
Level 3, 175 Scott Street
Newcastle NSW 2300

T 02 4907 4800
E info@emmconsulting.com.au

Ashton Coal

Monthly attended noise monitoring - August 2019

Report Number

H190081 RP7

Client

Ashton Coal Operations Pty Ltd

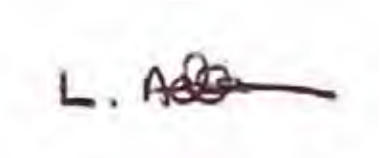
Date

26 August 2019

Version

v1-0 Final

Prepared by



Lucas Adamson
Acoustic Consultant
26 August 2019

Approved by

Katie Teyhan
Associate
26 August 2019

This report has been prepared in accordance with the brief provided by the client and has relied upon the information collected at the time and under the conditions specified in the report. All findings, conclusions or recommendations contained in the report are based on the aforementioned circumstances. The report is for the use of the client and no responsibility will be taken for its use by other parties. The client may, at its discretion, use the report to inform regulators and the public.

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Table of Contents

Appendices

Tables

Figures

1 Introduction

EMM Consulting Pty Limited (EMM) was engaged to complete monthly attended noise surveys on behalf of Ashton Coal Operations Pty Ltd (Ashton Coal).

The purpose of the monitoring was to address requirements of the approved Ashton Coal Noise Management Plan (NMP), prepared to satisfy the requirements of the Development Consent DA 309-11-2001-I (DC) and Environment Protection License (EPL) 11879.

This report presents the results and findings of attended noise monitoring conducted on 14 August 2019.

The following material was referenced as part of this assessment:

- Department of Planning and Environment (DPE), Development Consent 309-11-2001-I, as modified on 20 June 2016 (current as of 14 August 2019);
- Environment Protection Authority (EPA), Environment Protection License 11879, as varied on 27 March 2019 (current as of 14 August 2019);
- Ashton Coal Project Noise Management Plan (NMP), approved by DPE on 10 October 2017 (current as of 14 August 2019);
- NSW EPA, Industrial Noise Policy (INP), 2000;
- NSW EPA, Industrial Noise Policy Application notes, 2017; and
- NSW EPA, Noise Policy for Industry (NPfI), 2017.

2 Glossary of acoustic terms

Several technical terms are discussed in this report. These are explained in Table 2.1.

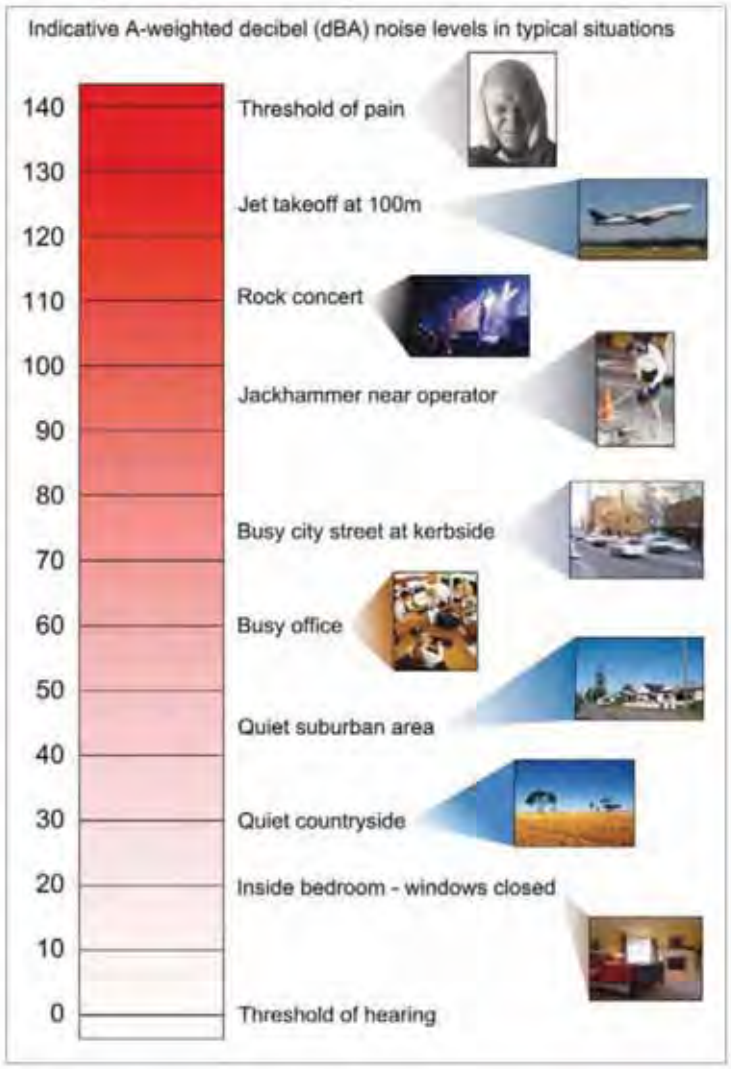
Table 2.1 Glossary of acoustic terms

Term	Description
dB	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.
L_{A1}	The 'A-weighted' noise level which is exceeded 1% of the time.
$L_{A1,1\ minute}$	The 'A-weighted' noise level exceeded for 1% of the specified time period of 1 minute.
L_{A10}	The 'A-weighted' noise level which is exceeded 10% of the time. It is approximately equivalent to the average of maximum noise level.
L_{A90}	Commonly referred to as the background noise level. The 'A-weighted' noise level exceeded 90% of the time.
L_{Aeq}	The energy average noise from a source. This is the equivalent continuous 'A-weighted' sound pressure level over a given period. The $L_{Aeq,15\ minute}$ descriptor refers to an L_{Aeq} noise level measured over a 15-minute period.
L_{Amin}	The minimum 'A-weighted' noise level received during a measuring interval.
L_{Amax}	The maximum root mean squared 'A-weighted' sound pressure level (or maximum noise level) received during a measuring interval.
L_{Ceq}	The equivalent continuous 'C-weighted' sound pressure level over a given period. The $L_{Ceq,15\ minute}$ descriptor refers to an L_{Ceq} noise level measured over a 15 minute period. C-weighting can be used to measure low frequency noise.
Day period	Monday – Saturday: 7 am to 6 pm, on Sundays and Public Holidays: 8 am to 6 pm.
Evening period	Monday – Saturday: 6 pm to 10 pm, on Sundays and Public Holidays: 6 pm to 10 pm.
Night period	Monday – Saturday: 10 pm to 7 am, on Sundays and Public Holidays: 10 pm to 8 am.
Temperature inversion	A meteorological condition where the atmospheric temperature increases with altitude.

It is useful to have an appreciation of decibels (dB), the unit of noise measurement. Table 2.2 gives an indication as to what an average person perceives about changes in noise levels. Examples of common noise levels are provided in Figure 2.1.

Table 2.2 Perceived change in noise

Change in sound pressure level (dB)	Perceived change in noise in surrounding environment
up to 2	not perceptible
3	just perceptible
5	noticeable difference
10	twice (or half) as loud
15	large change
20	four times (or quarter) as loud



Source: Road Noise Policy (Department of Environment, Climate Change and Water 2011)

Figure 2.1 Common noise levels

3 Noise limits

3.1 Operational and sleep disturbance noise limits

Ashton Coal noise limits are provided in Table 1, Condition 2 of Appendix 6 of the DC and Condition L4.1 of the EPL. Extracts of the relevant sections of the DC and EPL pertaining to noise are provided in Appendix A and B, respectively. The approved NMP adopts three attended noise monitoring locations that are representative of residences outlined in the DC. The noise monitoring locations and relevant criteria are summarised in Table 3.1.

Table 3.1 Noise impact assessment criteria

Monitoring location	Day $L_{Aeq,15\ minute}$, dB	Evening $L_{Aeq,15\ minute}$, dB	Night $L_{Aeq,15\ minute}$, dB	Night $L_{A1,1\ minute}$, dB
N2	38	38	36	46
N3	38	38	36	46
N4	38	38	36	46

The DC and the EPL specify the following meteorological conditions under which noise limits do not apply:

- during periods of rain or hail;
- average wind speed at microphone height exceeds 5 m/s;
- wind speeds greater than 3 m/s at 10 metres above ground level; and
- temperature inversion conditions greater than 3°C/100m.

For this assessment, the recorded L_{Amax} has been used as a conservative estimate of the $L_{A1,1\ minute}$. The INP application notes state that the EPA accepts sleep disturbance analysis based on either the $L_{A1,1\ minute}$ or L_{Amax} metrics (EPA 2013), with use of L_{Amax} resulting in a more conservative assessment.

The DC and EPL state that modification factor corrections in the application notes to the INP (2017) shall be applied to the measured mine noise levels where applicable. The application notes to the INP state that Fact Sheet C of the NPfI (EPA 2017) now applies regarding the application of modifying factors.

3.2 Cumulative noise criteria

Ashton Coal cumulative noise limits are provided in Condition 5 and Condition 6 of Schedule 3 of the DC. An extract of the conditions relevant to cumulative noise criteria is provided here.

> 5. The Applicant must implement all reasonable and feasible measures to ensure that the noise generated by the Ashton Mine Complex combined with the noise generated by other mines in the vicinity does not exceed the criteria in Table 4 at any residence on any privately-owned land or on more than 25 per cent of any privately-owned land (except for the noise affected residential receivers in Table 1).

Table 4: Cumulative Noise Criteria dB(A) $L_{Aeq\ (period)}$

Location	Day	Evening	Night
Camberwell Village	55	45	40
All other privately-owned land	50	45	40

> Cumulative noise is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.

> 6. If the cumulative noise generated by the Ashton Mine Complex combined with the noise generated by other coal mines in the vicinity exceeds the criteria in Table 5 at any residence on privately-owned land or more than 25 per cent of any privately-owned land (except for the noise-affected residential receivers ion Table 1), then upon receiving a written request from the landowner, the Applicant must, together with the relevant mines, acquire the land on as equitable basis as possible, in accordance with the procedures in conditions 7 and 8 of schedule 4.

Table 5: Cumulative Noise Acquisition Criteria dB(A) $L_{Aeq\ (period)}$

Location	Day	Evening	Night
Camberwell Village	60	50	45
All other privately-owned land	55	50	45

> Cumulative noise is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.

3.3 Low frequency noise criteria

Condition 3 of Appendix 8 of the DC and L4.3 of the EPL state that noise generated by Ashton Coal is to be measured in accordance with the relevant requirements of the INP. The INP application notes state that Section 4 of the INP has been withdrawn and the modifying factor adjustments outlined in Fact Sheet C of the NPfI are to be used when assessing the characteristics of a noise source.

Fact sheet C of the NPfI (EPA 2017) provides guidelines for applying modifying factor corrections to account for low frequency noise emissions. The NPfI specifies that a difference of 15 dB or more between site 'C-weighted' and site 'A-weighted' noise emission levels identifies the potential for an unbalanced spectrum and potential increased annoyance.

Where a difference of 15 dB or more between site 'C-weighted' and site 'A-weighted' noise emission levels is identified, the one-third octave noise levels recorded should be compared to the values in Table C2 of the NPfI (EPA 2017), which has been reproduced in Table 3.2 below.

Table 3.2 One-third octave low-frequency noise thresholds

	One-third octave $L_{Zeq,15\ minute}$ 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

The following modifying factor correction is to be applied where the site 'C-weighted' and site 'A-weighted' noise emission level is 15 dB or more and:

- where any of the one-third octave noise levels in Table 3.2 are exceeded by up to and including 5 dB and cannot be mitigated, a 2 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period; or

- where any of the one-third octave noise levels in Table 3.2 are exceeded by more than 5 dB and cannot be mitigated, a 5 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period.

Hence, where relevant throughout each survey the operator has estimated the difference between site 'C-weighted' and site 'A-weighted' noise emission levels by matching audible sounds with the response of the analyser (L_{Ceq}-L_{Aeq}). Where this was deemed to be 15 dB or greater, the measured one-third octave frequencies have been compared to the values in Table 3.2 to identify the relevant modifying factor correction (if applicable). This method has been applied to this assessment as presented in Section 5.

It is of note that the NPfI (EPA 2017) states that low-frequency noise corrections only apply under the standard or noise-enhancing (i.e. applicable) meteorological conditions.

4 Assessment methodology

4.1 Attended noise monitoring

To quantify noise emissions from Ashton Coal, 15-minute attended noise monitoring surveys were completed at representative locations as per the approved NMP. Noise monitoring locations and their coordinates are listed in Table 4.1 and are shown in Figure 4.1.

Table 4.1 Attended noise monitoring locations

Monitoring location	Description	MGA56	
		Easting	Northing
N2	Camberwell Village (west)	320297	6405670
N3	Camberwell Village (north east)	320554	6405839
N4	South of New England Highway	319776	6404101

Attended noise monitoring is scheduled to be "unannounced" and, to EMM's knowledge, Ashton Coal were not aware of the monitoring prior to its commencing. Noise monitoring is avoided during any scheduled downtime or major maintenance. Information provided by Ashton Coal after the noise monitoring was completed confirmed that regular operations were occurring during the monitoring period.

Where possible throughout each survey, the operator has quantified the contribution of each significant noise source. This was done by matching audible sounds with the response of the analyser (where applicable) and/or via post-analysis of data (e.g. low pass filtering).

4.2 Instrumentation

A Brüel & Kjær 2250 Type 1 sound analyser (s/n 2759405) was used to conduct 15-minute attended measurements and record 1/3 octave frequency and statistical noise indices. The sound analyser was calibrated before and on completion of the survey using a Brüel & Kjær type 4230 calibrator (s/n 1276091). The instrumentation's calibration certificates are provided in Appendix C.

Source: EMM (2019); DFSI (2017); GA (2011)

0 1 2 km

GDA 1994 MGA Zone 56

N

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KEY

- Site boundary
- Noise monitoring location
- Meteorological station
- Rail line
- Main road
- Local road
- Watercourse/drainage line
- Cadastral boundary

Noise monitoring locations and Ashton colliery boundary

Ashton Coal
Monthly attended noise monitoring
Figure 4.1

EMM
creating opportunities

4.3 Attended noise monitoring exceedance procedure

Ashton Coal has developed an attended monitoring exceedance procedure that is to be implemented if measurements show Ashton Coal noise emissions are above the relevant noise criteria. This response plan is implemented if site noise levels are determined to be above the relevant noise criteria and when noise limits are applicable due to suitable meteorological conditions. The following noise management initiatives are implemented:

- Consultant will record the reading and advise Ashton Coal of the exceedance. Ashton Coal will implement remedial action as required.
- A follow up measurement is to be conducted (within 75 minutes after the first measurement and no earlier than 10 pm).
- If the follow up measurement indicates that site noise levels are above the relevant noise criteria and that noise limits are applicable, the consultant will record the result, note the site has failed and is deemed a 'noise affected night' at that location. An additional monitoring test should be scheduled to be undertaken at the same location within one week and move on to the next monitoring location.
- If the follow up measurement indicates that site noise levels are below the relevant noise criteria and that noise limits are applicable, the consultant will record the result, note the site has passed, schedule an additional monitoring test to be undertaken at the location within one week and move on to the next monitoring location.

4.4 Determination of stability category

This assessment determined the stability categories throughout the attended monitoring period using the direct measurement method as per Appendix E2 of the INP (EPA 2000).

The temperature lapse rate between the two weather stations (M1 – Sentinex Unit 40 located in Camberwell Village and M2 – Ashton Coal 'repeater' meteorological station located in the north eastern open cut (NEOC) area) was calculated using the following formula:

$$\text{Temperature lapse rate} = (\Delta T) \times (100/(\Delta H))$$

Where:

- ΔT = temperature measured at M2 (at 10 metres above ground level) minus temperature measured at M1 (at 10 metres above ground level); and
- ΔH = the vertical height difference between M2 and M1 (equal to 73 metres).

Table E5 of the INP (EPA 2000) is reproduced in Table 4.2 and presents the stability categories and associated ranges in temperature lapse rates.

Table 4.2 Stability categories and temperature lapse rates

Stability category	Temperature lapse rate (ΔT) (°C/100 m)
A	$\Delta T < -1.9$
B	$-1.9 \leq \Delta T < -1.7$
C	$-1.7 \leq \Delta T < -1.5$
D	$-1.5 \leq \Delta T < -0.5$
E	$-0.5 \leq \Delta T < 1.5$
F	$1.5 \leq \Delta T < 4.0$
G	$\Delta T \geq 4.0$

Source: INP (EPA 2000).

Other meteorological data, such as wind speed, has been sourced directly from meteorological station M2 since it is more representative of the weather conditions nearer to the noise sources.

5 Review of data and discussion

5.1 Summary

Results of attended noise measurements are summarised in Table 5.1. Ashton Coal contribution and total mine noise were determined for each survey using in-field observations and post-analysis of data as required (e.g. removing higher frequencies that are not mine related i.e. above 630 Hz). Attended monitoring was completed on 14 August 2019.

The meteorological data for the monitoring period was sourced from Ashton Coal's two weather stations (M1 and M2) to determine applicability of criteria in accordance with the DC and EPL. Noise limits were not applicable during all measurements due to temperature inversion conditions greater than 3°C/100m.

Low frequency noise was conservatively assessed by comparison of the total measured one-third octave L_{Aeq} noise levels to the NPfI one-third octave low-frequency noise thresholds. As Ashton Coal was found to be inaudible at all monitoring locations, LFN modifying factors were not relevant and hence were not applied to estimated site noise levels at any of the locations.

Monitoring identified that site noise was inaudible at all three monitoring locations. Typically, when a particular source is not audible above local ambient noise levels, the likely contribution of that source is generally at least 10 dB below the measured background (L_{A90}) level.

Table 5.1 Ashton Coal attended noise monitoring results – August 2019

Location	Date	Start time	Total noise levels, dB							Site contributions, dB			Noise limits, dB		Meteorological conditions[3] limits apply (Y/N)	Exceedance, dB	Comments
			L_{Amin}	L_{A90}	L_{Aeq}	L_{A10}	L_{A1}	L_{Amax}	L_{Ceq}	LFN mod. factor[1]	L_{Aeq}	L_{Amax}[2]	L_{Aeq}	L_{Amax}[2]			
N2	14/8	22:07	34	36	48	52	58	64	58	Nil	IA	IA	36	46	0.9 m/s @ 293° G class stability 11.0°C/100m VTG N	N/A	**Site noise inaudible.** Other mines in the vicinity and insects consistently audible. Traffic on the New England Highway frequently audible. Resident noise, dogs barking and nearby animals occasionally audible.
N3	14/8	22:25	35	37	45	49	54	66	58	Nil	IA	IA	36	46	0.8 m/s @ 343° G class stability 10.0°C/100m VTG N	N/A	**Site noise inaudible.** Other mines in the vicinity and insects consistently audible. Traffic on the New England Highway frequently audible. Resident noise, dogs barking, distant car idling, train on the main line (unrelated to Ashton Coal) and nearby animals occasionally audible.
N4	14/8	22:47	35	38	43	47	51	57	58	Nil	IA	IA	36	46	1.1 m/s @ 157° G class stability 9.9°C/100m VTG N	N/A	**Site noise inaudible.** Other mines in the vicinity and insects consistently audible. Traffic on the New England Highway frequently audible. Distant dogs barking and bird noise occasionally audible.

Notes:
1. Modifying factor correction for low frequency noise in accordance with Fact Sheet C of the NPfI (refer Section 3.3).
2. For assessment purposes the L_{Amax} and the $L_{A1,1\ minute}$ are interchangeable.
3. Meteorological data were taken as an average over 15 minutes from the Ashton Coal weather station (Refer to Section 5.1). VTG assumes the temperature sensors on the two weather stations are in proper working order and calibrated to manufacturers requirements.
4. IA = inaudible.
5. N/A = not applicable.

5.2 N2 - Camberwell Village (west)

Ashton Coal operations were inaudible during the whole of the operator-attended noise survey. Given this and the measured background noise level of L_{A90} 36 dB, Ashton Coal $L_{Aeq,15\ minute}$ noise contributions were lower than the noise limits, and hence would have complied had limits applied. Other ambient noise sources included other mines in the vicinity, insects, nearby animals, dogs barking and traffic on the New England Highway.

Mining operations in the vicinity were consistently audible during the operator-attended noise survey at monitoring location N2. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ 34 dB ($L_{Aeq,15\ minute}$ 37 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

5.3 N3 - Camberwell Village (north east)

Ashton Coal operations were inaudible during the whole of the operator-attended noise survey. Given this and the measured background noise level of L_{A90} 37 dB, Ashton Coal $L_{Aeq,15\ minute}$ noise contributions were lower than the noise limits, and hence would have complied had limits applied. Other ambient noise sources included other mines in the vicinity, insects, nearby animals, resident noise, a distant car idling, dogs barking and road and rail traffic.

Mining operations in the vicinity were consistently audible during the operator-attended noise survey at monitoring location N3. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ 35 dB ($L_{Aeq,15\ minute}$ 38 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

5.4 N4 - South of New England Highway

Ashton Coal operations were inaudible during the whole of the operator-attended noise survey. Given this and the measured background noise level of L_{A90} 38 dB, Ashton Coal $L_{Aeq,15\ minute}$ noise contributions were lower than the noise limits, and hence would have complied had limits applied. Other ambient noise sources included other mines in the vicinity, insects, bird noise, dogs barking and traffic on the New England Highway.

Mining operations in the vicinity were consistently audible during the operator-attended noise survey at monitoring location N4. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ 34 dB ($L_{Aeq,15\ minute}$ 37 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

6 Conclusion

EMM has completed a review of mine noise from Ashton Coal within the surrounding community based on attended measurements conducted on 14 August 2019.

The applicability of noise limits was assessed with reference to Ashton Coal's two meteorological stations (M1 and M2) located to the east of the site. Noise limits were not applicable during all measurements due to temperature inversion conditions greater than 3°C/100m.

The assessment of noise contributions from site included consideration of modifying factors for noise characteristics where relevant and in accordance with the INP.

Ashton Coal noise contributions and cumulative mine noise contributions were at or below (satisfied) the relevant noise limits (had they applied) at all monitoring locations for this round of monitoring.

References

Ashton Coal Noise Management Plan, 2017.

NSW Department of Planning and Environment, Development Consent DA309-11-2001-I, 2016.

NSW Environment Protection Authority, Environment Protection License 11879.

NSW Environment Protection Authority, Industrial Noise Policy, 2000.

NSW Environment Protection Authority, Industrial Noise Policy Application notes, 2017.

NSW Environment Protection Authority, Noise Policy for Industry, 2017.

Appendix A

Project approval extract

APPENDIX 6
ALTERNATE NOISE CONDITIONS

NOISE

Application

1. Conditions 2 to 3 below have effect during times when open cut mining operations are not being undertaken at the Ashton Mine Complex, in the opinion of the Secretary.

Noise Criteria

2. Except for the noise-affected land in Table 1 of Schedule 3, the Applicant must ensure that the noise generated by the development does not exceed the criteria in Table 1 at any residence on privately-owned land or on more than 25 per cent of any privately-owned land.

Table 1: Noise Criteria dB(A)

Receiver No.	Receiver	Day ($L_{Aeq\ (15min)}$)	Evening ($L_{Aeq\ (15min)}$)	Night ($L_{Aeq\ (15min)}$)	Night ($L_{A1\ (1\ min)}$)
-	All privately-owned land	38	38	36	46

Noise generated by the development is to be measured in accordance with the relevant requirements of the *NSW Industrial Noise Policy*. Appendix 3 sets out the requirements for evaluating compliance with these criteria.

However, these noise criteria do not apply if the Applicant has an agreement with the relevant owner/s of the residence/land to generate higher noise levels, and the Applicant has advised the Department in writing of the terms of this agreement.

Additional Noise Mitigation Measures

3. Upon receiving a written request from the owner of any residence on any privately-owned land where subsequent operational noise monitoring shows the noise generated by the development exceeds the noise limits in Table 2, the Applicant must implement additional reasonable and feasible noise mitigation measures (such as double glazing, insulation, and/or air conditioning) at the residence in consultation with the owner.

If within 3 months of receiving this request from the landowner, the Applicant and the landowner cannot agree on the measures to be implemented, or there is a dispute about the implementation of these measures, then either party may refer the matter to the Secretary for resolution.

Table 2: Additional Noise Mitigation Criteria dB(A) $L_{Aeq\ (15min)}$

Receiver No.	Receiver	Day ($L_{Aeq\ (15min)}$)	Evening ($L_{Aeq\ (15min)}$)	Night ($L_{Aeq\ (15min)}$)
-	All privately-owned land	38	38	38

Notes:

- *Noise generated by the development is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.*
- *For this condition to apply, the exceedance of the criteria must be systemic.*

APPENDIX 8
NOISE COMPLIANCE ASSESSMENT

Compliance Monitoring

1. Attended monitoring is to be used to evaluate compliance with the relevant conditions of this approval.

2. Data collected for the purposes of determining compliance with the relevant conditions of this approval is to be excluded under the following meteorological conditions:
   a) during periods of rain or hail;
   b) average wind speed at microphone height exceeds 5 m/s;
   c) wind speeds greater than 3 m/s measures at 10 m above ground level; and
   d) temperature inversion conditions greater than 3°C/100m.

3. Unless otherwise agreed with the Secretary, this monitoring is to be carried out in accordance with the relevant requirements relating for reviewing performance set out in the NSW Industrial Noise Policy (as amended from time to time), in particular the requirements relating to:
   a) monitoring locations for the collection of representative noise data;
   b) equipment used to collect noise data, and conformity with Australian Standards relevant to such equipment; and
   c) modifications to noise data collected, including for the exclusion of extraneous noise and/or penalties for modifying factors apart from adjustments for duration.

4. To the extent that there is any inconsistency between the Industrial Noise Policy and the requirements set out in this Appendix, the Appendix prevails to the extent of the inconsistency.

Determination of Meteorological Conditions

5. Except for wind speed at microphone height, the data to be used for determining meteorological conditions shall be that recorded by the meteorological station located in the vicinity of the site (as required by condition 18 of Schedule 3).

Appendix B

EPL extract

Environment Protection Licence

Licence - 11879

13	Noise monitoring	Attended noise monitoring at coordinates 320554, 6405839 (Easting, Northing) identified as N3 on Figure 1.
14	Noise monitoring	Attended noise monitoring at coordinates 320297, 6405670 (Easting, Northing) identified as N2 on Figure 1.
15	Noise monitoring	Attended noise monitoring at coordinates 319776, 6404101 (Easting, Northing) identified as N4 on Figure 1.

P1.5 For the purposes of condition P1.1, P1.3 and P1.4 Figure 1 refers to the plan titled *"Ashton Underground Mine Environment Protection Licence 11879 Premises Boundary, Monitoring & Infrastructure"* dated 1/6/17 EPA Ref DOC17/375653-02.

3 Limit Conditions

L1 Pollution of waters

L1.1 Except as may be expressly provided in any other condition of this licence, the licensee must comply with section 120 of the Protection of the Environment Operations Act 1997.

L2 Concentration limits

L2.1 Flares must be operated by the licensee such that there is no visible emission other than for a total period of no more than 5 minutes in any 2 hours, except for heat haze.

L3 Waste

L3.1 The licensee must not cause, permit or allow any waste to be received at the premises unless specified in this licence.

L4 Noise limits

L4.1 Noise from the premises must not exceed the limits specified in the table below:

Location	Day LAeq(15 minute)	Evening LAeq(15 minute)	Night LAeq(15 minute)	Night LAeq(1 minute)

Any residence not owned by the licensee or not subject to an agreement between the licensee and the residence owner as to an alternative noise limit.	38	38	36	46

L4.2 For the purpose of Condition L2.1:
a) Day is defined as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sundays and Public Holidays,
b) Evening is defined as the period from 6pm to 10pm, and
c) Night is defined as the period from 10pm to 7am Monday to Saturday and 10pm to 8am Sundays and Public Holidays

L4.3 Noise from the premises must be measured at the most affected point on or within the residential boundary or at the most affected point within 30m of the dwelling where the dwelling is more than 30m from boundary to determine compliance with the LAeq(15 minute) noise limits in condition L2.1. Where it can be demonstrated that direct measurement of noise from the premises is impractical, the EPA may accept alternative means of determining compliance. See Chapter 11 of the NSW Industrial Noise Policy. The modification factors presented in Section 4 of the NSW Industrial Noise Policy shall also be applied to the measured noise level where applicable.

L4.4 Noise from the premises is to be measured or computed at 1m from the dwelling facade to determine compliance with condition L2.1 (LA1 (1 minute) noise limit).

L4.5 The noise emission limits identified in condition L2.1 apply under the following meteorological conditions:

a) wind speeds up to 3m/s at 10m above ground level; and
b) temperature inversion conditions up to 3 degrees C/100m.

L4.6 Noise generated at the premises that is measured at each noise monitoring point established under this licence must not exceed the noise levels specified in Column 4 of the table below for that point during the corresponding time periods specified in Column 1 when measured using the corresponding measurement parameters listed in Column 2.

POINT 13,14,15

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
Day	Day-LAeq (15 minute)	-	38
Evening	Evening-LAeq (15 minute)	-	38
Night	Night-LAeq (15 minute)	-	36
Night	Night-LA1 (1 minute)	-	46

Appendix C

Calibration certificates

CERTIFICATE OF CALIBRATION

CERTIFICATE NO: 24152

EQUIPMENT TESTED: Sound Level Calibrator

Manufacturer: B & K
Type No: 4230 **Serial No:** 1276091
Owner: EMM Consulting
Level 1, 146 Hunter Street
Newcastle, NSW 2300

Tests Performed: Measured output pressure level was found to be:

Parameter	Pre-Adj	Adj Y/N	Output: (db re 20 µPa)	Frequency: (Hz)	THD&N (%)
Level 1:	NA	N	93.81	989.84	1.58
Level 2:	NA	N	NA	NA	NA
Uncertainty:			±0.11 dB	±0.05%	±0.20 %
Uncertainty (at 95% c.l.) k=2					

CONDITION OF TEST:
Ambient Pressure: 1004 hPa ±1.5 hPa **Relative Humidity:** 47% ±5%
Temperature: 20 °C ±2° C
Date of Calibration: 14/02/2019 **Issue Date:** 15/02/2019
Acu-Vib Test Procedure: AVP02 (Calibrators)
Test Method: AS IEC 60942 - 2017
CHECKED BY: ..... **AUTHORISED SIGNATURE:** .....
Jack Kidt

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.
The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

NATA
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Accredited Lab. 9262
Acoustic and Vibration Measurements

ACU-VIB
ELECTRONICS
HEAD OFFICE
Unit 14, 22 Hudson Ave. Castle Hill NSW 2154
Tel: (02) 96808133 Fax: (02)96808233
Mobile: 0413 809806
Web site: www.acu-vib.com.au

CERTIFICATE OF CALIBRATION

CERTIFICATE NO.: **SLM 22129 & FILT 4384**

Equipment Description:	Sound Level Meter		
Manufacturer:	B & K		
Model No:	2250	**Serial No:**	2759405
Microphone Type:	4189	**Serial No:**	2888134
Filter Type:	1/3 Octave	**Serial No:**	2759405
Comments:	All tests passed for class 1. (See over for details)		
Owner:	EMGA Mitchell Mclennan Ground Floor, Suite 01, 20 Chandos St St Leonards NSW 2065		
Ambient Pressure:	1008 hPa ±1.5 hPa		
Temperature:	25 °C ±2° C	**Relative Humidity:**	48% ±5%
Date of Calibration:	07/02/2018	**Issue Date:**	09/02/2018

Acu-Vib Test Procedure: AVP10 (SLM) & AVP06 (Filters)

CHECKED BY: ..... **AUTHORISED SIGNATURE:** .....

Jack Kott

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

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Acoustic and Vibration Measurements

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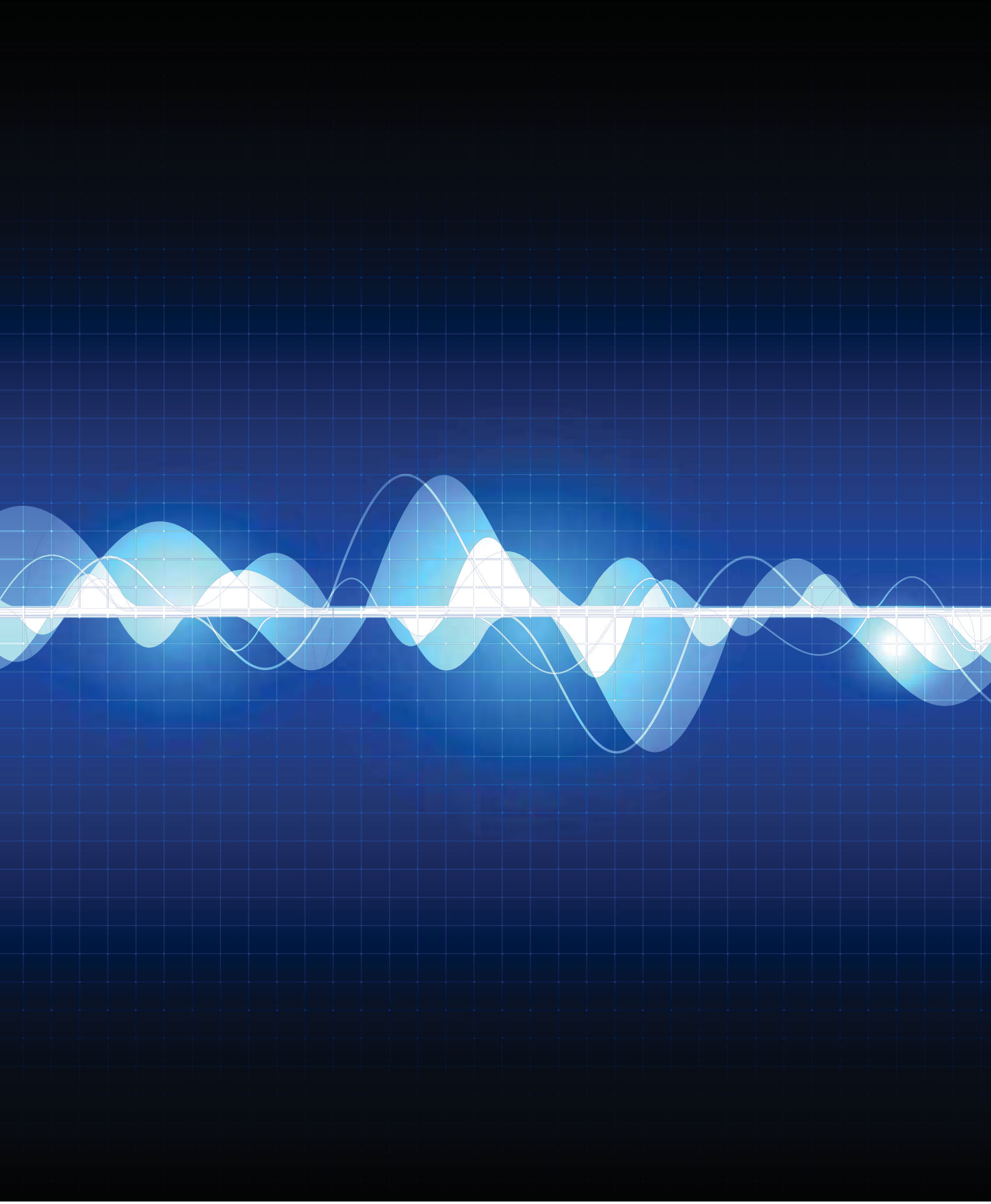


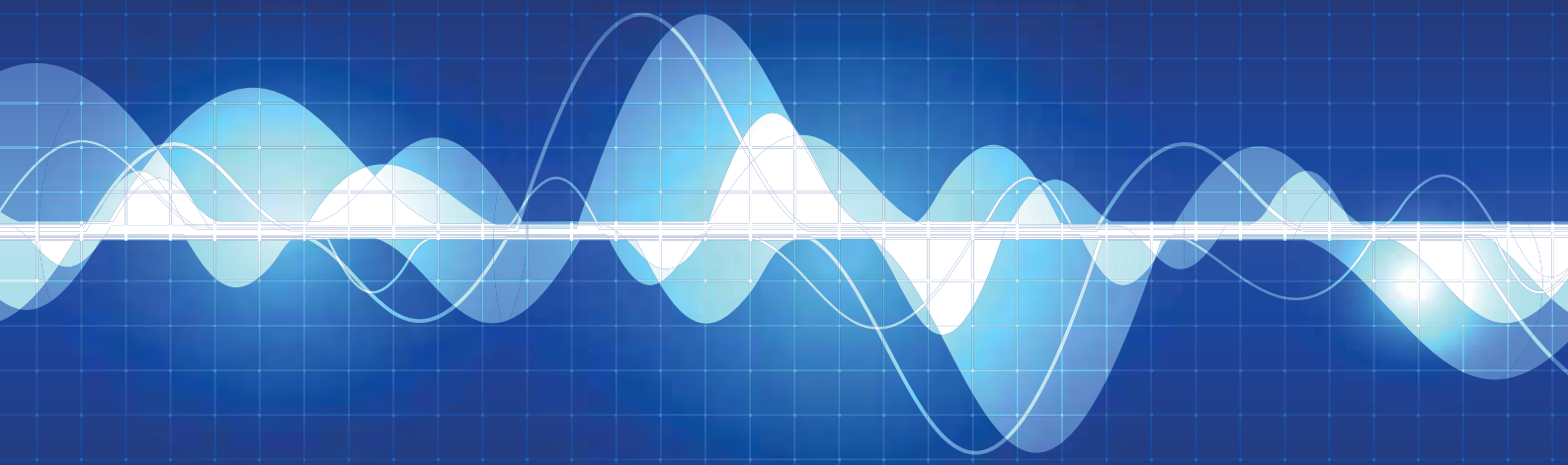
Appendix I

Monthly attended noise monitoring report - September 2019

Ashton Coal

Monthly attended noise monitoring
September 2019

Prepared for Ashton Coal Operations Pty Ltd
October 2019



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Ashton Coal

Monthly attended noise monitoring - September 2019

Prepared for Ashton Coal Operations Pty Ltd
October 2019

EMM Newcastle
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Ashton Coal

Monthly attended noise monitoring - September 2019

Report Number

H190081 RP8

Client

Ashton Coal Operations Pty Ltd

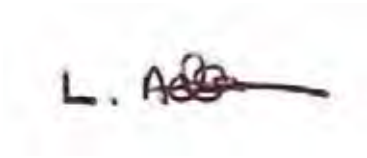
Date

3 October 2019

Version

v1-0 Final

Prepared by



Lucas Adamson
Acoustic Consultant
3 October 2019

Approved by

Katie Teyhan
Associate
3 October 2019

This report has been prepared in accordance with the brief provided by the client and has relied upon the information collected at the time and under the conditions specified in the report. All findings, conclusions or recommendations contained in the report are based on the aforementioned circumstances. The report is for the use of the client and no responsibility will be taken for its use by other parties. The client may, at its discretion, use the report to inform regulators and the public.

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Table of Contents

Appendices

Tables

Figures

1 Introduction

EMM Consulting Pty Limited (EMM) was engaged to complete monthly attended noise surveys on behalf of Ashton Coal Operations Pty Ltd (Ashton Coal).

The purpose of the monitoring was to address requirements of the approved Ashton Coal Noise Management Plan (NMP), prepared to satisfy the requirements of the Development Consent DA 309-11-2001-I (DC) and Environment Protection License (EPL) 11879.

This report presents the results and findings of attended noise monitoring conducted on 18 September 2019.

The following material was referenced as part of this assessment:

- Department of Planning, Industry and Environment (DPIE), Development Consent 309-11-2001-I, as modified on 20 June 2016 (current as of 18 September 2019);
- Environment Protection Authority (EPA), Environment Protection License 11879, as varied on 27 March 2019 (current as of 18 September 2019);
- Ashton Coal Project Noise Management Plan (NMP), approved by DPIE on 10 October 2017 (current as of 18 September 2019);
- NSW EPA, Industrial Noise Policy (INP), 2000;
- NSW EPA, Industrial Noise Policy Application notes, 2017; and
- NSW EPA, Noise Policy for Industry (NPfI), 2017.

2 Glossary of acoustic terms

Several technical terms are discussed in this report. These are explained in Table 2.1.

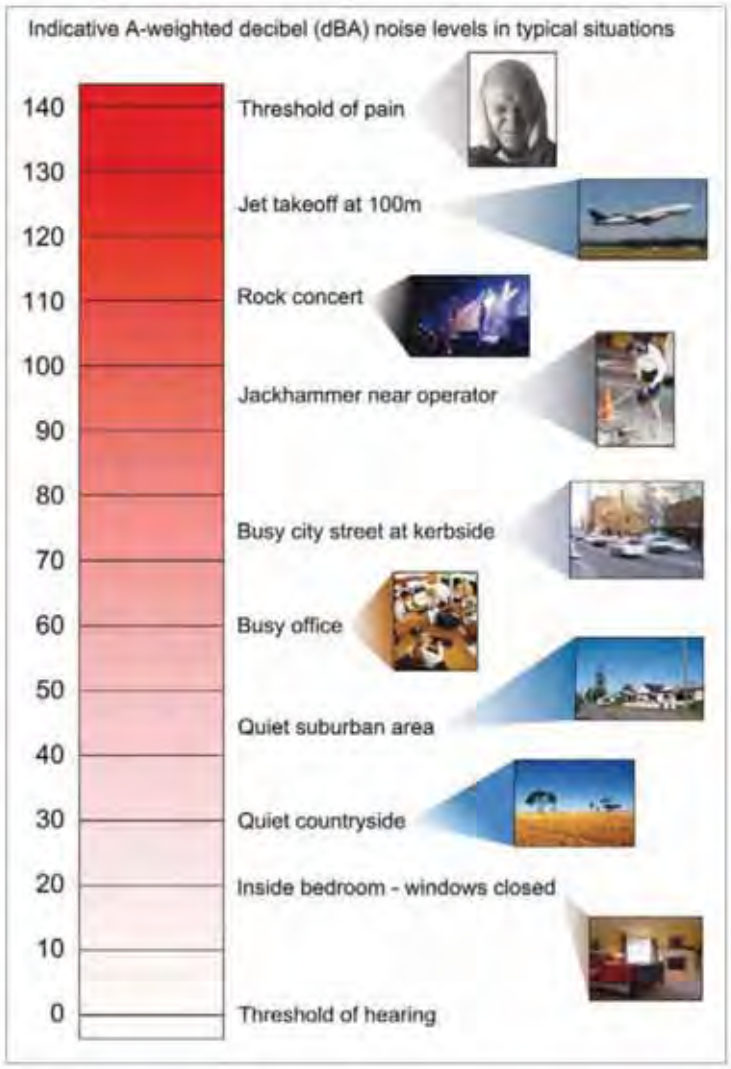
Table 2.1 Glossary of acoustic terms

Term	Description
dB	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.
L_{A1}	The 'A-weighted' noise level which is exceeded 1% of the time.
$L_{A1,1\ minute}$	The 'A-weighted' noise level exceeded for 1% of the specified time period of 1 minute.
L_{A10}	The 'A-weighted' noise level which is exceeded 10% of the time. It is approximately equivalent to the average of maximum noise level.
L_{A90}	Commonly referred to as the background noise level. The 'A-weighted' noise level exceeded 90% of the time.
L_{Aeq}	The energy average noise from a source. This is the equivalent continuous 'A-weighted' sound pressure level over a given period. The $L_{Aeq,15\ minute}$ descriptor refers to an L_{Aeq} noise level measured over a 15-minute period.
L_{Amin}	The minimum 'A-weighted' noise level received during a measuring interval.
L_{Amax}	The maximum root mean squared 'A-weighted' sound pressure level (or maximum noise level) received during a measuring interval.
L_{Ceq}	The equivalent continuous 'C-weighted' sound pressure level over a given period. The $L_{Ceq,15\ minute}$ descriptor refers to an L_{Ceq} noise level measured over a 15 minute period. C-weighting can be used to measure low frequency noise.
Day period	Monday – Saturday: 7 am to 6 pm, on Sundays and Public Holidays: 8 am to 6 pm.
Evening period	Monday – Saturday: 6 pm to 10 pm, on Sundays and Public Holidays: 6 pm to 10 pm.
Night period	Monday – Saturday: 10 pm to 7 am, on Sundays and Public Holidays: 10 pm to 8 am.
Temperature inversion	A meteorological condition where the atmospheric temperature increases with altitude.

It is useful to have an appreciation of decibels (dB), the unit of noise measurement. Table 2.2 gives an indication as to what an average person perceives about changes in noise levels. Examples of common noise levels are provided in Figure 2.1.

Table 2.2 Perceived change in noise

Change in sound pressure level (dB)	Perceived change in noise in surrounding environment
up to 2	not perceptible
3	just perceptible
5	noticeable difference
10	twice (or half) as loud
15	large change
20	four times (or quarter) as loud



Source: Road Noise Policy (Department of Environment, Climate Change and Water 2011)

Figure 2.1 Common noise levels

3 Noise limits

3.1 Operational and sleep disturbance noise limits

Ashton Coal noise limits are provided in Table 1, Condition 2 of Appendix 6 of the DC and Condition L4.1 of the EPL. Extracts of the relevant sections of the DC and EPL pertaining to noise are provided in Appendix A and B, respectively. The approved NMP adopts three attended noise monitoring locations that are representative of residences outlined in the DC. The noise monitoring locations and relevant criteria are summarised in Table 3.1.

Table 3.1 Noise impact assessment criteria

Monitoring location	Day $L_{Aeq,15\ minute}$, dB	Evening $L_{Aeq,15\ minute}$, dB	Night $L_{Aeq,15\ minute}$, dB	Night $L_{A1,1\ minute}$, dB
N2	38	38	36	46
N3	38	38	36	46
N4	38	38	36	46

The DC and the EPL specify the following meteorological conditions under which noise limits do not apply:

- during periods of rain or hail;
- average wind speed at microphone height exceeds 5 m/s;
- wind speeds greater than 3 m/s at 10 metres above ground level; and
- temperature inversion conditions greater than 3°C/100m.

For this assessment, the recorded L_{Amax} has been used as a conservative estimate of the $L_{A1,1\ minute}$. The INP application notes state that the EPA accepts sleep disturbance analysis based on either the $L_{A1,1\ minute}$ or L_{Amax} metrics (EPA 2013), with use of L_{Amax} resulting in a more conservative assessment.

The DC and EPL state that modification factor corrections in the application notes to the INP (2017) shall be applied to the measured mine noise levels where applicable. The application notes to the INP state that Fact Sheet C of the NPfI (EPA 2017) now applies regarding the application of modifying factors.

3.2 Cumulative noise criteria

Ashton Coal cumulative noise limits are provided in Condition 5 and Condition 6 of Schedule 3 of the DC. An extract of the conditions relevant to cumulative noise criteria is provided here.

> 5. The Applicant must implement all reasonable and feasible measures to ensure that the noise generated by the Ashton Mine Complex combined with the noise generated by other mines in the vicinity does not exceed the criteria in Table 4 at any residence on any privately-owned land or on more than 25 per cent of any privately-owned land (except for the noise affected residential receivers in Table 1).

Table 4: Cumulative Noise Criteria dB(A) $L_{Aeq\ (period)}$

Location	Day	Evening	Night
Camberwell Village	55	45	40
All other privately-owned land	50	45	40

> Cumulative noise is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.

> 6. If the cumulative noise generated by the Ashton Mine Complex combined with the noise generated by other coal mines in the vicinity exceeds the criteria in Table 5 at any residence on privately-owned land or more than 25 per cent of any privately-owned land (except for the noise-affected residential receivers ion Table 1), then upon receiving a written request from the landowner, the Applicant must, together with the relevant mines, acquire the land on as equitable basis as possible, in accordance with the procedures in conditions 7 and 8 of schedule 4.

Table 5: Cumulative Noise Acquisition Criteria dB(A) $L_{Aeq\ (period)}$

Location	Day	Evening	Night
Camberwell Village	60	50	45
All other privately-owned land	55	50	45

> Cumulative noise is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.

3.3 Low frequency noise criteria

Condition 3 of Appendix 8 of the DC and L4.3 of the EPL state that noise generated by Ashton Coal is to be measured in accordance with the relevant requirements of the INP. The INP application notes state that Section 4 of the INP has been withdrawn and the modifying factor adjustments outlined in Fact Sheet C of the NPfI are to be used when assessing the characteristics of a noise source.

Fact sheet C of the NPfI (EPA 2017) provides guidelines for applying modifying factor corrections to account for low frequency noise emissions. The NPfI specifies that a difference of 15 dB or more between site 'C-weighted' and site 'A-weighted' noise emission levels identifies the potential for an unbalanced spectrum and potential increased annoyance.

Where a difference of 15 dB or more between site 'C-weighted' and site 'A-weighted' noise emission levels is identified, the one-third octave noise levels recorded should be compared to the values in Table C2 of the NPfI (EPA 2017), which has been reproduced in Table 3.2 below.

Table 3.2 One-third octave low-frequency noise thresholds

	One-third octave $L_{Zeq,15\ minute}$ 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

The following modifying factor correction is to be applied where the site 'C-weighted' and site 'A-weighted' noise emission level is 15 dB or more and:

- where any of the one-third octave noise levels in Table 3.2 are exceeded by up to and including 5 dB and cannot be mitigated, a 2 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period; or

- where any of the one-third octave noise levels in Table 3.2 are exceeded by more than 5 dB and cannot be mitigated, a 5 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period.

Hence, where relevant throughout each survey the operator has estimated the difference between site 'C-weighted' and site 'A-weighted' noise emission levels by matching audible sounds with the response of the analyser (L_{Ceq}-L_{Aeq}). Where this was deemed to be 15 dB or greater, the measured one-third octave frequencies have been compared to the values in Table 3.2 to identify the relevant modifying factor correction (if applicable). This method has been applied to this assessment as presented in Section 5.

It is of note that the NPfI (EPA 2017) states that low-frequency noise corrections only apply under the standard or noise-enhancing (i.e. applicable) meteorological conditions.

4 Assessment methodology

4.1 Attended noise monitoring

To quantify noise emissions from Ashton Coal, 15-minute attended noise monitoring surveys were completed at representative locations as per the approved NMP. Noise monitoring locations and their coordinates are listed in Table 4.1 and are shown in Figure 4.1.

Table 4.1 Attended noise monitoring locations

Monitoring location	Description	MGA56	
		Easting	Northing
N2	Camberwell Village (west)	320297	6405670
N3	Camberwell Village (north east)	320554	6405839
N4	South of New England Highway	319776	6404101

Attended noise monitoring is scheduled to be "unannounced" and, to EMM's knowledge, Ashton Coal were not aware of the monitoring prior to its commencing. Noise monitoring is avoided during any scheduled downtime or major maintenance. Information provided by Ashton Coal after the noise monitoring was completed confirmed that regular operations were occurring during the monitoring period.

Where possible throughout each survey, the operator has quantified the contribution of each significant noise source. This was done by matching audible sounds with the response of the analyser (where applicable) and/or via post-analysis of data (e.g. low pass filtering).

4.2 Instrumentation

A Brüel & Kjær 2250 Type 1 sound analyser (s/n 2759405) was used to conduct 15-minute attended measurements and record 1/3 octave frequency and statistical noise indices. The sound analyser was calibrated before and on completion of the survey using a Brüel & Kjær type 4230 calibrator (s/n 1276091). The instrumentation's calibration certificates are provided in Appendix C.

Source: EMM (2019); DFSI (2017); GA (2011)

0 1 2 km

GDA 1994 MGA Zone 56

N

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KEY

- Site boundary
- Noise monitoring location
- Meteorological station
- Rail line
- Main road
- Local road
- Watercourse/drainage line
- Cadastral boundary

Noise monitoring locations and Ashton colliery boundary

Ashton Coal
Monthly attended noise monitoring
Figure 4.1

EMM
creating opportunities

4.3 Attended noise monitoring exceedance procedure

Ashton Coal has developed an attended monitoring exceedance procedure that is to be implemented if measurements show Ashton Coal noise emissions are above the relevant noise criteria. This response plan is implemented if site noise levels are determined to be above the relevant noise criteria and when noise limits are applicable due to suitable meteorological conditions. The following noise management initiatives are implemented:

- Consultant will record the reading and advise Ashton Coal of the exceedance. Ashton Coal will implement remedial action as required.
- A follow up measurement is to be conducted (within 75 minutes after the first measurement and no earlier than 10 pm).
- If the follow up measurement indicates that site noise levels are above the relevant noise criteria and that noise limits are applicable, the consultant will record the result, note the site has failed and is deemed a 'noise affected night' at that location. An additional monitoring test should be scheduled to be undertaken at the same location within one week and move on to the next monitoring location.
- If the follow up measurement indicates that site noise levels are below the relevant noise criteria and that noise limits are applicable, the consultant will record the result, note the site has passed, schedule an additional monitoring test to be undertaken at the location within one week and move on to the next monitoring location.

4.4 Determination of stability category

This assessment determined the stability categories throughout the attended monitoring period using the direct measurement method as per Appendix E2 of the INP (EPA 2000).

The temperature lapse rate between the two weather stations (M1 – Sentinex Unit 40 located in Camberwell Village and M2 – Ashton Coal 'repeater' meteorological station located in the north eastern open cut (NEOC) area) was calculated using the following formula:

$$\text{Temperature lapse rate} = (\Delta T) \times (100/(\Delta H))$$

Where:

- ΔT = temperature measured at M2 (at 10 metres above ground level) minus temperature measured at M1 (at 10 metres above ground level); and
- ΔH = the vertical height difference between M2 and M1 (equal to 73 metres).

Table E5 of the INP (EPA 2000) is reproduced in Table 4.2 and presents the stability categories and associated ranges in temperature lapse rates.

Table 4.2 Stability categories and temperature lapse rates

Stability category	Temperature lapse rate (ΔT) (°C/100 m)
A	$\Delta T < -1.9$
B	$-1.9 \leq \Delta T < -1.7$
C	$-1.7 \leq \Delta T < -1.5$
D	$-1.5 \leq \Delta T < -0.5$
E	$-0.5 \leq \Delta T < 1.5$
F	$1.5 \leq \Delta T < 4.0$
G	$\Delta T \geq 4.0$

Source: INP (EPA 2000).

Other meteorological data, such as wind speed, has been sourced directly from meteorological station M2 since it is more representative of the weather conditions nearer to the noise sources.

5 Review of data and discussion

5.1 Summary

Results of attended noise measurements are summarised in Table 5.1. Ashton Coal contribution and total mine noise were determined for each survey using in-field observations and post-analysis of data as required (e.g. removing higher frequencies that are not mine related i.e. above 630 Hz). Attended monitoring was completed on 18 September 2019.

The meteorological data for the monitoring period was sourced from Ashton Coal's two weather stations (M1 and M2) to determine applicability of criteria in accordance with the DC and EPL. Noise limits were found to be applicable during all measurements.

Low frequency noise was conservatively assessed by comparison of the total measured one-third octave L_{Aeq} noise levels to the NPfI one-third octave low-frequency noise thresholds. As Ashton Coal was found to be inaudible at all monitoring locations, LFN modifying factors were not relevant and hence were not applied to estimated site noise levels at any of the locations.

Monitoring identified that site noise was inaudible at all three monitoring locations. Typically, when a particular source is not audible above local ambient noise levels, the likely contribution of that source is generally at least 10 dB below the measured background (L_{A90}) level.

Table 5.1 Ashton Coal attended noise monitoring results – September 2019

Location	Date	Start time	Total noise levels, dB							Site contributions, dB			Noise limits, dB		Meteorological conditions[3] limits apply (Y/N)	Exceedance, dB	Comments
			L_{Amin}	L_{A90}	L_{Aeq}	L_{A10}	L_{A1}	L_{Amax}	L_{Ceq}	LFN mod. factor[1]	L_{Aeq}	L_{Amax}[2]	L_{Aeq}	L_{Amax}[2]			
N2	18/9	22:01	34	41	50	54	59	63	59	Nil	IA	IA	36	46	2.8 m/s @ 155° E class stability -0.4°C/100m VTG Y	Nil	**Site noise inaudible.** Insects and frogs consistently audible. Traffic on the New England Highway frequently audible. Bird noise, dogs barking and nearby animals occasionally audible.
N3	18/9	22:19	29	32	41	42	53	58	55	Nil	IA	IA	36	46	2.3 m/s @ 155° E class stability -0.4°C/100m VTG Y	Nil	**Site noise inaudible.** Other mines in the vicinity and insects consistently audible. Traffic on the New England Highway and nearby animals frequently audible. Bird noise occasionally audible.
N4	18/9	22:41	30	34	37	38	43	58	58	Nil	IA	IA	36	46	2.4 m/s @ 150° E class stability -0.4°C/100m VTG Y	Nil	**Site noise inaudible.** Powerline hum, insects and frogs consistently audible. Traffic on the New England Highway frequently audible. Livestock occasionally audible.

Notes:
1. Modifying factor correction for low frequency noise in accordance with Fact Sheet C of the NPfI (refer Section 3.3).
2. For assessment purposes the L_{Amax} and the $L_{A1,1\ minute}$ are interchangeable.
3. Meteorological data were taken as an average over 15 minutes from the Ashton Coal weather station (Refer to Section 5.1). VTG assumes the temperature sensors on the two weather stations are in proper working order and calibrated to manufacturers requirements.
4. IA = inaudible.
5. N/A = not applicable.

5.2 N2 - Camberwell Village (west)

Ashton Coal operations were inaudible during the whole of the operator-attended noise survey. Given this and the measured background noise level of L_{A90} 41 dB, Ashton Coal $L_{Aeq,15\ minute}$ noise contributions were lower than the noise limits, and hence complied with the relevant noise limits. Other ambient noise sources included insects, frogs, bird noise, nearby animals, dogs barking and traffic on the New England Highway.

Mining operations in the vicinity were also inaudible during the operator-attended noise survey at monitoring location N2. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ <28 dB ($L_{Aeq,15\ minute}$ <31 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

5.3 N3 - Camberwell Village (north east)

Ashton Coal operations were inaudible during the whole of the operator-attended noise survey. Given this and the measured background noise level of L_{A90} 32 dB, Ashton Coal $L_{Aeq,15\ minute}$ noise contributions were lower than the noise limits, and hence complied with the relevant noise limits. Other ambient noise sources included other mines in the vicinity, insects, nearby animals, bird noise and traffic on the New England Highway.

Mining operations in the vicinity were consistently audible during the operator-attended noise survey at monitoring location N3. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ <27 dB ($L_{Aeq,15\ minute}$ <30 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

5.4 N4 - South of New England Highway

Ashton Coal operations were inaudible during the whole of the operator-attended noise survey. Given this and the measured background noise level of L_{A90} 34 dB, Ashton Coal $L_{Aeq,15\ minute}$ noise contributions were lower than the noise limits, and hence complied with the relevant noise limits. Other ambient noise sources included powerline hum, insects, frogs, livestock and traffic on the New England Highway.

Mining operations in the vicinity were also inaudible during the operator-attended noise survey at monitoring location N4. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ <21 dB ($L_{Aeq,15\ minute}$ <24 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

6 Conclusion

EMM has completed a review of mine noise from Ashton Coal within the surrounding community based on attended measurements conducted on 18 September 2019.

The applicability of noise limits was assessed with reference to Ashton Coal's two meteorological stations (M1 and M2) located to the east of the site. Noise limits were found to be applicable during all measurements.

The assessment of noise contributions from site included consideration of modifying factors for noise characteristics where relevant and in accordance with the INP.

Ashton Coal noise contributions and cumulative mine noise contributions were at or below (satisfied) the relevant noise limits at all monitoring locations for this round of monitoring.

References

Ashton Coal Noise Management Plan, 2017.

NSW Department of Planning, Industry and Environment, Development Consent DA309-11-2001-I, 2016.

NSW Environment Protection Authority, Environment Protection License 11879.

NSW Environment Protection Authority, Industrial Noise Policy, 2000.

NSW Environment Protection Authority, Industrial Noise Policy Application notes, 2017.

NSW Environment Protection Authority, Noise Policy for Industry, 2017.

Appendix A

Project approval extract

APPENDIX 6
ALTERNATE NOISE CONDITIONS

NOISE

Application

1. Conditions 2 to 3 below have effect during times when open cut mining operations are not being undertaken at the Ashton Mine Complex, in the opinion of the Secretary.

Noise Criteria

2. Except for the noise-affected land in Table 1 of Schedule 3, the Applicant must ensure that the noise generated by the development does not exceed the criteria in Table 1 at any residence on privately-owned land or on more than 25 per cent of any privately-owned land.

Table 1: Noise Criteria dB(A)

Receiver No.	Receiver	Day ($L_{Aeq\ (15min)}$)	Evening ($L_{Aeq\ (15min)}$)	Night ($L_{Aeq\ (15min)}$)	Night ($L_{A1\ (1\ min)}$)
-	All privately-owned land	38	38	36	46

Noise generated by the development is to be measured in accordance with the relevant requirements of the *NSW Industrial Noise Policy*. Appendix 3 sets out the requirements for evaluating compliance with these criteria.

However, these noise criteria do not apply if the Applicant has an agreement with the relevant owner/s of the residence/land to generate higher noise levels, and the Applicant has advised the Department in writing of the terms of this agreement.

Additional Noise Mitigation Measures

3. Upon receiving a written request from the owner of any residence on any privately-owned land where subsequent operational noise monitoring shows the noise generated by the development exceeds the noise limits in Table 2, the Applicant must implement additional reasonable and feasible noise mitigation measures (such as double glazing, insulation, and/or air conditioning) at the residence in consultation with the owner.

If within 3 months of receiving this request from the landowner, the Applicant and the landowner cannot agree on the measures to be implemented, or there is a dispute about the implementation of these measures, then either party may refer the matter to the Secretary for resolution.

Table 2: Additional Noise Mitigation Criteria dB(A) $L_{Aeq\ (15min)}$

Receiver No.	Receiver	Day ($L_{Aeq\ (15min)}$)	Evening ($L_{Aeq\ (15min)}$)	Night ($L_{Aeq\ (15min)}$)
-	All privately-owned land	38	38	38

Notes:

- *Noise generated by the development is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.*
- *For this condition to apply, the exceedance of the criteria must be systemic.*

APPENDIX 8
NOISE COMPLIANCE ASSESSMENT

Compliance Monitoring

1. Attended monitoring is to be used to evaluate compliance with the relevant conditions of this approval.

2. Data collected for the purposes of determining compliance with the relevant conditions of this approval is to be excluded under the following meteorological conditions:
   a) during periods of rain or hail;
   b) average wind speed at microphone height exceeds 5 m/s;
   c) wind speeds greater than 3 m/s measures at 10 m above ground level; and
   d) temperature inversion conditions greater than 3°C/100m.

3. Unless otherwise agreed with the Secretary, this monitoring is to be carried out in accordance with the relevant requirements relating for reviewing performance set out in the NSW Industrial Noise Policy (as amended from time to time), in particular the requirements relating to:
   a) monitoring locations for the collection of representative noise data;
   b) equipment used to collect noise data, and conformity with Australian Standards relevant to such equipment; and
   c) modifications to noise data collected, including for the exclusion of extraneous noise and/or penalties for modifying factors apart from adjustments for duration.

4. To the extent that there is any inconsistency between the Industrial Noise Policy and the requirements set out in this Appendix, the Appendix prevails to the extent of the inconsistency.

Determination of Meteorological Conditions

5. Except for wind speed at microphone height, the data to be used for determining meteorological conditions shall be that recorded by the meteorological station located in the vicinity of the site (as required by condition 18 of Schedule 3).

Appendix B

EPL extract

Environment Protection Licence

Licence - 11879

13	Noise monitoring	Attended noise monitoring at coordinates 320554, 6405839 (Easting, Northing) identified as N3 on Figure 1.
14	Noise monitoring	Attended noise monitoring at coordinates 320297, 6405670 (Easting, Northing) identified as N2 on Figure 1.
15	Noise monitoring	Attended noise monitoring at coordinates 319776, 6404101 (Easting, Northing) identified as N4 on Figure 1.

P1.5 For the purposes of condition P1.1, P1.3 and P1.4 Figure 1 refers to the plan titled *"Ashton Underground Mine Environment Protection Licence 11879 Premises Boundary, Monitoring & Infrastructure"* dated 1/6/17 EPA Ref DOC17/375653-02.

3 Limit Conditions

L1 Pollution of waters

L1.1 Except as may be expressly provided in any other condition of this licence, the licensee must comply with section 120 of the Protection of the Environment Operations Act 1997.

L2 Concentration limits

L2.1 Flares must be operated by the licensee such that there is no visible emission other than for a total period of no more than 5 minutes in any 2 hours, except for heat haze.

L3 Waste

L3.1 The licensee must not cause, permit or allow any waste to be received at the premises unless specified in this licence.

L4 Noise limits

L4.1 Noise from the premises must not exceed the limits specified in the table below:

Location	Day LAeq(15 minute)	Evening LAeq(15 minute)	Night LAeq(15 minute)	Night LAeq(1 minute)

Any residence not owned by the licensee or not subject to an agreement between the licensee and the residence owner as to an alternative noise limit.	38	38	36	46

L4.2 For the purpose of Condition L2.1:
a) Day is defined as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sundays and Public Holidays,
b) Evening is defined as the period from 6pm to 10pm, and
c) Night is defined as the period from 10pm to 7am Monday to Saturday and 10pm to 8am Sundays and Public Holidays

L4.3 Noise from the premises must be measured at the most affected point on or within the residential boundary or at the most affected point within 30m of the dwelling where the dwelling is more than 30m from boundary to determine compliance with the LAeq(15 minute) noise limits in condition L2.1. Where it can be demonstrated that direct measurement of noise from the premises is impractical, the EPA may accept alternative means of determining compliance. See Chapter 11 of the NSW Industrial Noise Policy. The modification factors presented in Section 4 of the NSW Industrial Noise Policy shall also be applied to the measured noise level where applicable.

L4.4 Noise from the premises is to be measured or computed at 1m from the dwelling facade to determine compliance with condition L2.1 (LA1 (1 minute) noise limit).

L4.5 The noise emission limits identified in condition L2.1 apply under the following meteorological conditions:

a) wind speeds up to 3m/s at 10m above ground level; and
b) temperature inversion conditions up to 3 degrees C/100m.

L4.6 Noise generated at the premises that is measured at each noise monitoring point established under this licence must not exceed the noise levels specified in Column 4 of the table below for that point during the corresponding time periods specified in Column 1 when measured using the corresponding measurement parameters listed in Column 2.

POINT 13,14,15

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
Day	Day-LAeq (15 minute)	-	38
Evening	Evening-LAeq (15 minute)	-	38
Night	Night-LAeq (15 minute)	-	36
Night	Night-LA1 (1 minute)	-	46

Appendix C

Calibration certificates

CERTIFICATE OF CALIBRATION

CERTIFICATE NO: 24152

EQUIPMENT TESTED: Sound Level Calibrator

Manufacturer: B & K
Type No: 4230 **Serial No:** 1276091
Owner: EMM Consulting
Level 1, 146 Hunter Street
Newcastle, NSW 2300

Tests Performed: Measured output pressure level was found to be:

Parameter	Pre-Adj	Adj Y/N	Output: (db re 20 µPa)	Frequency: (Hz)	THD&N (%)
Level 1:	NA	N	93.81	989.84	1.58
Level 2:	NA	N	NA	NA	NA
Uncertainty:			±0.11 dB	±0.05%	±0.20 %
Uncertainty (at 95% c.l.) k=2					

CONDITION OF TEST:
Ambient Pressure: 1004 hPa ±1.5 hPa **Relative Humidity:** 47% ±5%
Temperature: 20 °C ±2° C
Date of Calibration: 14/02/2019 **Issue Date:** 15/02/2019
Acu-Vib Test Procedure: AVP02 (Calibrators)
Test Method: AS IEC 60942 - 2017
CHECKED BY: ..... **AUTHORISED SIGNATURE:** .....
Jack Kidt

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.
The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

NATA
ACCREDITATION
Accredited Lab. 9262
Acoustic and Vibration Measurements

ACU-VIB
ELECTRONICS
HEAD OFFICE
Unit 14, 22 Hudson Ave. Castle Hill NSW 2154
Tel: (02) 96808133 Fax: (02)96808233
Mobile: 0413 809806
Web site: www.acu-vib.com.au

CERTIFICATE OF CALIBRATION

CERTIFICATE NO.: **SLM 22129 & FILT 4384**

Equipment Description:	Sound Level Meter		
Manufacturer:	B & K		
Model No:	2250	**Serial No:**	2759405
Microphone Type:	4189	**Serial No:**	2888134
Filter Type:	1/3 Octave	**Serial No:**	2759405
Comments:	All tests passed for class 1. (See over for details)		
Owner:	EMGA Mitchell Mclennan Ground Floor, Suite 01, 20 Chandos St St Leonards NSW 2065		
Ambient Pressure:	1008 hPa ±1.5 hPa		
Temperature:	25 °C ±2° C	**Relative Humidity:**	48% ±5%
Date of Calibration:	07/02/2018	**Issue Date:**	09/02/2018

Acu-Vib Test Procedure: AVP10 (SLM) & AVP06 (Filters)

CHECKED BY: ..... **AUTHORISED SIGNATURE:** .....

Jack Kott

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.

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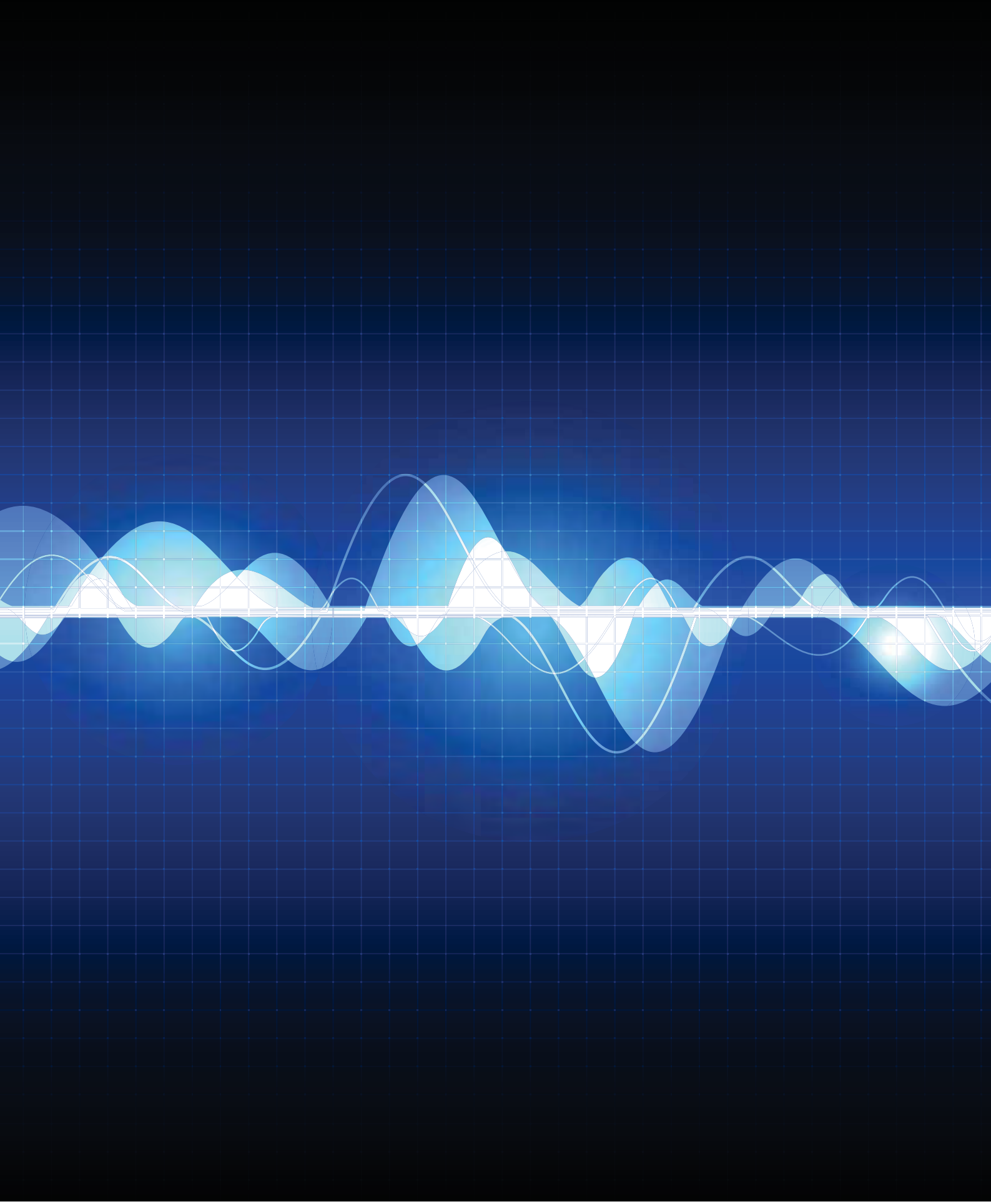


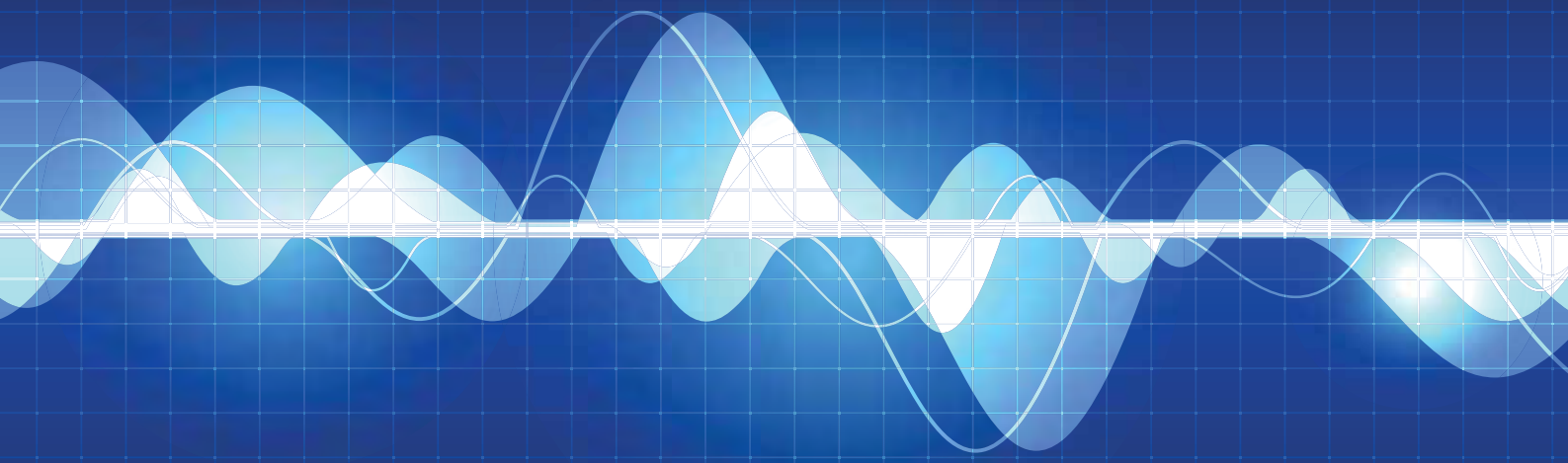
Appendix J

Monthly attended noise monitoring report - October 2019

Ashton Coal

Monthly attended noise monitoring
October 2019

Prepared for Ashton Coal Operations Pty Ltd
November 2019



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Ashton Coal

Monthly attended noise monitoring - October 2019

Prepared for Ashton Coal Operations Pty Ltd
November 2019

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Ashton Coal

Monthly attended noise monitoring - October 2019

Report Number

H190081 RP9

Client

Ashton Coal Operations Pty Ltd

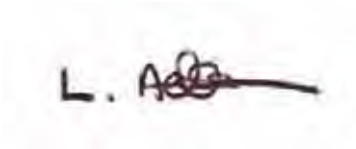
Date

12 November 2019

Version

v1-0 Final

Prepared by



Lucas Adamson
Acoustic Consultant
12 November 2019

Approved by

Katie Teyhan
Associate
12 November 2019

This report has been prepared in accordance with the brief provided by the client and has relied upon the information collected at the time and under the conditions specified in the report. All findings, conclusions or recommendations contained in the report are based on the aforementioned circumstances. The report is for the use of the client and no responsibility will be taken for its use by other parties. The client may, at its discretion, use the report to inform regulators and the public.

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Table of Contents

Appendices

Tables

Figures

1 Introduction

EMM Consulting Pty Limited (EMM) was engaged to complete monthly attended noise surveys on behalf of Ashton Coal Operations Pty Ltd (Ashton Coal).

The purpose of the monitoring was to address requirements of the approved Ashton Coal Noise Management Plan (NMP), prepared to satisfy the requirements of the Development Consent DA 309-11-2001-I (DC) and Environment Protection License (EPL) 11879.

This report presents the results and findings of attended noise monitoring conducted on 21 October 2019.

The following material was referenced as part of this assessment:

- Department of Planning, Industry and Environment (DPIE), Development Consent 309-11-2001-I, as modified on 20 June 2016 (current as of 21 October 2019);
- Environment Protection Authority (EPA), Environment Protection License 11879, as varied on 27 March 2019 (current as of 21 October 2019);
- Ashton Coal Project Noise Management Plan (NMP), approved by DPIE on 10 October 2017 (current as of 21 October 2019);
- NSW EPA, Industrial Noise Policy (INP), 2000;
- NSW EPA, Industrial Noise Policy Application notes, 2017; and
- NSW EPA, Noise Policy for Industry (NPfI), 2017.

2 Glossary of acoustic terms

Several technical terms are discussed in this report. These are explained in Table 2.1.

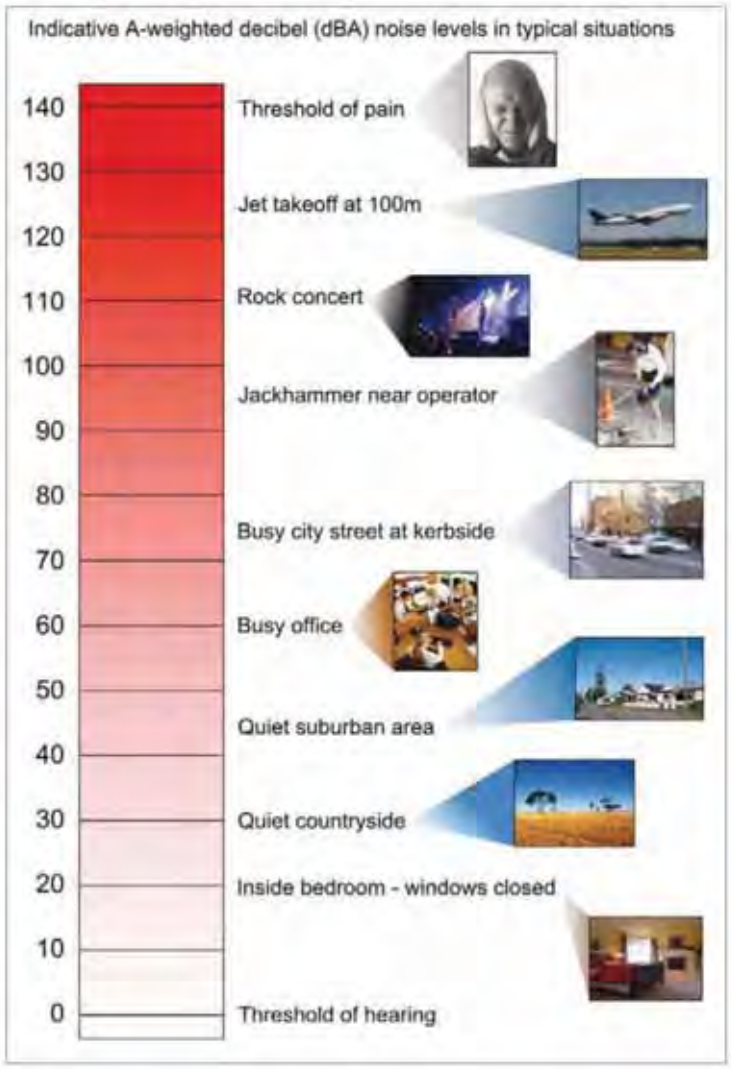
Table 2.1 Glossary of acoustic terms

Term	Description
dB	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.
L_{A1}	The 'A-weighted' noise level which is exceeded 1% of the time.
$L_{A1,1\ minute}$	The 'A-weighted' noise level exceeded for 1% of the specified time period of 1 minute.
L_{A10}	The 'A-weighted' noise level which is exceeded 10% of the time. It is approximately equivalent to the average of maximum noise level.
L_{A90}	Commonly referred to as the background noise level. The 'A-weighted' noise level exceeded 90% of the time.
L_{Aeq}	The energy average noise from a source. This is the equivalent continuous 'A-weighted' sound pressure level over a given period. The $L_{Aeq,15\ minute}$ descriptor refers to an L_{Aeq} noise level measured over a 15-minute period.
L_{Amin}	The minimum 'A-weighted' noise level received during a measuring interval.
L_{Amax}	The maximum root mean squared 'A-weighted' sound pressure level (or maximum noise level) received during a measuring interval.
L_{Ceq}	The equivalent continuous 'C-weighted' sound pressure level over a given period. The $L_{Ceq,15\ minute}$ descriptor refers to an L_{Ceq} noise level measured over a 15 minute period. C-weighting can be used to measure low frequency noise.
Day period	Monday – Saturday: 7 am to 6 pm, on Sundays and Public Holidays: 8 am to 6 pm.
Evening period	Monday – Saturday: 6 pm to 10 pm, on Sundays and Public Holidays: 6 pm to 10 pm.
Night period	Monday – Saturday: 10 pm to 7 am, on Sundays and Public Holidays: 10 pm to 8 am.
Temperature inversion	A meteorological condition where the atmospheric temperature increases with altitude.

It is useful to have an appreciation of decibels (dB), the unit of noise measurement. Table 2.2 gives an indication as to what an average person perceives about changes in noise levels. Examples of common noise levels are provided in Figure 2.1.

Table 2.2 Perceived change in noise

Change in sound pressure level (dB)	Perceived change in noise in surrounding environment
up to 2	not perceptible
3	just perceptible
5	noticeable difference
10	twice (or half) as loud
15	large change
20	four times (or quarter) as loud



Source: Road Noise Policy (Department of Environment, Climate Change and Water 2011)

Figure 2.1 Common noise levels

3 Noise limits

3.1 Operational and sleep disturbance noise limits

Ashton Coal noise limits are provided in Table 1, Condition 2 of Appendix 6 of the DC and Condition L4.1 of the EPL. Extracts of the relevant sections of the DC and EPL pertaining to noise are provided in Appendix A and B, respectively. The approved NMP adopts three attended noise monitoring locations that are representative of residences outlined in the DC. The noise monitoring locations and relevant criteria are summarised in Table 3.1.

Table 3.1 Noise impact assessment criteria

Monitoring location	Day $L_{Aeq,15\ minute}$, dB	Evening $L_{Aeq,15\ minute}$, dB	Night $L_{Aeq,15\ minute}$, dB	Night $L_{A1,1\ minute}$, dB
N2	38	38	36	46
N3	38	38	36	46
N4	38	38	36	46

The DC and the EPL specify the following meteorological conditions under which noise limits do not apply:

- during periods of rain or hail;
- average wind speed at microphone height exceeds 5 m/s;
- wind speeds greater than 3 m/s at 10 metres above ground level; and
- temperature inversion conditions greater than 3°C/100m.

For this assessment, the recorded L_{Amax} has been used as a conservative estimate of the $L_{A1,1\ minute}$. The INP application notes state that the EPA accepts sleep disturbance analysis based on either the $L_{A1,1\ minute}$ or L_{Amax} metrics (EPA 2013), with use of L_{Amax} resulting in a more conservative assessment.

The DC and EPL state that modification factor corrections in the application notes to the INP (2017) shall be applied to the measured mine noise levels where applicable. The application notes to the INP state that Fact Sheet C of the NPfI (EPA 2017) now applies regarding the application of modifying factors.

3.2 Cumulative noise criteria

Ashton Coal cumulative noise limits are provided in Condition 5 and Condition 6 of Schedule 3 of the DC. An extract of the conditions relevant to cumulative noise criteria is provided here.

> 5. The Applicant must implement all reasonable and feasible measures to ensure that the noise generated by the Ashton Mine Complex combined with the noise generated by other mines in the vicinity does not exceed the criteria in Table 4 at any residence on any privately-owned land or on more than 25 per cent of any privately-owned land (except for the noise affected residential receivers in Table 1).

Table 4: Cumulative Noise Criteria dB(A) $L_{Aeq\ (period)}$

Location	Day	Evening	Night
Camberwell Village	55	45	40
All other privately-owned land	50	45	40

> Cumulative noise is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.

> 6. If the cumulative noise generated by the Ashton Mine Complex combined with the noise generated by other coal mines in the vicinity exceeds the criteria in Table 5 at any residence on privately-owned land or more than 25 per cent of any privately-owned land (except for the noise-affected residential receivers ion Table 1), then upon receiving a written request from the landowner, the Applicant must, together with the relevant mines, acquire the land on as equitable basis as possible, in accordance with the procedures in conditions 7 and 8 of schedule 4.

Table 5: Cumulative Noise Acquisition Criteria dB(A) $L_{Aeq\ (period)}$

Location	Day	Evening	Night
Camberwell Village	60	50	45
All other privately-owned land	55	50	45

> Cumulative noise is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.

3.3 Low frequency noise criteria

Condition 3 of Appendix 8 of the DC and L4.3 of the EPL state that noise generated by Ashton Coal is to be measured in accordance with the relevant requirements of the INP. The INP application notes state that Section 4 of the INP has been withdrawn and the modifying factor adjustments outlined in Fact Sheet C of the NPfI are to be used when assessing the characteristics of a noise source.

Fact sheet C of the NPfI (EPA 2017) provides guidelines for applying modifying factor corrections to account for low frequency noise emissions. The NPfI specifies that a difference of 15 dB or more between site 'C-weighted' and site 'A-weighted' noise emission levels identifies the potential for an unbalanced spectrum and potential increased annoyance.

Where a difference of 15 dB or more between site 'C-weighted' and site 'A-weighted' noise emission levels is identified, the one-third octave noise levels recorded should be compared to the values in Table C2 of the NPfI (EPA 2017), which has been reproduced in Table 3.2 below.

Table 3.2 One-third octave low-frequency noise thresholds

	One-third octave $L_{Zeq,15\ minute}$ 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

The following modifying factor correction is to be applied where the site 'C-weighted' and site 'A-weighted' noise emission level is 15 dB or more and:

- where any of the one-third octave noise levels in Table 3.2 are exceeded by up to and including 5 dB and cannot be mitigated, a 2 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period; or

- where any of the one-third octave noise levels in Table 3.2 are exceeded by more than 5 dB and cannot be mitigated, a 5 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period.

Hence, where relevant throughout each survey the operator has estimated the difference between site 'C-weighted' and site 'A-weighted' noise emission levels by matching audible sounds with the response of the analyser (L_{Ceq}-L_{Aeq}). Where this was deemed to be 15 dB or greater, the measured one-third octave frequencies have been compared to the values in Table 3.2 to identify the relevant modifying factor correction (if applicable). This method has been applied to this assessment as presented in Section 5.

It is of note that the NPfI (EPA 2017) states that low-frequency noise corrections only apply under the standard or noise-enhancing (i.e. applicable) meteorological conditions.

4 Assessment methodology

4.1 Attended noise monitoring

To quantify noise emissions from Ashton Coal, 15-minute attended noise monitoring surveys were completed at representative locations as per the approved NMP. Noise monitoring locations and their coordinates are listed in Table 4.1 and are shown in Figure 4.1.

Table 4.1 Attended noise monitoring locations

Monitoring location	Description	MGA56	
		Easting	Northing
N2	Camberwell Village (west)	320297	6405670
N3	Camberwell Village (north east)	320554	6405839
N4	South of New England Highway	319776	6404101

Attended noise monitoring is scheduled to be "unannounced" and, to EMM's knowledge, Ashton Coal were not aware of the monitoring prior to its commencing. Noise monitoring is avoided during any scheduled downtime or major maintenance. Information provided by Ashton Coal after the noise monitoring was completed confirmed that regular operations were occurring during the monitoring period.

Where possible throughout each survey, the operator has quantified the contribution of each significant noise source. This was done by matching audible sounds with the response of the analyser (where applicable) and/or via post-analysis of data (e.g. low pass filtering).

4.2 Instrumentation

A Brüel & Kjær 2250 Type 1 sound analyser (s/n 2759405) was used to conduct 15-minute attended measurements and record 1/3 octave frequency and statistical noise indices. The sound analyser was calibrated before and on completion of the survey using a Brüel & Kjær type 4230 calibrator (s/n 1276091). The instrumentation's calibration certificates are provided in Appendix C.

Source: EMM (2019); DFSI (2017); GA (2011)

0 1 2 km

GDA 1994 MGA Zone 56

N

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KEY

- Site boundary
- Noise monitoring location
- Meteorological station
- Rail line
- Main road
- Local road
- Watercourse/drainage line
- Cadastral boundary

Noise monitoring locations and Ashton colliery boundary

Ashton Coal
Monthly attended noise monitoring
Figure 4.1

EMM
creating opportunities

4.3 Attended noise monitoring exceedance procedure

Ashton Coal has developed an attended monitoring exceedance procedure that is to be implemented if measurements show Ashton Coal noise emissions are above the relevant noise criteria. This response plan is implemented if site noise levels are determined to be above the relevant noise criteria and when noise limits are applicable due to suitable meteorological conditions. The following noise management initiatives are implemented:

- Consultant will record the reading and advise Ashton Coal of the exceedance. Ashton Coal will implement remedial action as required.
- A follow up measurement is to be conducted (within 75 minutes after the first measurement and no earlier than 10 pm).
- If the follow up measurement indicates that site noise levels are above the relevant noise criteria and that noise limits are applicable, the consultant will record the result, note the site has failed and is deemed a 'noise affected night' at that location. An additional monitoring test should be scheduled to be undertaken at the same location within one week and move on to the next monitoring location.
- If the follow up measurement indicates that site noise levels are below the relevant noise criteria and that noise limits are applicable, the consultant will record the result, note the site has passed, schedule an additional monitoring test to be undertaken at the location within one week and move on to the next monitoring location.

4.4 Determination of stability category

This assessment determined the stability categories throughout the attended monitoring period using the direct measurement method as per Appendix E2 of the INP (EPA 2000).

The temperature lapse rate between the two weather stations (M1 – Sentinex Unit 40 located in Camberwell Village and M2 – Ashton Coal 'repeater' meteorological station located in the north eastern open cut (NEOC) area) was calculated using the following formula:

$$\text{Temperature lapse rate} = (\Delta T) \times (100/(\Delta H))$$

Where:

- ΔT = temperature measured at M2 (at 10 metres above ground level) minus temperature measured at M1 (at 10 metres above ground level); and
- ΔH = the vertical height difference between M2 and M1 (equal to 73 metres).

Table E5 of the INP (EPA 2000) is reproduced in Table 4.2 and presents the stability categories and associated ranges in temperature lapse rates.

Table 4.2 Stability categories and temperature lapse rates

Stability category	Temperature lapse rate (ΔT) (°C/100 m)
A	$\Delta T < -1.9$
B	$-1.9 \leq \Delta T < -1.7$
C	$-1.7 \leq \Delta T < -1.5$
D	$-1.5 \leq \Delta T < -0.5$
E	$-0.5 \leq \Delta T < 1.5$
F	$1.5 \leq \Delta T < 4.0$
G	$\Delta T \geq 4.0$

Source: INP (EPA 2000).

Other meteorological data, such as wind speed, has been sourced directly from meteorological station M2 since it is more representative of the weather conditions nearer to the noise sources.

5 Review of data and discussion

5.1 Summary

Results of attended noise measurements are summarised in Table 5.1. Ashton Coal contribution and total mine noise were determined for each survey using in-field observations and post-analysis of data as required (e.g. removing higher frequencies that are not mine related i.e. above 630 Hz). Attended monitoring was completed on 21 October 2019.

The meteorological data for the monitoring period was sourced from Ashton Coal's two weather stations (M1 and M2) to determine applicability of criteria in accordance with the DC and EPL. Noise limits were found to be not applicable during one of the three measurements due to the presence of wind speeds greater than 3 m/s at the time of the measurement.

Low frequency noise was conservatively assessed by comparison of the total measured one-third octave L_{Aeq} noise levels to the NPfI one‐third octave low‐frequency noise thresholds. As Ashton Coal was found to be inaudible at all monitoring locations, LFN modifying factors were not relevant and hence were not applied to estimated site noise levels at any of the locations.

Monitoring identified that site noise was inaudible at all three monitoring locations. Typically, when a particular source is not audible above local ambient noise levels, the likely contribution of that source is generally at least 10 dB below the measured background (L_{A90}) level.

Table 5.1 Ashton Coal attended noise monitoring results – October 2019

Location	Date	Start time	Total noise levels, dB							Site contributions, dB			Noise limits, dB		Meteorological conditions[3] limits apply (Y/N)	Exceedance, dB	Comments
			L_{Amin}	L_{A90}	L_{Aeq}	L_{A10}	L_{A1}	L_{Amax}	L_{Ceq}	LFN mod. factor[1]	L_{Aeq}	L_{Amax}^2	L_{Aeq}	L_{Amax}^2			
N2	21/10	22:04	32	35	45	50	55	59	58	Nil	IA	IA	36	46	3.2 m/s @ 136° E class stability -0.4°C/100m VTG N	N/A	**Site noise inaudible.** Insects, frogs and other mine in the vicinity consistently audible. Traffic on the New England Highway and wind in trees frequently audible. Distant dogs barking, resident noise and train horns (unrelated to AC) occasionally audible.
N3	21/10	22:21	31	34	39	41	49	55	56	Nil	IA	IA	36	46	2.5 m/s @ 132° E class stability -0.4°C/100m VTG Y	Nil	**Site noise inaudible.** Other mines in the vicinity consistently audible. Traffic on the New England Highway and trains on the main line (unrelated to AC) frequently audible. Distant dogs barking, resident noise, nearby animals, train horns (unrelated to AC) occasionally audible.
N4	21/10	22:42	32	35	43	44	56	62	58	Nil	IA	IA	36	46	1.9 m/s @ 147° E class stability -0.4°C/100m VTG Y	Nil	**Site noise inaudible.** Insects and other mines in the vicinity consistently audible. Traffic on the New England Highway frequently audible. Car passby, bird noise and train horns (unrelated to AC) occasionally audible.

Notes:
1. Modifying factor correction for low frequency noise in accordance with Fact Sheet C of the NPfI (refer Section 3.3).
2. For assessment purposes the L_{Amax} and the $L_{A1,1\ minute}$ are interchangeable.
3. Meteorological data were taken as an average over 15 minutes from the Ashton Coal weather station (Refer to Section 5.1). VTG assumes the temperature sensors on the two weather stations are in proper working order and calibrated to manufacturers requirements.
4. IA = inaudible.
5. N/A = not applicable.

5.2 N2 - Camberwell Village (west)

Ashton Coal operations were inaudible during the whole of the operator-attended noise survey. Given this and the measured background noise level of L_{A90} 36 dB, Ashton Coal $L_{Aeq,15\ minute}$ noise contributions were lower than the noise limits, and hence complied with the relevant noise limits. Other ambient noise sources included other mines in the vicinity, insects, frogs, resident noise, distant dogs barking train horns (unrelated to AC) and traffic on the New England Highway.

Mining operations in the vicinity were also inaudible during the operator-attended noise survey at monitoring location N2. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ <31 dB ($L_{Aeq,15\ minute}$ <34 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

5.3 N3 - Camberwell Village (north east)

Ashton Coal operations were inaudible during the whole of the operator-attended noise survey. Given this and the measured background noise level of L_{A90} 34 dB, Ashton Coal $L_{Aeq,15\ minute}$ noise contributions were lower than the noise limits, and hence complied with the relevant noise limits. Other ambient noise sources included other mines in the vicinity, trains on the main line and train horns (unrelated to AC), nearby animals, resident noise, distant dogs barking and traffic on the New England Highway.

Mining operations in the vicinity were consistently audible during the operator-attended noise survey at monitoring location N3. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ <31 dB ($L_{Aeq,15\ minute}$ <34 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

5.4 N4 - South of New England Highway

Ashton Coal operations were inaudible during the whole of the operator-attended noise survey. Given this and the measured background noise level of L_{A90} 35 dB, Ashton Coal $L_{Aeq,15\ minute}$ noise contributions were lower than the noise limits, and hence complied with the relevant noise limits. Other ambient noise sources included other mines in the vicinity, insects, a car passby, bird noise, train horns (unrelated to AC) and traffic on the New England Highway.

Mining operations in the vicinity were also inaudible during the operator-attended noise survey at monitoring location N4. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ <27 dB ($L_{Aeq,15\ minute}$ <30 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

6 Conclusion

EMM has completed a review of mine noise from Ashton Coal within the surrounding community based on attended measurements conducted on 21 October 2019.

The applicability of noise limits was assessed with reference to Ashton Coal's two meteorological stations (M1 and M2) located to the east of the site. Noise limits were found to be not applicable during one of the three measurements due to the presence of wind speeds greater than 3 m/s at the time of the measurement.

The assessment of noise contributions from site included consideration of modifying factors for noise characteristics where relevant and in accordance with the INP.

Ashton Coal noise contributions and cumulative mine noise contributions were at or below (satisfied) the relevant noise limits at all monitoring locations for this round of monitoring.

References

Ashton Coal Noise Management Plan, 2017.

NSW Department of Planning, Industry and Environment, Development Consent DA309-11-2001-I, 2016.

NSW Environment Protection Authority, Environment Protection License 11879.

NSW Environment Protection Authority, Industrial Noise Policy, 2000.

NSW Environment Protection Authority, Industrial Noise Policy Application notes, 2017.

NSW Environment Protection Authority, Noise Policy for Industry, 2017.

Appendix A

Project approval extract

APPENDIX 6
ALTERNATE NOISE CONDITIONS

NOISE

Application

1. Conditions 2 to 3 below have effect during times when open cut mining operations are not being undertaken at the Ashton Mine Complex, in the opinion of the Secretary.

Noise Criteria

2. Except for the noise-affected land in Table 1 of Schedule 3, the Applicant must ensure that the noise generated by the development does not exceed the criteria in Table 1 at any residence on privately-owned land or on more than 25 per cent of any privately-owned land.

Table 1: Noise Criteria dB(A)

Receiver No.	Receiver	Day ($L_{Aeq\ (15min)}$)	Evening ($L_{Aeq\ (15min)}$)	Night ($L_{Aeq\ (15min)}$)	Night ($L_{A1\ (1\ min)}$)
-	All privately-owned land	38	38	36	46

Noise generated by the development is to be measured in accordance with the relevant requirements of the *NSW Industrial Noise Policy*. Appendix 3 sets out the requirements for evaluating compliance with these criteria.

However, these noise criteria do not apply if the Applicant has an agreement with the relevant owner/s of the residence/land to generate higher noise levels, and the Applicant has advised the Department in writing of the terms of this agreement.

Additional Noise Mitigation Measures

3. Upon receiving a written request from the owner of any residence on any privately-owned land where subsequent operational noise monitoring shows the noise generated by the development exceeds the noise limits in Table 2, the Applicant must implement additional reasonable and feasible noise mitigation measures (such as double glazing, insulation, and/or air conditioning) at the residence in consultation with the owner.

If within 3 months of receiving this request from the landowner, the Applicant and the landowner cannot agree on the measures to be implemented, or there is a dispute about the implementation of these measures, then either party may refer the matter to the Secretary for resolution.

Table 2: Additional Noise Mitigation Criteria dB(A) $L_{Aeq\ (15min)}$

Receiver No.	Receiver	Day ($L_{Aeq\ (15min)}$)	Evening ($L_{Aeq\ (15min)}$)	Night ($L_{Aeq\ (15min)}$)
-	All privately-owned land	38	38	38

Notes:

- *Noise generated by the development is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.*
- *For this condition to apply, the exceedance of the criteria must be systemic.*

APPENDIX 8
NOISE COMPLIANCE ASSESSMENT

Compliance Monitoring

1. Attended monitoring is to be used to evaluate compliance with the relevant conditions of this approval.

2. Data collected for the purposes of determining compliance with the relevant conditions of this approval is to be excluded under the following meteorological conditions:
   a) during periods of rain or hail;
   b) average wind speed at microphone height exceeds 5 m/s;
   c) wind speeds greater than 3 m/s measures at 10 m above ground level; and
   d) temperature inversion conditions greater than 3°C/100m.

3. Unless otherwise agreed with the Secretary, this monitoring is to be carried out in accordance with the relevant requirements relating for reviewing performance set out in the NSW Industrial Noise Policy (as amended from time to time), in particular the requirements relating to:
   a) monitoring locations for the collection of representative noise data;
   b) equipment used to collect noise data, and conformity with Australian Standards relevant to such equipment; and
   c) modifications to noise data collected, including for the exclusion of extraneous noise and/or penalties for modifying factors apart from adjustments for duration.

4. To the extent that there is any inconsistency between the Industrial Noise Policy and the requirements set out in this Appendix, the Appendix prevails to the extent of the inconsistency.

Determination of Meteorological Conditions

5. Except for wind speed at microphone height, the data to be used for determining meteorological conditions shall be that recorded by the meteorological station located in the vicinity of the site (as required by condition 18 of Schedule 3).

Appendix B

EPL extract

Environment Protection Licence

Licence - 11879

13	Noise monitoring	Attended noise monitoring at coordinates 320554, 6405839 (Easting, Northing) identified as N3 on Figure 1.
14	Noise monitoring	Attended noise monitoring at coordinates 320297, 6405670 (Easting, Northing) identified as N2 on Figure 1.
15	Noise monitoring	Attended noise monitoring at coordinates 319776, 6404101 (Easting, Northing) identified as N4 on Figure 1.

P1.5 For the purposes of condition P1.1, P1.3 and P1.4 Figure 1 refers to the plan titled *"Ashton Underground Mine Environment Protection Licence 11879 Premises Boundary, Monitoring & Infrastructure"* dated 1/6/17 EPA Ref DOC17/375653-02.

3 Limit Conditions

L1 Pollution of waters

L1.1 Except as may be expressly provided in any other condition of this licence, the licensee must comply with section 120 of the Protection of the Environment Operations Act 1997.

L2 Concentration limits

L2.1 Flares must be operated by the licensee such that there is no visible emission other than for a total period of no more than 5 minutes in any 2 hours, except for heat haze.

L3 Waste

L3.1 The licensee must not cause, permit or allow any waste to be received at the premises unless specified in this licence.

L4 Noise limits

L4.1 Noise from the premises must not exceed the limits specified in the table below:

Location	Day LAeq(15 minute)	Evening LAeq(15 minute)	Night LAeq(15 minute)	Night LAeq(1 minute)

Any residence not owned by the licensee or not subject to an agreement between the licensee and the residence owner as to an alternative noise limit.	38	38	36	46

L4.2 For the purpose of Condition L2.1:
a) Day is defined as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sundays and Public Holidays,
b) Evening is defined as the period from 6pm to 10pm, and
c) Night is defined as the period from 10pm to 7am Monday to Saturday and 10pm to 8am Sundays and Public Holidays

L4.3 Noise from the premises must be measured at the most affected point on or within the residential boundary or at the most affected point within 30m of the dwelling where the dwelling is more than 30m from boundary to determine compliance with the LAeq(15 minute) noise limits in condition L2.1. Where it can be demonstrated that direct measurement of noise from the premises is impractical, the EPA may accept alternative means of determining compliance. See Chapter 11 of the NSW Industrial Noise Policy. The modification factors presented in Section 4 of the NSW Industrial Noise Policy shall also be applied to the measured noise level where applicable.

L4.4 Noise from the premises is to be measured or computed at 1m from the dwelling facade to determine compliance with condition L2.1 (LA1 (1 minute) noise limit).

L4.5 The noise emission limits identified in condition L2.1 apply under the following meteorological conditions:

a) wind speeds up to 3m/s at 10m above ground level; and
b) temperature inversion conditions up to 3 degrees C/100m.

L4.6 Noise generated at the premises that is measured at each noise monitoring point established under this licence must not exceed the noise levels specified in Column 4 of the table below for that point during the corresponding time periods specified in Column 1 when measured using the corresponding measurement parameters listed in Column 2.

POINT 13,14,15

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
Day	Day-LAeq (15 minute)	-	38
Evening	Evening-LAeq (15 minute)	-	38
Night	Night-LAeq (15 minute)	-	36
Night	Night-LA1 (1 minute)	-	46

Appendix C

Calibration certificates

CERTIFICATE OF CALIBRATION

CERTIFICATE NO: 24152

EQUIPMENT TESTED: Sound Level Calibrator

Manufacturer: B & K
Type No: 4230 **Serial No:** 1276091
Owner: EMM Consulting
Level 1, 146 Hunter Street
Newcastle, NSW 2300

Tests Performed: Measured output pressure level was found to be:

Parameter	Pre-Adj	Adj Y/N	Output: (db re 20 µPa)	Frequency: (Hz)	THD&N (%)
Level 1:	NA	N	93.81	989.84	1.58
Level 2:	NA	N	NA	NA	NA
Uncertainty:			±0.11 dB	±0.05%	±0.20 %
Uncertainty (at 95% c.l.) k=2					

CONDITION OF TEST:
Ambient Pressure: 1004 hPa ±1.5 hPa **Relative Humidity:** 47% ±5%
Temperature: 20 °C ±2° C
Date of Calibration: 14/02/2019 **Issue Date:** 15/02/2019
Acu-Vib Test Procedure: AVP02 (Calibrators)
Test Method: AS IEC 60942 - 2017
CHECKED BY: ..... **AUTHORISED SIGNATURE:** .....
Jack Kidt

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.
The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

NATA
ACCREDITATION
Accredited Lab. 9262
Acoustic and Vibration Measurements

ACU-VIB
ELECTRONICS
HEAD OFFICE
Unit 14, 22 Hudson Ave. Castle Hill NSW 2154
Tel: (02) 96808133 Fax: (02)96808233
Mobile: 0413 809806
Web site: www.acu-vib.com.au

CERTIFICATE OF CALIBRATION

CERTIFICATE NO.: **SLM 22129 & FILT 4384**

Equipment Description:	Sound Level Meter		
Manufacturer:	B & K		
Model No:	2250	**Serial No:**	2759405
Microphone Type:	4189	**Serial No:**	2888134
Filter Type:	1/3 Octave	**Serial No:**	2759405
Comments:	All tests passed for class 1. (See over for details)		
Owner:	EMGA Mitchell Mclennan Ground Floor, Suite 01, 20 Chandos St St Leonards NSW 2065		
Ambient Pressure:	1008 hPa ±1.5 hPa		
Temperature:	25 °C ±2° C	**Relative Humidity:**	48% ±5%
Date of Calibration:	07/02/2018	**Issue Date:**	09/02/2018

Acu-Vib Test Procedure: AVP10 (SLM) & AVP06 (Filters)

CHECKED BY: ..... **AUTHORISED SIGNATURE:** .....

Jack Kott

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.

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Acoustic and Vibration Measurements

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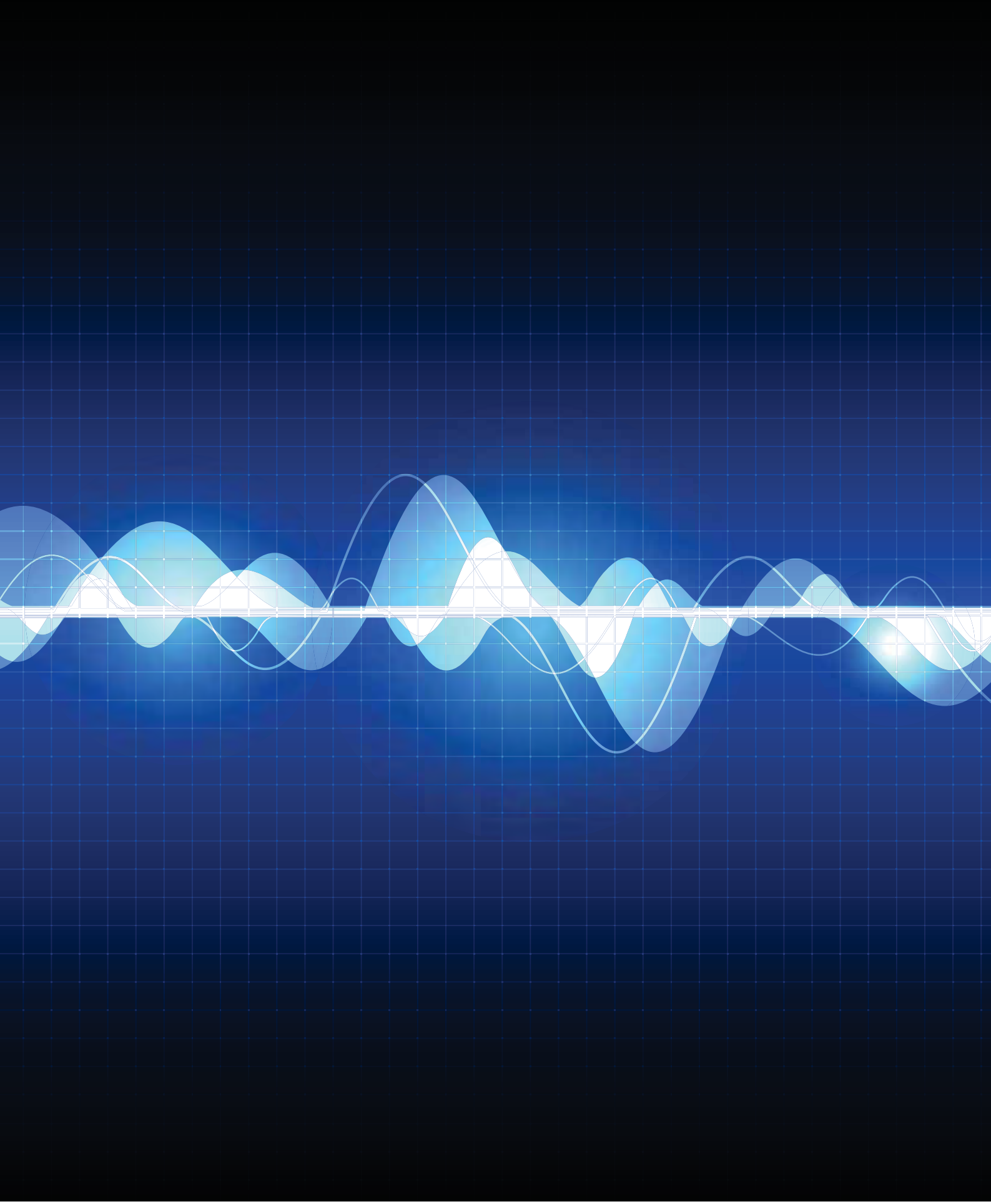


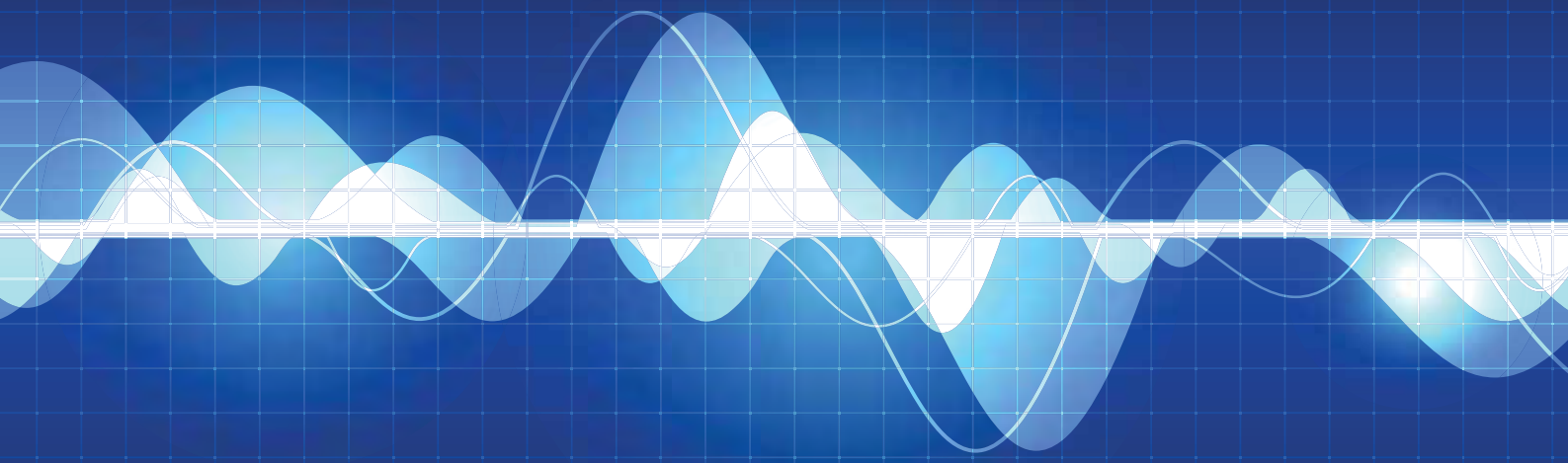
Appendix K

Monthly attended noise monitoring report - November 2019

Ashton Coal

Monthly attended noise monitoring
November 2019

Prepared for Ashton Coal Operations Pty Ltd
December 2019



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Ashton Coal

Monthly attended noise monitoring - November 2019

Prepared for Ashton Coal Operations Pty Ltd
December 2019

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Ashton Coal

Monthly attended noise monitoring - November 2019

Report Number

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Ashton Coal Operations Pty Ltd

Date

5 December 2019

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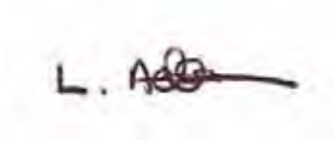
Prepared by



Lucas Adamson
Acoustic Consultant
5 December 2019

Approved by

Katie Teyhan
Associate
5 December 2019

This report has been prepared in accordance with the brief provided by the client and has relied upon the information collected at the time and under the conditions specified in the report. All findings, conclusions or recommendations contained in the report are based on the aforementioned circumstances. The report is for the use of the client and no responsibility will be taken for its use by other parties. The client may, at its discretion, use the report to inform regulators and the public.

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Appendices

Tables

Figures

1 Introduction

EMM Consulting Pty Limited (EMM) was engaged to complete monthly attended noise surveys on behalf of Ashton Coal Operations Pty Ltd (Ashton Coal).

The purpose of the monitoring was to address requirements of the approved Ashton Coal Noise Management Plan (NMP), prepared to satisfy the requirements of the Development Consent DA 309-11-2001-I (DC) and Environment Protection License (EPL) 11879.

This report presents the results and findings of attended noise monitoring conducted on 7 November 2019.

The following material was referenced as part of this assessment:

- Department of Planning, Industry and Environment (DPIE), Development Consent 309-11-2001-I, as modified on 20 June 2016 (current as of 7 November 2019);
- Environment Protection Authority (EPA), Environment Protection License 11879, as varied on 27 March 2019 (current as of 7 November 2019);
- Ashton Coal Project Noise Management Plan (NMP), approved by DPIE on 10 October 2017 (current as of 7 November 2019);
- NSW EPA, Industrial Noise Policy (INP), 2000;
- NSW EPA, Industrial Noise Policy Application notes, 2017; and
- NSW EPA, Noise Policy for Industry (NPfI), 2017.

2 Glossary of acoustic terms

Several technical terms are discussed in this report. These are explained in Table 2.1.

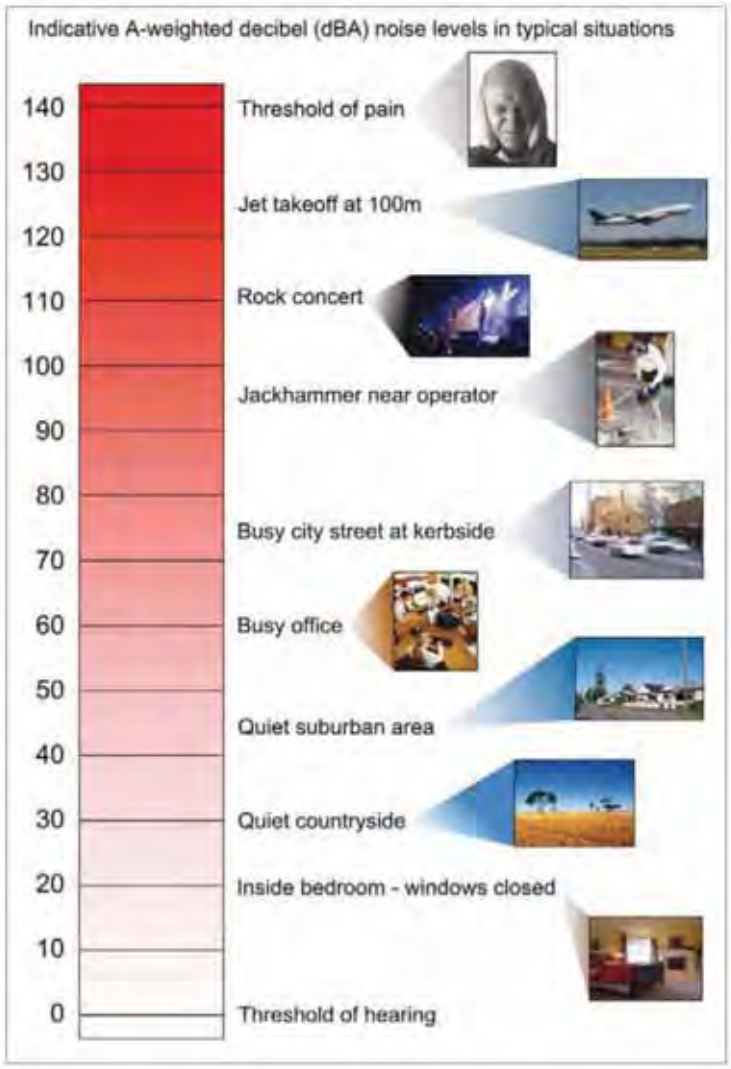
Table 2.1 Glossary of acoustic terms

Term	Description
dB	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.
L_{A1}	The 'A-weighted' noise level which is exceeded 1% of the time.
$L_{A1,1\ minute}$	The 'A-weighted' noise level exceeded for 1% of the specified time period of 1 minute.
L_{A10}	The 'A-weighted' noise level which is exceeded 10% of the time. It is approximately equivalent to the average of maximum noise level.
L_{A90}	Commonly referred to as the background noise level. The 'A-weighted' noise level exceeded 90% of the time.
L_{Aeq}	The energy average noise from a source. This is the equivalent continuous 'A-weighted' sound pressure level over a given period. The $L_{Aeq,15\ minute}$ descriptor refers to an L_{Aeq} noise level measured over a 15-minute period.
L_{Amin}	The minimum 'A-weighted' noise level received during a measuring interval.
L_{Amax}	The maximum root mean squared 'A-weighted' sound pressure level (or maximum noise level) received during a measuring interval.
L_{Ceq}	The equivalent continuous 'C-weighted' sound pressure level over a given period. The $L_{Ceq,15\ minute}$ descriptor refers to an L_{Ceq} noise level measured over a 15 minute period. C-weighting can be used to measure low frequency noise.
Day period	Monday – Saturday: 7 am to 6 pm, on Sundays and Public Holidays: 8 am to 6 pm.
Evening period	Monday – Saturday: 6 pm to 10 pm, on Sundays and Public Holidays: 6 pm to 10 pm.
Night period	Monday – Saturday: 10 pm to 7 am, on Sundays and Public Holidays: 10 pm to 8 am.
Temperature inversion	A meteorological condition where the atmospheric temperature increases with altitude.

It is useful to have an appreciation of decibels (dB), the unit of noise measurement. Table 2.2 gives an indication as to what an average person perceives about changes in noise levels. Examples of common noise levels are provided in Figure 2.1.

Table 2.2 Perceived change in noise

Change in sound pressure level (dB)	Perceived change in noise in surrounding environment
up to 2	not perceptible
3	just perceptible
5	noticeable difference
10	twice (or half) as loud
15	large change
20	four times (or quarter) as loud



Source: Road Noise Policy (Department of Environment, Climate Change and Water 2011)

Figure 2.1 Common noise levels

3 Noise limits

3.1 Operational and sleep disturbance noise limits

Ashton Coal noise limits are provided in Table 1, Condition 2 of Appendix 6 of the DC and Condition L4.1 of the EPL. Extracts of the relevant sections of the DC and EPL pertaining to noise are provided in Appendix A and B, respectively. The approved NMP adopts three attended noise monitoring locations that are representative of residences outlined in the DC. The noise monitoring locations and relevant criteria are summarised in Table 3.1.

Table 3.1 Noise impact assessment criteria

Monitoring location	Day $L_{Aeq,15\ minute}$, dB	Evening $L_{Aeq,15\ minute}$, dB	Night $L_{Aeq,15\ minute}$, dB	Night $L_{A1,1\ minute}$, dB
N2	38	38	36	46
N3	38	38	36	46
N4	38	38	36	46

The DC and the EPL specify the following meteorological conditions under which noise limits do not apply:

- during periods of rain or hail;
- average wind speed at microphone height exceeds 5 m/s;
- wind speeds greater than 3 m/s at 10 metres above ground level; and
- temperature inversion conditions greater than 3°C/100m.

For this assessment, the recorded L_{Amax} has been used as a conservative estimate of the $L_{A1,1\ minute}$. The INP application notes state that the EPA accepts sleep disturbance analysis based on either the $L_{A1,1\ minute}$ or L_{Amax} metrics (EPA 2013), with use of L_{Amax} resulting in a more conservative assessment.

The DC and EPL state that modification factor corrections in the application notes to the INP (2017) shall be applied to the measured mine noise levels where applicable. The application notes to the INP state that Fact Sheet C of the NPfI (EPA 2017) now applies regarding the application of modifying factors.

3.2 Cumulative noise criteria

Ashton Coal cumulative noise limits are provided in Condition 5 and Condition 6 of Schedule 3 of the DC. An extract of the conditions relevant to cumulative noise criteria is provided here.

> 5. The Applicant must implement all reasonable and feasible measures to ensure that the noise generated by the Ashton Mine Complex combined with the noise generated by other mines in the vicinity does not exceed the criteria in Table 4 at any residence on any privately-owned land or on more than 25 per cent of any privately-owned land (except for the noise affected residential receivers in Table 1).

Table 4: Cumulative Noise Criteria dB(A) $L_{Aeq\ (period)}$

Location	Day	Evening	Night
Camberwell Village	55	45	40
All other privately-owned land	50	45	40

> Cumulative noise is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.

> 6. If the cumulative noise generated by the Ashton Mine Complex combined with the noise generated by other coal mines in the vicinity exceeds the criteria in Table 5 at any residence on privately-owned land or more than 25 per cent of any privately-owned land (except for the noise-affected residential receivers ion Table 1), then upon receiving a written request from the landowner, the Applicant must, together with the relevant mines, acquire the land on as equitable basis as possible, in accordance with the procedures in conditions 7 and 8 of schedule 4.

Table 5: Cumulative Noise Acquisition Criteria dB(A) $L_{Aeq\ (period)}$

Location	Day	Evening	Night
Camberwell Village	60	50	45
All other privately-owned land	55	50	45

> Cumulative noise is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.

3.3 Low frequency noise criteria

Condition 3 of Appendix 8 of the DC and L4.3 of the EPL state that noise generated by Ashton Coal is to be measured in accordance with the relevant requirements of the INP. The INP application notes state that Section 4 of the INP has been withdrawn and the modifying factor adjustments outlined in Fact Sheet C of the NPfI are to be used when assessing the characteristics of a noise source.

Fact sheet C of the NPfI (EPA 2017) provides guidelines for applying modifying factor corrections to account for low frequency noise emissions. The NPfI specifies that a difference of 15 dB or more between site 'C-weighted' and site 'A-weighted' noise emission levels identifies the potential for an unbalanced spectrum and potential increased annoyance.

Where a difference of 15 dB or more between site 'C-weighted' and site 'A-weighted' noise emission levels is identified, the one-third octave noise levels recorded should be compared to the values in Table C2 of the NPfI (EPA 2017), which has been reproduced in Table 3.2 below.

Table 3.2 One-third octave low-frequency noise thresholds

	One-third octave $L_{Zeq,15\ minute}$ 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

The following modifying factor correction is to be applied where the site 'C-weighted' and site 'A-weighted' noise emission level is 15 dB or more and:

- where any of the one-third octave noise levels in Table 3.2 are exceeded by up to and including 5 dB and cannot be mitigated, a 2 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period; or

- where any of the one-third octave noise levels in Table 3.2 are exceeded by more than 5 dB and cannot be mitigated, a 5 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period.

Hence, where relevant throughout each survey the operator has estimated the difference between site 'C-weighted' and site 'A-weighted' noise emission levels by matching audible sounds with the response of the analyser (L_{Ceq}-L_{Aeq}). Where this was deemed to be 15 dB or greater, the measured one-third octave frequencies have been compared to the values in Table 3.2 to identify the relevant modifying factor correction (if applicable). This method has been applied to this assessment as presented in Section 5.

It is of note that the NPfI (EPA 2017) states that low-frequency noise corrections only apply under the standard or noise-enhancing (i.e. applicable) meteorological conditions.

4 Assessment methodology

4.1 Attended noise monitoring

To quantify noise emissions from Ashton Coal, 15-minute attended noise monitoring surveys were completed at representative locations as per the approved NMP. Noise monitoring locations and their coordinates are listed in Table 4.1 and are shown in Figure 4.1.

Table 4.1 Attended noise monitoring locations

Monitoring location	Description	MGA56	
		Easting	Northing
N2	Camberwell Village (west)	320297	6405670
N3	Camberwell Village (north east)	320554	6405839
N4	South of New England Highway	319776	6404101

Attended noise monitoring is scheduled to be "unannounced" and, to EMM's knowledge, Ashton Coal were not aware of the monitoring prior to its commencing. Noise monitoring is avoided during any scheduled downtime or major maintenance. Information provided by Ashton Coal after the noise monitoring was completed confirmed that regular operations were occurring during the monitoring period.

Where possible throughout each survey, the operator has quantified the contribution of each significant noise source. This was done by matching audible sounds with the response of the analyser (where applicable) and/or via post-analysis of data (e.g. low pass filtering).

4.2 Instrumentation

A Brüel & Kjær 2250 Type 1 sound analyser (s/n 2759405) was used to conduct 15-minute attended measurements and record 1/3 octave frequency and statistical noise indices. The sound analyser was calibrated before and on completion of the survey using a Brüel & Kjær type 4230 calibrator (s/n 1276091). The instrumentation's calibration certificates are provided in Appendix C.

Source: EMM (2019); DFSI (2017); GA (2011)

0 1 2 km

GDA 1994 MGA Zone 56

N

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KEY

- Site boundary
- Noise monitoring location
- Meteorological station
- Rail line
- Main road
- Local road
- Watercourse/drainage line
- Cadastral boundary

Noise monitoring locations and Ashton colliery boundary

Ashton Coal
Monthly attended noise monitoring
Figure 4.1

EMM
creating opportunities

4.3 Attended noise monitoring exceedance procedure

Ashton Coal has developed an attended monitoring exceedance procedure that is to be implemented if measurements show Ashton Coal noise emissions are above the relevant noise criteria. This response plan is implemented if site noise levels are determined to be above the relevant noise criteria and when noise limits are applicable due to suitable meteorological conditions. The following noise management initiatives are implemented:

- Consultant will record the reading and advise Ashton Coal of the exceedance. Ashton Coal will implement remedial action as required.
- A follow up measurement is to be conducted (within 75 minutes after the first measurement and no earlier than 10 pm).
- If the follow up measurement indicates that site noise levels are above the relevant noise criteria and that noise limits are applicable, the consultant will record the result, note the site has failed and is deemed a 'noise affected night' at that location. An additional monitoring test should be scheduled to be undertaken at the same location within one week and move on to the next monitoring location.
- If the follow up measurement indicates that site noise levels are below the relevant noise criteria and that noise limits are applicable, the consultant will record the result, note the site has passed, schedule an additional monitoring test to be undertaken at the location within one week and move on to the next monitoring location.

4.4 Determination of stability category

This assessment determined the stability categories throughout the attended monitoring period using the direct measurement method as per Appendix E2 of the INP (EPA 2000).

The temperature lapse rate between the two weather stations (M1 – Sentinex Unit 40 located in Camberwell Village and M2 – Ashton Coal 'repeater' meteorological station located in the north eastern open cut (NEOC) area) was calculated using the following formula:

$$\text{Temperature lapse rate} = (\Delta T) \times (100/(\Delta H))$$

Where:

- ΔT = temperature measured at M2 (at 10 metres above ground level) minus temperature measured at M1 (at 10 metres above ground level); and
- ΔH = the vertical height difference between M2 and M1 (equal to 73 metres).

Table E5 of the INP (EPA 2000) is reproduced in Table 4.2 and presents the stability categories and associated ranges in temperature lapse rates.

Table 4.2 Stability categories and temperature lapse rates

Stability category	Temperature lapse rate (ΔT) (°C/100 m)
A	$\Delta T < -1.9$
B	$-1.9 \leq \Delta T < -1.7$
C	$-1.7 \leq \Delta T < -1.5$
D	$-1.5 \leq \Delta T < -0.5$
E	$-0.5 \leq \Delta T < 1.5$
F	$1.5 \leq \Delta T < 4.0$
G	$\Delta T \geq 4.0$

Source: INP (EPA 2000).

Other meteorological data, such as wind speed, has been sourced directly from meteorological station M2 since it is more representative of the weather conditions nearer to the noise sources.

5 Review of data and discussion

5.1 Summary

Results of attended noise measurements are summarised in Table 5.1. Ashton Coal contribution and total mine noise were determined for each survey using in-field observations and post-analysis of data as required (e.g. removing higher frequencies that are not mine related i.e. above 630 Hz). Attended monitoring was completed on 7 November 2019.

The meteorological data for the monitoring period was sourced from Ashton Coal's two weather stations (M1 and M2) to determine applicability of criteria in accordance with the DC and EPL. Noise limits were found to be not applicable during all three measurements due to the presence of wind speeds greater than 3 m/s at the time of the measurements.

Low frequency noise was conservatively assessed by comparison of the total measured one-third octave L_{Aeq} noise levels to the NPfI one-third octave low-frequency noise thresholds. Measured noise levels did not exceed the relevant LFN thresholds during any of the measurements where Ashton Coal was audible. Therefore, in accordance with the NPfI, LFN modifying factors were found to be not relevant and hence were not applied to estimated site noise levels at any of the locations.

At all locations where site noise was audible, Ashton Coal noise contributions and cumulative mine noise contributions were below (i.e. complied with) the relevant noise limits, had they applied.

Table 5.1 Ashton Coal attended noise monitoring results – November 2019

Location	Date	Start time	Total noise levels, dB							Site contributions, dB			Noise limits, dB		Meteorological conditions[3] limits apply (Y/N)	Exceedance, dB	Comments
			L_{Amin}	L_{A90}	L_{Aeq}	L_{A10}	L_{A1}	L_{Amax}	L_{Ceq}	LFN mod. factor[1]	L_{Aeq}	L_{Amax}[2]	L_{Aeq}	L_{Amax}[2]			
N2	7/11	22:01	35	40	51	55	60	66	60	Nil	35	36	36	46	3.3 m/s @ 276° D class stability -1.1°C/100m VTG N	N/A	**Ashton Coal hum consistently audible.** Insects, traffic on the New England Highway and another mine in the vicinity consistently audible. Wind in trees frequently audible. Bird noise occasionally audible.
N3	7/11	22:19	37	40	44	46	51	65	59	Nil	36	42	36	46	4.4 m/s @ 265° D class stability -1.1°C/100m VTG N	N/A	**Ashton Coal hum consistently audible with engine revs on occasion.** Insects, traffic on the New England Highway and another mine in the vicinity consistently audible. Wind in trees frequently audible. Train on the main line (unrelated to Ashton Coal) audible for approx. 5 minutes.
N4	7/11	22:40	31	34	38	40	47	64	59	Nil	29	30	36	46	3.3 m/s @ 281° D class stability -1.0°C/100m VTG N	N/A	**Ashton Coal hum consistently audible.** Traffic on the New England Highway, another mine in the vicinity and powerline hum consistently audible. Resident noise frequently audible.

Notes:
1. Modifying factor correction for low frequency noise in accordance with Fact Sheet C of the NPfI (refer Section 3.3).
2. For assessment purposes the L_{Amax} and the $L_{A1,1\ minute}$ are interchangeable.
3. Meteorological data were taken as an average over 15 minutes from the Ashton Coal weather station (Refer to Section 5.1). VTG assumes the temperature sensors on the two weather stations are in proper working order and calibrated to manufacturers requirements.
4. IA = inaudible.
5. N/A = not applicable.

5.2 N2 - Camberwell Village (west)

Ashton Coal operations were audible during the entire operator-attended noise survey including consistent mine hum. The Ashton Coal mine noise contribution was estimated at up to $L_{Aeq,15\ minute}$ 35 dB. Mine hum from site generated an estimated L_{Amax} 36 dB. Ashton Coal noise contributions complied with the DC and EPL noise limits, had they applied. Other ambient noise sources included another mine in the vicinity, traffic on the New England Highway, insects, bird noise and wind in trees.

Mining operations in the vicinity were consistently audible during the operator-attended noise survey at monitoring location N2. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ 35 dB ($L_{Aeq,15\ minute}$ 38 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

5.3 N3 - Camberwell Village (north east)

Ashton Coal operations were audible during the entire operator-attended noise survey including consistent mine hum, with engine revs on occasion. The Ashton Coal mine noise contribution was estimated at up to $L_{Aeq,15\ minute}$ 36 dB. Engine revs from site generated an estimated L_{Amax} 42 dB. Ashton Coal noise contributions complied with the DC and EPL noise limits, had they applied. Other ambient noise sources included another mine in the vicinity, traffic on the New England Highway, insects, wind in trees and a train on the main line (unrelated to Ashton Coal).

Mining operations in the vicinity were consistently audible during the operator-attended noise survey at monitoring location N3. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ 36 dB ($L_{Aeq,15\ minute}$ 39 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

5.4 N4 - South of New England Highway

Ashton Coal operations were audible during the entire operator-attended noise survey including consistent mine hum. The Ashton Coal mine noise contribution was estimated at up to $L_{Aeq,15\ minute}$ 29 dB. Mine hum from site generated an estimated L_{Amax} 30 dB. Ashton Coal noise contributions complied with the DC and EPL noise limits, had they applied. Other ambient noise sources included another mine in the vicinity, traffic on the New England Highway, resident noise and nearby powerline hum.

Mining operations in the vicinity were consistently audible during the operator-attended noise survey at monitoring location N4. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ 29 dB ($L_{Aeq,15\ minute}$ 32 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

6 Conclusion

EMM has completed a review of mine noise from Ashton Coal within the surrounding community based on attended measurements conducted on 7 November 2019.

The applicability of noise limits was assessed with reference to Ashton Coal's two meteorological stations (M1 and M2) located to the east of the site. Noise limits were found to be not applicable during all three measurements due to the presence of wind speeds greater than 3 m/s at the time of the measurements.

The assessment of noise contributions from site included consideration of modifying factors for noise characteristics where relevant and in accordance with the INP.

Ashton Coal noise contributions and cumulative mine noise contributions were at or below (satisfied) the relevant noise limits at all monitoring locations for this round of monitoring.

References

Ashton Coal Noise Management Plan, 2017.

NSW Department of Planning, Industry and Environment, Development Consent DA309-11-2001-I, 2016.

NSW Environment Protection Authority, Environment Protection License 11879.

NSW Environment Protection Authority, Industrial Noise Policy, 2000.

NSW Environment Protection Authority, Industrial Noise Policy Application notes, 2017.

NSW Environment Protection Authority, Noise Policy for Industry, 2017.

Appendix A

Project approval extract

APPENDIX 6
ALTERNATE NOISE CONDITIONS

NOISE

Application

1. Conditions 2 to 3 below have effect during times when open cut mining operations are not being undertaken at the Ashton Mine Complex, in the opinion of the Secretary.

Noise Criteria

2. Except for the noise-affected land in Table 1 of Schedule 3, the Applicant must ensure that the noise generated by the development does not exceed the criteria in Table 1 at any residence on privately-owned land or on more than 25 per cent of any privately-owned land.

Table 1: Noise Criteria dB(A)

Receiver No.	Receiver	Day ($L_{Aeq\ (15min)}$)	Evening ($L_{Aeq\ (15min)}$)	Night ($L_{Aeq\ (15min)}$)	Night ($L_{A1\ (1\ min)}$)
-	All privately-owned land	38	38	36	46

Noise generated by the development is to be measured in accordance with the relevant requirements of the *NSW Industrial Noise Policy*. Appendix 3 sets out the requirements for evaluating compliance with these criteria.

However, these noise criteria do not apply if the Applicant has an agreement with the relevant owner/s of the residence/land to generate higher noise levels, and the Applicant has advised the Department in writing of the terms of this agreement.

Additional Noise Mitigation Measures

3. Upon receiving a written request from the owner of any residence on any privately-owned land where subsequent operational noise monitoring shows the noise generated by the development exceeds the noise limits in Table 2, the Applicant must implement additional reasonable and feasible noise mitigation measures (such as double glazing, insulation, and/or air conditioning) at the residence in consultation with the owner.

If within 3 months of receiving this request from the landowner, the Applicant and the landowner cannot agree on the measures to be implemented, or there is a dispute about the implementation of these measures, then either party may refer the matter to the Secretary for resolution.

Table 2: Additional Noise Mitigation Criteria dB(A) $L_{Aeq\ (15min)}$

Receiver No.	Receiver	Day ($L_{Aeq\ (15min)}$)	Evening ($L_{Aeq\ (15min)}$)	Night ($L_{Aeq\ (15min)}$)
-	All privately-owned land	38	38	38

Notes:

- *Noise generated by the development is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.*
- *For this condition to apply, the exceedance of the criteria must be systemic.*

APPENDIX 8
NOISE COMPLIANCE ASSESSMENT

Compliance Monitoring

1. Attended monitoring is to be used to evaluate compliance with the relevant conditions of this approval.

2. Data collected for the purposes of determining compliance with the relevant conditions of this approval is to be excluded under the following meteorological conditions:
   a) during periods of rain or hail;
   b) average wind speed at microphone height exceeds 5 m/s;
   c) wind speeds greater than 3 m/s measures at 10 m above ground level; and
   d) temperature inversion conditions greater than 3°C/100m.

3. Unless otherwise agreed with the Secretary, this monitoring is to be carried out in accordance with the relevant requirements relating for reviewing performance set out in the NSW Industrial Noise Policy (as amended from time to time), in particular the requirements relating to:
   a) monitoring locations for the collection of representative noise data;
   b) equipment used to collect noise data, and conformity with Australian Standards relevant to such equipment; and
   c) modifications to noise data collected, including for the exclusion of extraneous noise and/or penalties for modifying factors apart from adjustments for duration.

4. To the extent that there is any inconsistency between the Industrial Noise Policy and the requirements set out in this Appendix, the Appendix prevails to the extent of the inconsistency.

Determination of Meteorological Conditions

5. Except for wind speed at microphone height, the data to be used for determining meteorological conditions shall be that recorded by the meteorological station located in the vicinity of the site (as required by condition 18 of Schedule 3).

Appendix B

EPL extract

Environment Protection Licence

Licence - 11879

13	Noise monitoring	Attended noise monitoring at coordinates 320554, 6405839 (Easting, Northing) identified as N3 on Figure 1.
14	Noise monitoring	Attended noise monitoring at coordinates 320297, 6405670 (Easting, Northing) identified as N2 on Figure 1.
15	Noise monitoring	Attended noise monitoring at coordinates 319776, 6404101 (Easting, Northing) identified as N4 on Figure 1.

P1.5 For the purposes of condition P1.1, P1.3 and P1.4 Figure 1 refers to the plan titled *"Ashton Underground Mine Environment Protection Licence 11879 Premises Boundary, Monitoring & Infrastructure"* dated 1/6/17 EPA Ref DOC17/375653-02.

3 Limit Conditions

L1 Pollution of waters

L1.1 Except as may be expressly provided in any other condition of this licence, the licensee must comply with section 120 of the Protection of the Environment Operations Act 1997.

L2 Concentration limits

L2.1 Flares must be operated by the licensee such that there is no visible emission other than for a total period of no more than 5 minutes in any 2 hours, except for heat haze.

L3 Waste

L3.1 The licensee must not cause, permit or allow any waste to be received at the premises unless specified in this licence.

L4 Noise limits

L4.1 Noise from the premises must not exceed the limits specified in the table below:

Location	Day LAeq(15 minute)	Evening LAeq(15 minute)	Night LAeq(15 minute)	Night LAeq(1 minute)

Any residence not owned by the licensee or not subject to an agreement between the licensee and the residence owner as to an alternative noise limit.	38	38	36	46

L4.2 For the purpose of Condition L2.1:
a) Day is defined as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sundays and Public Holidays,
b) Evening is defined as the period from 6pm to 10pm, and
c) Night is defined as the period from 10pm to 7am Monday to Saturday and 10pm to 8am Sundays and Public Holidays

L4.3 Noise from the premises must be measured at the most affected point on or within the residential boundary or at the most affected point within 30m of the dwelling where the dwelling is more than 30m from boundary to determine compliance with the LAeq(15 minute) noise limits in condition L2.1. Where it can be demonstrated that direct measurement of noise from the premises is impractical, the EPA may accept alternative means of determining compliance. See Chapter 11 of the NSW Industrial Noise Policy. The modification factors presented in Section 4 of the NSW Industrial Noise Policy shall also be applied to the measured noise level where applicable.

L4.4 Noise from the premises is to be measured or computed at 1m from the dwelling facade to determine compliance with condition L2.1 (LA1 (1 minute) noise limit).

L4.5 The noise emission limits identified in condition L2.1 apply under the following meteorological conditions:

a) wind speeds up to 3m/s at 10m above ground level; and
b) temperature inversion conditions up to 3 degrees C/100m.

L4.6 Noise generated at the premises that is measured at each noise monitoring point established under this licence must not exceed the noise levels specified in Column 4 of the table below for that point during the corresponding time periods specified in Column 1 when measured using the corresponding measurement parameters listed in Column 2.

POINT 13,14,15

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
Day	Day-LAeq (15 minute)	-	38
Evening	Evening-LAeq (15 minute)	-	38
Night	Night-LAeq (15 minute)	-	36
Night	Night-LA1 (1 minute)	-	46

Appendix C

Calibration certificates

CERTIFICATE OF CALIBRATION

CERTIFICATE NO: 24152

EQUIPMENT TESTED: Sound Level Calibrator

Manufacturer: B & K
Type No: 4230 **Serial No:** 1276091
Owner: EMM Consulting
Level 1, 146 Hunter Street
Newcastle, NSW 2300

Tests Performed: Measured output pressure level was found to be:

Parameter	Pre-Adj	Adj Y/N	Output: (db re 20 µPa)	Frequency: (Hz)	THD&N (%)
Level 1:	NA	N	93.81	989.84	1.58
Level 2:	NA	N	NA	NA	NA
Uncertainty:			±0.11 dB	±0.05%	±0.20 %
Uncertainty (at 95% c.l.) k=2					

CONDITION OF TEST:
Ambient Pressure: 1004 hPa ±1.5 hPa **Relative Humidity:** 47% ±5%
Temperature: 20 °C ±2° C
Date of Calibration: 14/02/2019 **Issue Date:** 15/02/2019
Acu-Vib Test Procedure: AVP02 (Calibrators)
Test Method: AS IEC 60942 - 2017
CHECKED BY: ..... **AUTHORISED SIGNATURE:** .....
Jack Kidt

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.
The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

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Accredited Lab. 9262
Acoustic and Vibration Measurements

ACU-VIB
ELECTRONICS
HEAD OFFICE
Unit 14, 22 Hudson Ave. Castle Hill NSW 2154
Tel: (02) 96808133 Fax: (02)96808233
Mobile: 0413 809806
Web site: www.acu-vib.com.au

CERTIFICATE OF CALIBRATION

CERTIFICATE NO.: **SLM 22129 & FILT 4384**

Equipment Description:	Sound Level Meter		
Manufacturer:	B & K		
Model No:	2250	**Serial No:**	2759405
Microphone Type:	4189	**Serial No:**	2888134
Filter Type:	1/3 Octave	**Serial No:**	2759405
Comments:	All tests passed for class 1. (See over for details)		
Owner:	EMGA Mitchell Mclennan Ground Floor, Suite 01, 20 Chandos St St Leonards NSW 2065		
Ambient Pressure:	1008 hPa ±1.5 hPa		
Temperature:	25 °C ±2° C	**Relative Humidity:**	48% ±5%
Date of Calibration:	07/02/2018	**Issue Date:**	09/02/2018

Acu-Vib Test Procedure: AVP10 (SLM) & AVP06 (Filters)

CHECKED BY: ..... **AUTHORISED SIGNATURE:** .....

Jack Kott

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

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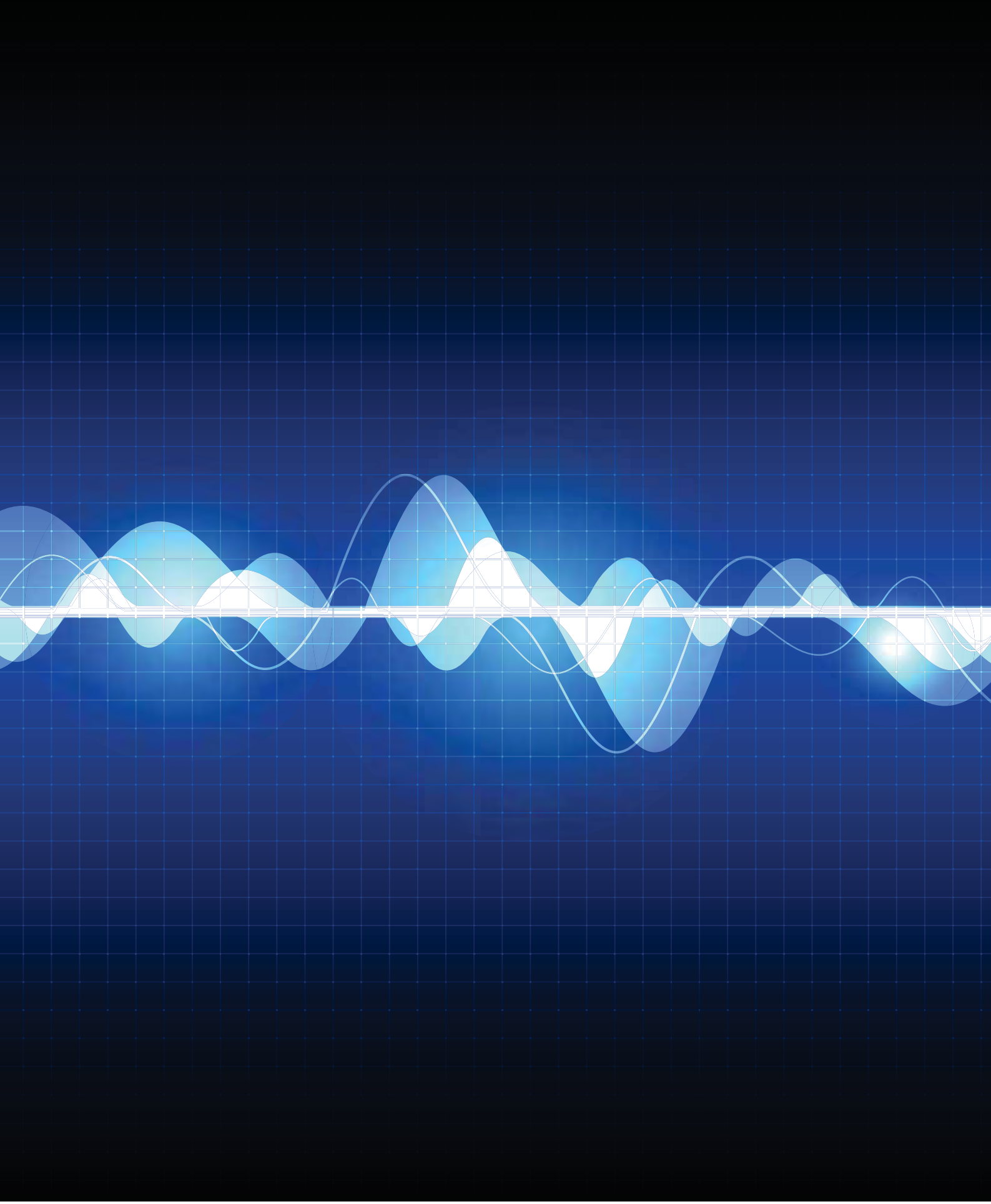


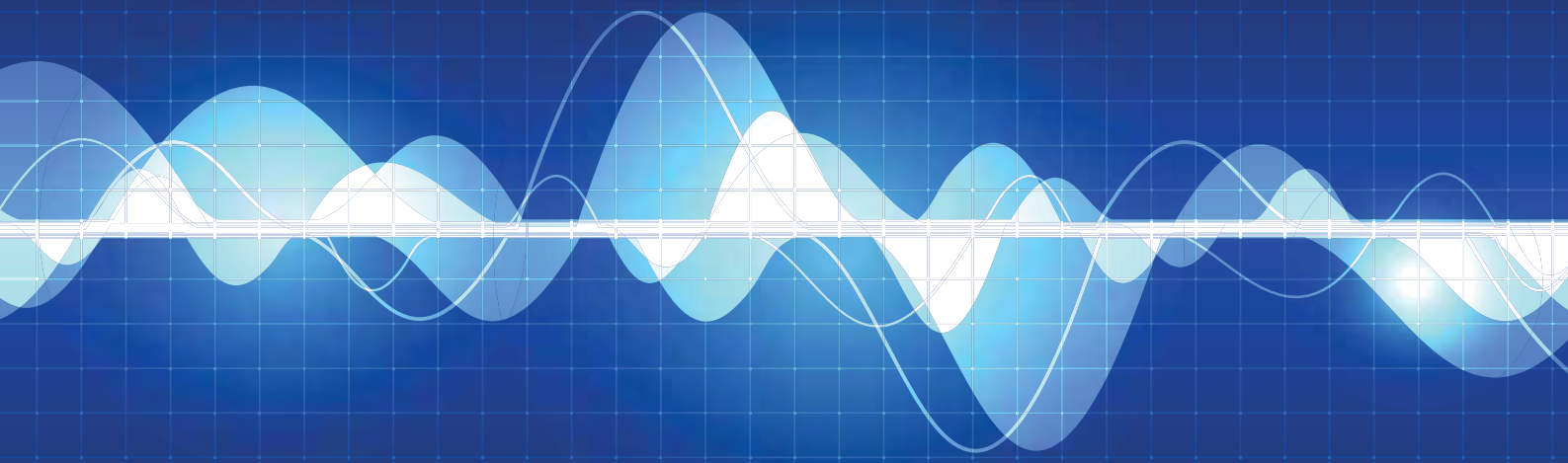
Appendix L

Monthly attended noise monitoring report - December 2019

Ashton Coal

Monthly attended noise monitoring
December 2019

Prepared for Ashton Coal Operations Pty Ltd
December 2019



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Monthly attended noise monitoring - December 2019

Prepared for Ashton Coal Operations Pty Ltd
December 2019

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Ashton Coal

Monthly attended noise monitoring - December 2019

Report Number

H190081 RP11

Client

Ashton Coal Operations Pty Ltd

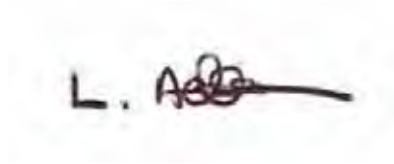
Date

12 December 2019

Version

v1-0 Final

Prepared by



Lucas Adamson
Acoustic Consultant
12 December 2019

Approved by

Katie Teyhan
Associate
12 December 2019

This report has been prepared in accordance with the brief provided by the client and has relied upon the information collected at the time and under the conditions specified in the report. All findings, conclusions or recommendations contained in the report are based on the aforementioned circumstances. The report is for the use of the client and no responsibility will be taken for its use by other parties. The client may, at its discretion, use the report to inform regulators and the public.

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Table of Contents

Appendices

Tables

Figures

1 Introduction

EMM Consulting Pty Limited (EMM) was engaged to complete monthly attended noise surveys on behalf of Ashton Coal Operations Pty Ltd (Ashton Coal).

The purpose of the monitoring was to address requirements of the approved Ashton Coal Noise Management Plan (NMP), prepared to satisfy the requirements of the Development Consent DA 309-11-2001-I (DC) and Environment Protection License (EPL) 11879.

This report presents the results and findings of attended noise monitoring conducted on 5 December 2019.

The following material was referenced as part of this assessment:

- Department of Planning, Industry and Environment (DPIE), Development Consent 309-11-2001-I, as modified on 20 June 2016 (current as of 5 December 2019);
- Environment Protection Authority (EPA), Environment Protection License 11879, as varied on 21 November 2019 (current as of 5 December 2019);
- Ashton Coal Project Noise Management Plan (NMP), approved by DPIE on 10 October 2017 (current as of 5 December 2019);
- NSW EPA, Industrial Noise Policy (INP), 2000;
- NSW EPA, Industrial Noise Policy Application notes, 2017; and
- NSW EPA, Noise Policy for Industry (NPfI), 2017.

2 Glossary of acoustic terms

Several technical terms are discussed in this report. These are explained in Table 2.1.

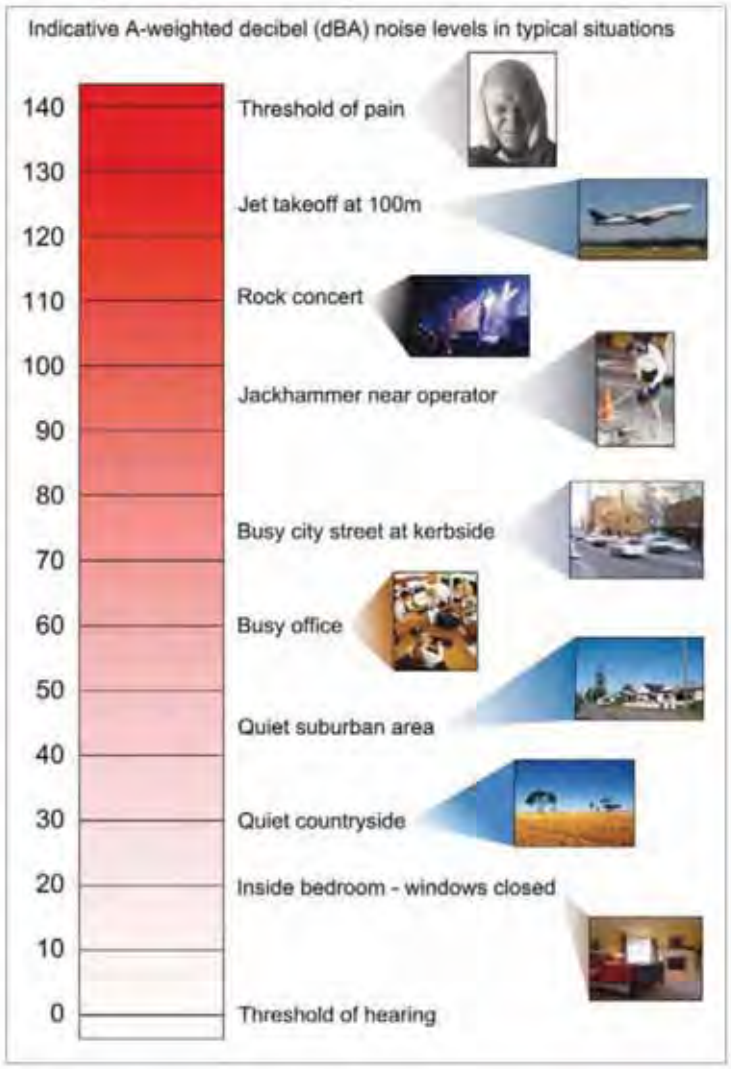
Table 2.1 Glossary of acoustic terms

Term	Description
dB	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.
L_{A1}	The 'A-weighted' noise level which is exceeded 1% of the time.
$L_{A1,1\ minute}$	The 'A-weighted' noise level exceeded for 1% of the specified time period of 1 minute.
L_{A10}	The 'A-weighted' noise level which is exceeded 10% of the time. It is approximately equivalent to the average of maximum noise level.
L_{A90}	Commonly referred to as the background noise level. The 'A-weighted' noise level exceeded 90% of the time.
L_{Aeq}	The energy average noise from a source. This is the equivalent continuous 'A-weighted' sound pressure level over a given period. The $L_{Aeq,15\ minute}$ descriptor refers to an L_{Aeq} noise level measured over a 15-minute period.
L_{Amin}	The minimum 'A-weighted' noise level received during a measuring interval.
L_{Amax}	The maximum root mean squared 'A-weighted' sound pressure level (or maximum noise level) received during a measuring interval.
L_{Ceq}	The equivalent continuous 'C-weighted' sound pressure level over a given period. The $L_{Ceq,15\ minute}$ descriptor refers to an L_{Ceq} noise level measured over a 15 minute period. C-weighting can be used to measure low frequency noise.
Day period	Monday – Saturday: 7 am to 6 pm, on Sundays and Public Holidays: 8 am to 6 pm.
Evening period	Monday – Saturday: 6 pm to 10 pm, on Sundays and Public Holidays: 6 pm to 10 pm.
Night period	Monday – Saturday: 10 pm to 7 am, on Sundays and Public Holidays: 10 pm to 8 am.
Temperature inversion	A meteorological condition where the atmospheric temperature increases with altitude.

It is useful to have an appreciation of decibels (dB), the unit of noise measurement. Table 2.2 gives an indication as to what an average person perceives about changes in noise levels. Examples of common noise levels are provided in Figure 2.1.

Table 2.2 Perceived change in noise

Change in sound pressure level (dB)	Perceived change in noise in surrounding environment
up to 2	not perceptible
3	just perceptible
5	noticeable difference
10	twice (or half) as loud
15	large change
20	four times (or quarter) as loud



Source: Road Noise Policy (Department of Environment, Climate Change and Water 2011)

Figure 2.1 Common noise levels

3 Noise limits

3.1 Operational and sleep disturbance noise limits

Ashton Coal noise limits are provided in Table 1, Condition 2 of Appendix 6 of the DC and Condition L4.1 of the EPL. Extracts of the relevant sections of the DC and EPL pertaining to noise are provided in Appendix A and B, respectively. The approved NMP adopts three attended noise monitoring locations that are representative of residences outlined in the DC. The noise monitoring locations and relevant criteria are summarised in Table 3.1.

Table 3.1 Noise impact assessment criteria

Monitoring location	Day $L_{Aeq,15\ minute}$, dB	Evening $L_{Aeq,15\ minute}$, dB	Night $L_{Aeq,15\ minute}$, dB	Night $L_{A1,1\ minute}$, dB
N2	38	38	36	46
N3	38	38	36	46
N4	38	38	36	46

The DC and the EPL specify the following meteorological conditions under which noise limits do not apply:

- during periods of rain or hail;
- average wind speed at microphone height exceeds 5 m/s;
- wind speeds greater than 3 m/s at 10 metres above ground level; and
- temperature inversion conditions greater than 3°C/100m.

For this assessment, the recorded L_{Amax} has been used as a conservative estimate of the $L_{A1,1\ minute}$. The INP application notes state that the EPA accepts sleep disturbance analysis based on either the $L_{A1,1\ minute}$ or L_{Amax} metrics (EPA 2013), with use of L_{Amax} resulting in a more conservative assessment.

The DC and EPL state that modification factor corrections in the application notes to the INP (2017) shall be applied to the measured mine noise levels where applicable. The application notes to the INP state that Fact Sheet C of the NPfI (EPA 2017) now applies regarding the application of modifying factors.

3.2 Cumulative noise criteria

Ashton Coal cumulative noise limits are provided in Condition 5 and Condition 6 of Schedule 3 of the DC. An extract of the conditions relevant to cumulative noise criteria is provided here.

> 5. The Applicant must implement all reasonable and feasible measures to ensure that the noise generated by the Ashton Mine Complex combined with the noise generated by other mines in the vicinity does not exceed the criteria in Table 4 at any residence on any privately-owned land or on more than 25 per cent of any privately-owned land (except for the noise affected residential receivers in Table 1).

Table 4: Cumulative Noise Criteria dB(A) $L_{Aeq\ (period)}$

Location	Day	Evening	Night
Camberwell Village	55	45	40
All other privately-owned land	50	45	40

> Cumulative noise is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.

> 6. If the cumulative noise generated by the Ashton Mine Complex combined with the noise generated by other coal mines in the vicinity exceeds the criteria in Table 5 at any residence on privately-owned land or more than 25 per cent of any privately-owned land (except for the noise-affected residential receivers ion Table 1), then upon receiving a written request from the landowner, the Applicant must, together with the relevant mines, acquire the land on as equitable basis as possible, in accordance with the procedures in conditions 7 and 8 of schedule 4.

Table 5: Cumulative Noise Acquisition Criteria dB(A) $L_{Aeq\ (period)}$

Location	Day	Evening	Night
Camberwell Village	60	50	45
All other privately-owned land	55	50	45

> Cumulative noise is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.

3.3 Low frequency noise criteria

Condition 3 of Appendix 8 of the DC states that noise generated by Ashton Coal is to be measured in accordance with the relevant requirements of the INP. The INP application notes state that Section 4 of the INP has been withdrawn and the modifying factor adjustments outlined in Fact Sheet C of the NPfI are to be used when assessing the characteristics of a noise source.

Fact sheet C of the NPfI (EPA 2017) provides guidelines for applying modifying factor corrections to account for low frequency noise emissions. The NPfI specifies that a difference of 15 dB or more between site 'C-weighted' and site 'A-weighted' noise emission levels identifies the potential for an unbalanced spectrum and potential increased annoyance.

Where a difference of 15 dB or more between site 'C-weighted' and site 'A-weighted' noise emission levels is identified, the one-third octave noise levels recorded should be compared to the values in Table C2 of the NPfI (EPA 2017), which has been reproduced in Table 3.2 below.

Table 3.2 One-third octave low-frequency noise thresholds

	One-third octave $L_{Zeq,15\ minute}$ 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

The following modifying factor correction is to be applied where the site 'C-weighted' and site 'A-weighted' noise emission level is 15 dB or more and:

- where any of the one-third octave noise levels in Table 3.2 are exceeded by up to and including 5 dB and cannot be mitigated, a 2 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period; or

- where any of the one-third octave noise levels in Table 3.2 are exceeded by more than 5 dB and cannot be mitigated, a 5 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period.

Hence, where relevant throughout each survey the operator has estimated the difference between site 'C-weighted' and site 'A-weighted' noise emission levels by matching audible sounds with the response of the analyser (L_{Ceq}-L_{Aeq}). Where this was deemed to be 15 dB or greater, the measured one-third octave frequencies have been compared to the values in Table 3.2 to identify the relevant modifying factor correction (if applicable). This method has been applied to this assessment as presented in Section 5.

It is of note that the NPfI (EPA 2017) states that low-frequency noise corrections only apply under the standard or noise-enhancing (i.e. applicable) meteorological conditions.

4 Assessment methodology

4.1 Attended noise monitoring

To quantify noise emissions from Ashton Coal, 15-minute attended noise monitoring surveys were completed at representative locations as per the approved NMP. Noise monitoring locations and their coordinates are listed in Table 4.1 and are shown in Figure 4.1.

Table 4.1 Attended noise monitoring locations

Monitoring location	Description	MGA56	
		Easting	Northing
N2	Camberwell Village (west)	320297	6405670
N3	Camberwell Village (north east)	320554	6405839
N4	South of New England Highway	319776	6404101

Attended noise monitoring is scheduled to be "unannounced" and, to EMM's knowledge, Ashton Coal were not aware of the monitoring prior to its commencing. Noise monitoring is avoided during any scheduled downtime or major maintenance. Information provided by Ashton Coal after the noise monitoring was completed confirmed that regular operations were occurring during the monitoring period.

Where possible throughout each survey, the operator has quantified the contribution of each significant noise source. This was done by matching audible sounds with the response of the analyser (where applicable) and/or via post-analysis of data (e.g. low pass filtering).

4.2 Instrumentation

A Brüel & Kjær 2250 Type 1 sound analyser (s/n 2759405) was used to conduct 15-minute attended measurements and record 1/3 octave frequency and statistical noise indices. The sound analyser was calibrated before and on completion of the survey using a Brüel & Kjær type 4230 calibrator (s/n 1276091). The instrumentation's calibration certificates are provided in Appendix C.

Source: EMM (2019); DFSI (2017); GA (2011)

0 1 2 km

GDA 1994 MGA Zone 56

N

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KEY

- Site boundary
- Noise monitoring location
- Meteorological station
- Rail line
- Main road
- Local road
- Watercourse/drainage line
- Cadastral boundary

Noise monitoring locations and Ashton colliery boundary

Ashton Coal
Monthly attended noise monitoring
Figure 4.1

EMM
creating opportunities

4.3 Attended noise monitoring exceedance procedure

Ashton Coal has developed an attended monitoring exceedance procedure that is to be implemented if measurements show Ashton Coal noise emissions are above the relevant noise criteria. This response plan is implemented if site noise levels are determined to be above the relevant noise criteria and when noise limits are applicable due to suitable meteorological conditions. The following noise management initiatives are implemented:

- Consultant will record the reading and advise Ashton Coal of the exceedance. Ashton Coal will implement remedial action as required.
- A follow up measurement is to be conducted (within 75 minutes after the first measurement and no earlier than 10 pm).
- If the follow up measurement indicates that site noise levels are above the relevant noise criteria and that noise limits are applicable, the consultant will record the result, note the site has failed and is deemed a 'noise affected night' at that location. An additional monitoring test should be scheduled to be undertaken at the same location within one week and move on to the next monitoring location.
- If the follow up measurement indicates that site noise levels are below the relevant noise criteria and that noise limits are applicable, the consultant will record the result, note the site has passed, schedule an additional monitoring test to be undertaken at the location within one week and move on to the next monitoring location.

4.4 Determination of stability category

As per Condition L4.4, this assessment determined the stability categories throughout the attended monitoring period using the direct measurement method as per Appendix E2 of the INP (EPA 2000).

The temperature lapse rate between the two weather stations (M1 – Sentinex Unit 40 located in Camberwell Village and M2 – Ashton Coal 'repeater' meteorological station located in the north eastern open cut (NEOC) area) was calculated using the following formula:

$$\text{Temperature lapse rate} = (\Delta T) \times (100/(\Delta H))$$

Where:

- ΔT = temperature measured at M2 (at 10 metres above ground level) minus temperature measured at M1 (at 10 metres above ground level); and
- ΔH = the vertical height difference between M2 and M1 (equal to 73 metres).

Table E5 of the INP (EPA 2000) is reproduced in Table 4.2 and presents the stability categories and associated ranges in temperature lapse rates.

Table 4.2 Stability categories and temperature lapse rates

Stability category	Temperature lapse rate (ΔT) (°C/100 m)
A	$\Delta T < -1.9$
B	$-1.9 \leq \Delta T < -1.7$
C	$-1.7 \leq \Delta T < -1.5$
D	$-1.5 \leq \Delta T < -0.5$
E	$-0.5 \leq \Delta T < 1.5$
F	$1.5 \leq \Delta T < 4.0$
G	$\Delta T \geq 4.0$

Source: INP (EPA 2000).

Other meteorological data, such as wind speed, has been sourced directly from meteorological station M2 since it is more representative of the weather conditions nearer to the noise sources.

5 Review of data and discussion

5.1 Summary

Results of attended noise measurements are summarised in Table 5.1. Ashton Coal contribution and total mine noise were determined for each survey using in-field observations and post-analysis of data as required (e.g. removing higher frequencies that are not mine related i.e. above 630 Hz). Attended monitoring was completed on 5 December 2019.

The meteorological data for the monitoring period was sourced from Ashton Coal's two weather stations (M1 and M2) to determine applicability of criteria in accordance with the DC and EPL. Noise limits were found to be applicable during all three measurements.

Low frequency noise was conservatively assessed by comparison of the total measured one-third octave L_{Aeq} noise levels to the NPfI one-third octave low-frequency noise thresholds. Measured noise levels did not exceed the relevant LFN thresholds during any of the measurements where Ashton Coal was audible. Therefore, in accordance with the NPfI, LFN modifying factors were found to be not relevant and hence were not applied to estimated site noise levels at any of the locations.

At all locations where site noise was audible, Ashton Coal noise contributions and cumulative mine noise contributions were below (i.e. complied with) the relevant noise limits, had they applied.

Table 5.1 Ashton Coal attended noise monitoring results – December 2019

Location	Date	Start time	Total noise levels, dB							Site contributions, dB			Noise limits, dB		Meteorological conditions[3] limits apply (Y/N)	Exceedance, dB	Comments
			L_{Amin}	L_{A90}	L_{Aeq}	L_{A10}	L_{A1}	L_{Amax}	L_{Ceq}	LFN mod. factor[1]	L_{Aeq}	L_{Amax}[2]	L_{Aeq}	L_{Amax}[2]			
N2	5/12	22:00	38	42	49	53	57	60	59	Nil	≤36	42	36	46	2.2 m/s @ 247° E class stability 1.2°C/100m VTG Y	Nil	**Ashton Coal hum consistently audible with engine revs on occasion.** Insects, traffic on the New England Highway and another mine in the vicinity consistently audible. Bat noise and distant dogs barking occasionally audible.
N3	5/12	22:17	36	39	43	45	50	61	58	Nil	≤35	38	36	46	2.1 m/s @ 257° F class stability 2.2°C/100m VTG Y	Nil	**Ashton Coal hum consistently audible with engine revs on occasion.** Insects, traffic on the New England Highway and another mine in the vicinity consistently audible. Dogs barking, nearby animals and a train on the main line (unrelated to Ashton Coal) occasionally audible.
N4	5/12	22:39	25	27	34	36	42	61	51	Nil	≤23	23	36	46	2.6 m/s @ 280° F class stability 2.6°C/100m VTG Y	Nil	**Ashton Coal hum consistently audible.** Other mines in the vicinity consistently audible. Traffic on the New England Highway and bird noise frequently audible.

Notes:
1. Modifying factor correction for low frequency noise in accordance with Fact Sheet C of the NPfI (refer Section 3.3).
2. For assessment purposes the L_{Amax} and the $L_{A1,1\ minute}$ are interchangeable.
3. Meteorological data were taken as an average over 15 minutes from the Ashton Coal weather station (Refer to Section 5.1). VTG assumes the temperature sensors on the two weather stations are in proper working order and calibrated to manufacturers requirements.
4. IA = inaudible.
5. N/A = not applicable.

5.2 N2 - Camberwell Village (west)

Ashton Coal operations were audible during the entire operator-attended noise survey including consistent mine hum, with engine revs on occasion. The Ashton Coal mine noise contribution was estimated at up to ≤36 dB $L_{Aeq,15\ minute}$. Engine revs from site generated an estimated 42 dB L_{Amax}. Ashton Coal noise contributions complied with the DC and EPL noise limits. Other ambient noise sources included another mine in the vicinity, traffic on the New England Highway, insects, bat noise and distant dogs barking.

Mining operations in the vicinity were consistently audible during the operator-attended noise survey at monitoring location N2. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ 35 dB ($L_{Aeq,15\ minute}$ 38 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

5.3 N3 - Camberwell Village (north east)

Ashton Coal operations were audible during the entire operator-attended noise survey including consistent mine hum, with engine revs on occasion. The Ashton Coal mine noise contribution was estimated at up to ≤35 dB $L_{Aeq,15\ minute}$. Engine revs from site generated an estimated 38 dB L_{Amax}. Ashton Coal noise contributions complied with the DC and EPL noise limits. Other ambient noise sources included another mine in the vicinity, traffic on the New England Highway, insects, dogs barking, nearby animals and a train on the main line (unrelated to Ashton Coal).

Mining operations in the vicinity were consistently audible during the operator-attended noise survey at monitoring location N3. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ 35 dB ($L_{Aeq,15\ minute}$ 38 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

5.4 N4 - South of New England Highway

Ashton Coal operations were audible during the entire operator-attended noise survey including consistent mine hum. The Ashton Coal mine noise contribution was estimated at up to ≤23 dB $L_{Aeq,15\ minute}$. Mine hum from site generated an estimated 23 dB L_{Amax}. Ashton Coal noise contributions complied with the DC and EPL noise limits. Other ambient noise sources included other mines in the vicinity, traffic on the New England Highway and bird noise.

Mining operations in the vicinity were consistently audible during the operator-attended noise survey at monitoring location N4. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ 23 dB ($L_{Aeq,15\ minute}$ 26 dB - 3 dB as per NPfI methodology) which is below the cumulative mine noise night-time criterion (i.e. $L_{Aeq,night}$ 40 dB). Therefore, the total cumulative mine $L_{Aeq,night}$ noise contribution was below the cumulative mine noise criterion.

6 Conclusion

EMM has completed a review of mine noise from Ashton Coal within the surrounding community based on attended measurements conducted on 7 November 2019.

The applicability of noise limits was assessed with reference to Ashton Coal's two meteorological stations (M1 and M2) located to the east of the site. Noise limits were found to be applicable during all three measurements.

The assessment of noise contributions from site included consideration of modifying factors for noise characteristics where relevant and in accordance with the INP.

Ashton Coal noise contributions and cumulative mine noise contributions were at or below (satisfied) the relevant noise limits at all monitoring locations for this round of monitoring.

References

Ashton Coal Noise Management Plan, 2017.

NSW Department of Planning, Industry and Environment, Development Consent DA309-11-2001-I, 2016.

NSW Environment Protection Authority, Environment Protection License 11879.

NSW Environment Protection Authority, Industrial Noise Policy, 2000.

NSW Environment Protection Authority, Industrial Noise Policy Application notes, 2017.

NSW Environment Protection Authority, Noise Policy for Industry, 2017.

Appendix A

Project approval extract

APPENDIX 6
ALTERNATE NOISE CONDITIONS

NOISE

Application

1. Conditions 2 to 3 below have effect during times when open cut mining operations are not being undertaken at the Ashton Mine Complex, in the opinion of the Secretary.

Noise Criteria

2. Except for the noise-affected land in Table 1 of Schedule 3, the Applicant must ensure that the noise generated by the development does not exceed the criteria in Table 1 at any residence on privately-owned land or on more than 25 per cent of any privately-owned land.

Table 1: Noise Criteria dB(A)

Receiver No.	Receiver	Day ($L_{Aeq\ (15min)}$)	Evening ($L_{Aeq\ (15min)}$)	Night ($L_{Aeq\ (15min)}$)	Night ($L_{A1\ (1\ min)}$)
-	All privately-owned land	38	38	36	46

Noise generated by the development is to be measured in accordance with the relevant requirements of the *NSW Industrial Noise Policy*. Appendix 3 sets out the requirements for evaluating compliance with these criteria.

However, these noise criteria do not apply if the Applicant has an agreement with the relevant owner/s of the residence/land to generate higher noise levels, and the Applicant has advised the Department in writing of the terms of this agreement.

Additional Noise Mitigation Measures

3. Upon receiving a written request from the owner of any residence on any privately-owned land where subsequent operational noise monitoring shows the noise generated by the development exceeds the noise limits in Table 2, the Applicant must implement additional reasonable and feasible noise mitigation measures (such as double glazing, insulation, and/or air conditioning) at the residence in consultation with the owner.

If within 3 months of receiving this request from the landowner, the Applicant and the landowner cannot agree on the measures to be implemented, or there is a dispute about the implementation of these measures, then either party may refer the matter to the Secretary for resolution.

Table 2: Additional Noise Mitigation Criteria dB(A) $L_{Aeq\ (15min)}$

Receiver No.	Receiver	Day ($L_{Aeq\ (15min)}$)	Evening ($L_{Aeq\ (15min)}$)	Night ($L_{Aeq\ (15min)}$)
-	All privately-owned land	38	38	38

Notes:

- *Noise generated by the development is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy. Appendix 8 sets out the requirements for evaluating compliance with these criteria.*
- *For this condition to apply, the exceedance of the criteria must be systemic.*

APPENDIX 8
NOISE COMPLIANCE ASSESSMENT

Compliance Monitoring

1. Attended monitoring is to be used to evaluate compliance with the relevant conditions of this approval.

2. Data collected for the purposes of determining compliance with the relevant conditions of this approval is to be excluded under the following meteorological conditions:
   a) during periods of rain or hail;
   b) average wind speed at microphone height exceeds 5 m/s;
   c) wind speeds greater than 3 m/s measures at 10 m above ground level; and
   d) temperature inversion conditions greater than 3°C/100m.

3. Unless otherwise agreed with the Secretary, this monitoring is to be carried out in accordance with the relevant requirements relating for reviewing performance set out in the NSW Industrial Noise Policy (as amended from time to time), in particular the requirements relating to:
   a) monitoring locations for the collection of representative noise data;
   b) equipment used to collect noise data, and conformity with Australian Standards relevant to such equipment; and
   c) modifications to noise data collected, including for the exclusion of extraneous noise and/or penalties for modifying factors apart from adjustments for duration.

4. To the extent that there is any inconsistency between the Industrial Noise Policy and the requirements set out in this Appendix, the Appendix prevails to the extent of the inconsistency.

Determination of Meteorological Conditions

5. Except for wind speed at microphone height, the data to be used for determining meteorological conditions shall be that recorded by the meteorological station located in the vicinity of the site (as required by condition 18 of Schedule 3).

Appendix B

EPL extract

Environment Protection Licence

Licence - 11879

L3 Waste

L3.1 The licensee must not cause, permit or allow any waste to be received at the premises unless specified in this licence.

L4 Noise limits

L4.1 Noise from the premises must not exceed the noise limits specified in the table below.

Residences referenced in this table are from the consent DA 309-11-2001-i and summarised in the EPA reference DOC19/761196.

Location	Day LAeq(15 minute)	Evening LAeq(15 minute)	Night LAeq(15 minute)	Night LAeq(1 minute)
EPA Point 13	38	38	36	46
EPA Point 14	38	38	36	46
EPA Point 15	38	38	36	46
All other privately owned residences	38	38	36	46

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, and
c) Night is defined as the period from 10pm to 7am Monday to Saturday and 10pm to 8am Sundays and Public Holidays

L4.3 The noise emission limits identified in condition L4.1 apply under the following meteorological conditions:

a) wind speeds up to 3m/s at 10m above ground level; and
b) temperature inversion conditions up to 3 degrees C/100m.

L4.4 For the purposes of condition L4.1:

a) Data recorded by the closest and most representative meteorological station installed on the premises at EPA Identification Point 12 must be used to determine meteorological conditions; and
b) Temperature inversion conditions (stability category) are to be determined by the methods referred to in Fact Sheet D of the Noise Policy for Industry (2017) using EPA Identification Points 32 and 33.

4 Operating Conditions

O1 Activities must be carried out in a competent manner

O1.1 Licensed activities must be carried out in a competent manner.

Appendix C

Calibration certificates

CERTIFICATE OF CALIBRATION

CERTIFICATE NO: 24152

EQUIPMENT TESTED: Sound Level Calibrator

Manufacturer: B & K
Type No: 4230 **Serial No:** 1276091
Owner: EMM Consulting
Level 1, 146 Hunter Street
Newcastle, NSW 2300

Tests Performed: Measured output pressure level was found to be:

Parameter	Pre-Adj	Adj Y/N	Output: (db re 20 µPa)	Frequency: (Hz)	THD&N (%)
Level 1:	NA	N	93.81	989.84	1.58
Level 2:	NA	N	NA	NA	NA
Uncertainty:			±0.11 dB	±0.05%	±0.20 %
Uncertainty (at 95% c.l.) k=2					

CONDITION OF TEST:
Ambient Pressure: 1004 hPa ±1.5 hPa **Relative Humidity:** 47% ±5%
Temperature: 20 °C ±2° C
Date of Calibration: 14/02/2019 **Issue Date:** 15/02/2019
Acu-Vib Test Procedure: AVP02 (Calibrators)
Test Method: AS IEC 60942 - 2017
CHECKED BY: ..... **AUTHORISED SIGNATURE:** .....
Jack Kidt

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.
The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

NATA
ACCREDITATION
Accredited Lab. 9262
Acoustic and Vibration Measurements

ACU-VIB
ELECTRONICS
HEAD OFFICE
Unit 14, 22 Hudson Ave. Castle Hill NSW 2154
Tel: (02) 96808133 Fax: (02)96808233
Mobile: 0413 809806
Web site: www.acu-vib.com.au

CERTIFICATE OF CALIBRATION

CERTIFICATE NO.: **SLM 22129 & FILT 4384**

Equipment Description:	Sound Level Meter		
Manufacturer:	B & K		
Model No:	2250	**Serial No:**	2759405
Microphone Type:	4189	**Serial No:**	2888134
Filter Type:	1/3 Octave	**Serial No:**	2759405
Comments:	All tests passed for class 1. (See over for details)		
Owner:	EMGA Mitchell Mclennan Ground Floor, Suite 01, 20 Chandos St St Leonards NSW 2065		
Ambient Pressure:	1008 hPa ±1.5 hPa		
Temperature:	25 °C ±2° C	**Relative Humidity:**	48% ±5%
Date of Calibration:	07/02/2018	**Issue Date:**	09/02/2018

Acu-Vib Test Procedure: AVP10 (SLM) & AVP06 (Filters)

CHECKED BY: ..... **AUTHORISED SIGNATURE:** .....

Jack Kott

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.

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ACCREDITATION

Accredited Lab. No. 9262
Acoustic and Vibration Measurements

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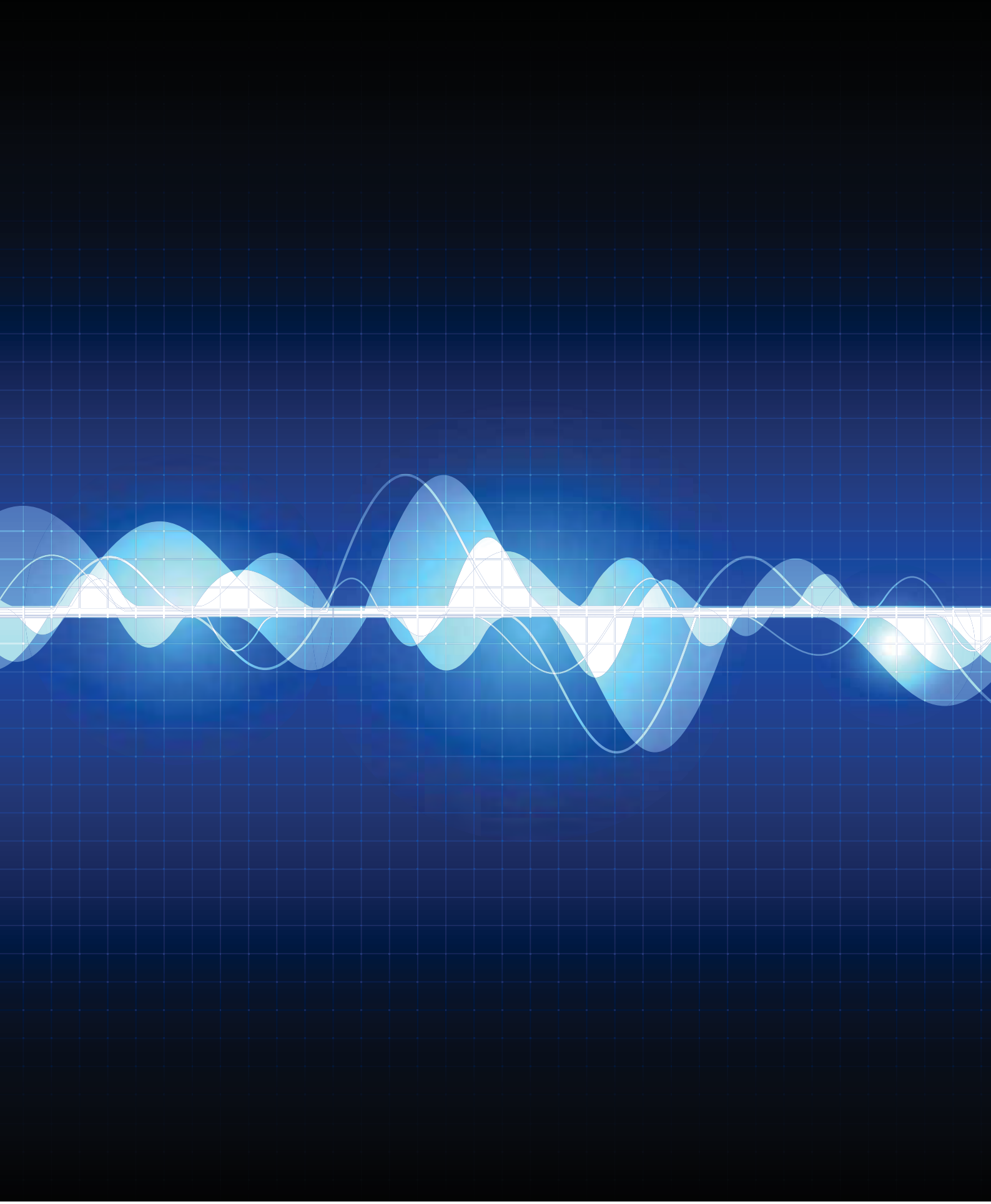

Appendix 2

Annual Groundwater Monitoring Review 2019

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Australasian Groundwater and
Environmental Consultants Pty Ltd

Report on

Yancoal - Ashton Coal Annual Groundwater Monitoring Review 2019

Prepared for
Yancoal Australia Limited

Project No. G1922H March 2020
www.ageconsultants.com.au 64 080 238 642

Document details and history

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Report on

Yancoal – Ashton Coal
Annual Groundwater Monitoring Review 2019

1 Introduction

The Ashton Coal Project (ACP) is located 14 km north-west of Singleton in the Hunter Valley region of New South Wales (NSW) (Figure 1.1). The ACP consists of decommissioned open cut and active underground mining to access a series of coal seams within the Permian Foybrook Formation. Ashton Coal Operations Ltd (ACOL) is wholly owned and operated by Yancoal Australia Limited (Yancoal).

Between 2003 and 2011, coal was recovered from eleven seams of varying thickness, down to and including the Lower Barrett Seam (LB), from an open cut mine known as the North-East Open Cut (NEOC). Between 2007 and 2016, underground longwall (LW) mining extracted coal from the Pike's Gully Seam (PG), the Upper Liddell (ULD) and the Upper Lower Liddell Seams (ULLD). Mining in longwall panel LW202 within the ULLD extracted coal between June 2018 and August 2019. Works on longwall panel LW203 within the ULLD began in October 2019.

The underground mine is located south of the New England Highway and includes a diversion of Bowmans Creek via two excavated and lined channels. The channels have re-routed Bowmans Creek to areas located above abandoned longwall panels.

1.1 Objective

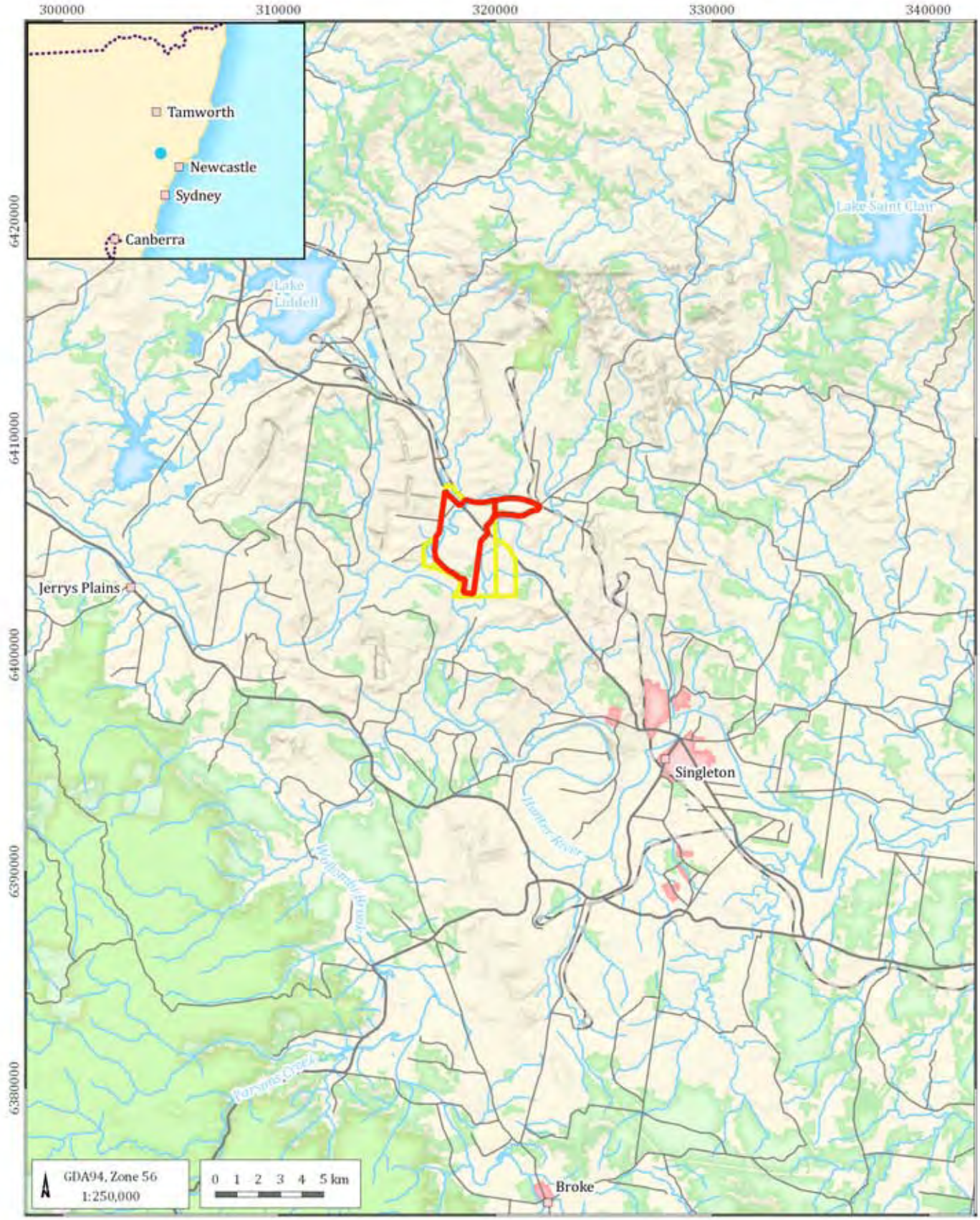
The ACOL development consent (DA 309-11-2001-i – 11 February 2002; last modified June 2016), requires that groundwater be monitored for potential impacts from mining. In 2018, the Department of Planning and Environment (DPE) approved the current water management plan (WMP; Ashton document HSEC Management System Plan Doc. No. 3.4.1.8 version 10, dated 01 March 2018). The WMP outlines the groundwater monitoring program and establishes trigger values for groundwater levels and quality in the various groundwater systems located within the ACP site.

This report summarises the monthly data collected by Australasian Groundwater and Environmental Consultants Pty Ltd (AGE) from January 2019 to December 2019. The aim of this report is to provide a consolidated summary of groundwater conditions at ACP throughout 2019.

1.2 Scope

The scope undertaken to achieve the objectives includes:

- review and assess rainfall, groundwater levels, pH, electrical conductivity (EC) and water chemistry data from groundwater monitoring campaigns;
- comparison of groundwater monitoring results against WMP triggers;
- notify ACOL of exceedances which require the enactment of the WMP groundwater response plan; and
- make recommendations regarding the groundwater monitoring network and program, where necessary, to ensure ongoing quality control/assurance of groundwater monitoring.



LEGEND

- Ashton mining lease
- Ashton exploration lease
- Study area location
- Populated place
- Built up area
- Major road
- Minor road
- Rail
- Watercourse
- Water area
- Reserve
- Vegetation
- Land

Yancoal Ashton - AGMR 2019 (G1922H)

Study area location

AGE

DATE 07/01/2020

FIGURE No **1.1**

© 2020 Australasian Groundwater and Environmental Consultants Pty Ltd (AGE) - www.agecconsultants.com.au
N:\Groundwaterjobs\G1922H Yancoal Ashton Compliance reporting 2019\3_GIS\G1922H_Ashton_site location.qgs

2 Physical setting

The Ashton underground mine is located south of the New England Highway, bounded by the Hunter River to the south and two Hunter River tributaries – Glennies Creek and Bowmans Creek to the east and west, respectively (Figure 1.1). Underground operations intend extracting four coal seams; PG, ULD, ULLD and LB, via a longwall arrangement.

The underground workings (LW1 to LW8) extracted coal from the PG seam and underlying ULD seam (LW101 to LW108). Noteworthy, LW notation increases from east westward 1 to 8. Currently, longwall mining is taking place within LW203 of the ULLD seam (LW201 to LW208). LW203 is situated centrally within the mining lease (ML), with the Hunter River and the Hunter River alluvium to the south. The final LW panels within ULLD seams are located down dip of LW203, in the western portion of the ML.

2.1 Climate and rainfall

Climate monitoring data was collected by Ashton Weather Station and the Bureau of Meteorology (BOM) station at Bulga (South Wambo) (BOM station 061191), located about 19 km south-west of Ashton. Data was previously sourced from Singleton STP (BOM station 061937), which was decommissioned in February 2019. The Ashton Weather station has 14 years of rainfall data for the period 1 July 2005 to present, while the Bulga (South Wambo) station has 61 years of rainfall data dating from 1959 to 2019. A summary of average monthly rainfall from the Bulga (South Wambo) station and the Ashton Weather station for 2019 is presented in Table 2.1. Rainfall is highest throughout November to March; whereas the winter months are generally drier. The data presented in Table 2.1 shows that rainfall at Ashton in 2019 was only above average for two months of 2019 (January and March), and rainfall at the Bulga (South Wambo) station was only above average for one month (March).

Table 2.1 Average Monthly Rainfall 2019 – Ashton Coal and Bulga

Month	Ashton average monthly rainfall (mm)	% of long-term average	Bulga (South Wambo) average monthly rainfall (mm)	% of long-term average
Jan	62.3	107%	86.6	69%
Feb	73.1	43%	84.2	25%
Mar	86.2	280%	66.7	218%
Apr	57.1	16%	45.9	7%
May	33.1	59%	40.3	29%
Jun	71.1	29%	44.1	15%
Jul	23.4	29%	30.0	45%
Aug	30.9	96%	34.2	64%
Sep	40.3	100%	38.5	56%
Oct	42.3	4%	54.3	8%
Nov	74.8	29%	61.8	50%
Dec	59.5	0%	71.5	0%

An evapotranspiration (ET) rate of 765 mm/year was sourced from the Bureau of Meteorology (BOM)[1] database for the Camberwell area.

Long-term rainfall trends can be characterised using the Cumulative Rainfall Departure (CRD) method (Bredenkamp et al., 1995). CRD shows trends in rainfall relative to the long-term monthly average and provides a historical record of wetter and drier periods. A rising gradient in the CRD plot indicates periods of above average rainfall, while a declining slope indicates periods of below average rainfall. CRD has been used in this study to provide context to variations in groundwater levels and chemistry.

The CRD for Ashton weather station and Bulga (South Wambo) (BOM station 061191) are shown on Figure 2.1. CRD trends for both stations show below average rainfall for 2019 from March onwards, as represented by a declining CRD slope.

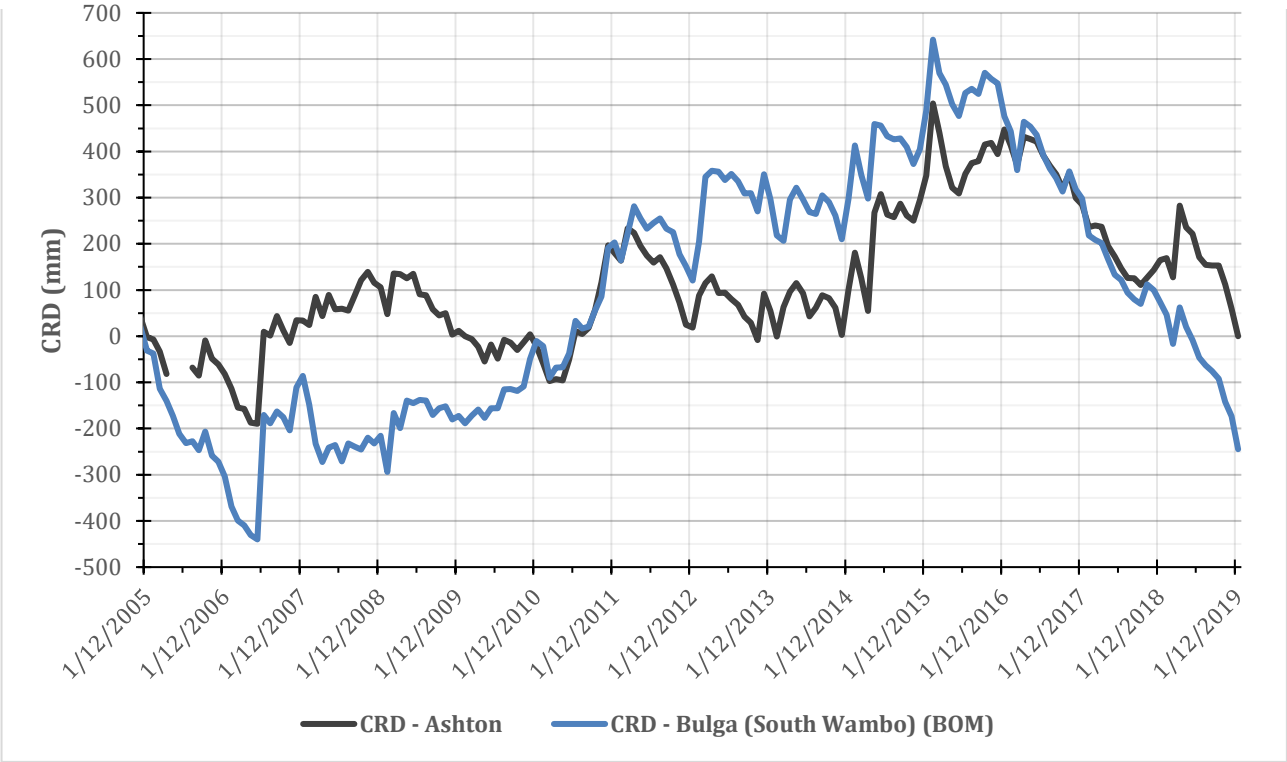


Figure 2.1 Cumulative Rainfall Departure – Ashton Coal and Bulga

[1] Bureau of Meteorology (2016). Average annual & monthly evapotranspiration. Available at: http://www.bom.gov.au/jsp/ncc/climate_averages/evapotranspiration/index.jsp

2.2 Surface water

The Ashton mine lease is bounded by Bowmans Creek to the west, Bettys Creek (tributary of Bowmans Creek) to the north, Glennies Creek to the east side and Hunter River to the south. Both Bowmans and Glennies Creeks are an affluent of the Hunter River. The three main water courses are described below:

- Hunter River is the main surface water body with a catchment area at Bowmans Creek of 13,590 km^2. The flow is regulated by Glenbawn Dam and by other licensed extractions and releases.
- Glennies Creek and its associated alluvium are located to the east of the underground workings and the PG sub-crop area. The catchment area is approximately 600 km^2. Up to half of the Glennies Creek catchment feeds into Lake St. Clair, located within the far north-eastern section of the catchment. Water from Lake St. Clair discharges into Glennies Creek under controlled release.
- Bowmans Creek natural channel is above the longwall panel LW6B/LW106B and its associated alluvium is over LW5 to LW8. It is the main water course over the underground workings area. Bowmans creek was diverted in two locations to minimise the impact of mining on both the creek and the potential inflows to the underground workings. The construction of the eastern diversion commenced in March 2011 and the western diversion commenced in February 2012. Both diversions were commissioned in November 2012 and are located within the Bowmans Creek Alluvium (BCA). The diversions were designed to replicate the natural creek setting in terms of channel cross-sectional variability in bed level and ecological features (i.e. resting pools). The diversions were lined with a geosynthetic clay liner to minimise leakage from the creek.
- Bowmans Creek flow is not regulated and is monitored according to the WMP. The streamflow gauging station no. 210130, regulated by WaterNSW, was installed in October 1993 and is used as a flow baseline for Bowmans creek with a catchment area of 240 km^2. This station is located in the middle section of the creek on the ML, upstream to the western diversion. Since August 2018, Bowmans Creek has been dry at the gauge.

2.3 Mining

The longwall panels accessing the ULLD (including active LW203) are generally offset 24 m to the east and 10 m south from the overlying ULD longwall panels. This offset is designed to reduce the resulting subsidence and associated impacts to the surrounding environment. That said, the northern extent of PG, ULD, ULLD longwalls, and the main gate road are aligned resulting in a "stacked edge" where subsidence impacts are slightly more noticeable at the surface than elsewhere.

The start and end dates of longwall panel mining at ACP are summarised in Table 2.2.

Table 2.2 Longwall panel schedule

Longwall panel	Target seam	Start date	End date
LW1	PG	12/03/2007	15/10/2007
LW2	PG	10/11/2007	21/07/2008
LW3	PG	20/08/2008	3/03/2009
LW4	PG	2/04/2009	15/10/2009
LW5	PG	4/01/2010	7/06/2010
LW6A	PG	9/07/2010	22/11/2010

Longwall panel	Target seam	Start date	End date
LW7A	PG	22/03/2011	8/08/2011
LW7B	PG	3/10/2011	17/01/2012
LW8	PG	27/02/2012	5/06/2012
LW101	ULD	31/07/2012	16/06/2013
LW6B	PG	14/07/2013	10/10/2013
LW102	ULD	10/11/2013	24/07/2014
LW103	ULD	21/08/2014	21/06/2015
LW104A	ULD	23/07/2015	16/01/2016
LW104B	ULD	3/02/2016	11/04/2016
LW105	ULD	17/05/2016	26/09/2016
LW106A	ULD	18/10/2016	31/05/2017
LW201	ULLD	7/07/2017	04/05/2018
LW202	ULLD	07/06/2018	20/08/2019
LW203	ULLD	08/10/2019	Present

2.4 Conceptual hydrogeology

2.4.1 Hydrostratigraphy

Ashton is located in the central Hunter Valley of NSW where the lower sequences of the Wittingham Coal Measures (Singleton Supergroup) subcrop (Figure 2.2). Within the Ashton mining lease, the Hebden seam to the Bayswater seam (inclusive) subcrop. The underground operation targets the PG, ULD, ULLD and the LB seams.

The Wittingham Coal Measures dip west south-west in the Ashton area, an orientation locally controlled by the Camberwell Anticline to the east of the mine and the Bayswater Syncline to the west. The top target coal seam at Ashton, the PG seam, subcrops under the Glennies Creek Alluvium (GCA) approximately 150 m east of the mine, while the lowest target coal seam, the LB seam, subcrops under regolith approximately 2 km to the east of the mine. In the western portion of the mining area, the overburden above the PG seam ranges in thickness between 100 m (north end of LW7) and 190 m (south end of LW7).

The stratigraphic sequence in the region comprises two distinct units: Quaternary alluvium and Permian strata. The Permian strata comprise coal seams (typically 2 m to 2.5 m thick) with overburden and interburden (typically 30 m thick between successive seams) consisting of sandstone, siltstone, tuffaceous mudstone, and conglomerate. The Quaternary alluvium consists of unconsolidated silt, sand and gravel in the alluvial floodplains of the Hunter River (HR), Bowmans Creek (BC) and Glennies Creek (GC). The alluvium unconformably overlies the Permian within the floodplains of the HR, BC and GC. Elsewhere, the Permian is overlain by a regolith comprising colluvium, eluvium and completely weathered rock, which interfaces with the floodplain alluvium at the flanks of the valleys.

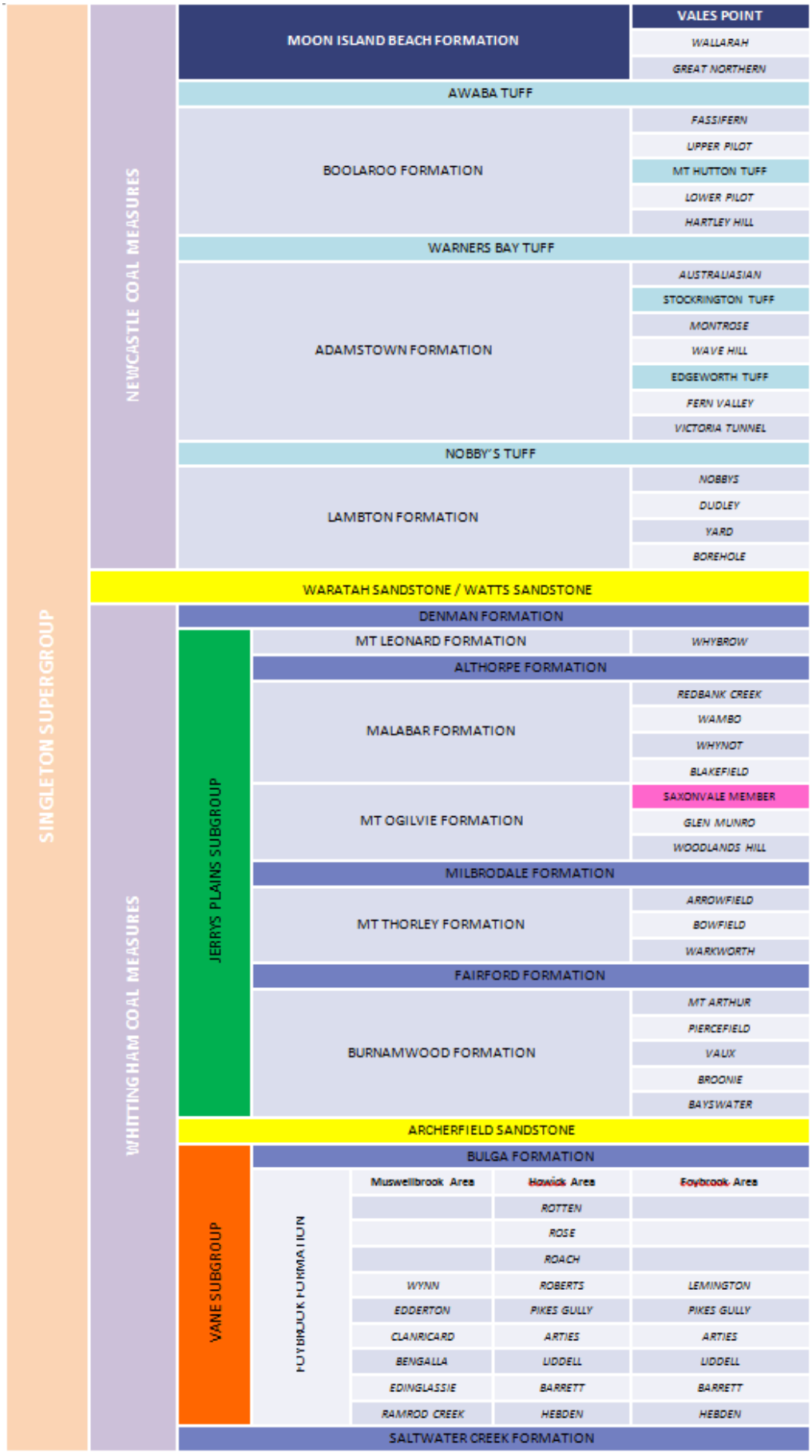


Figure 2.2 Singleton Super Group sequence stratigraphy (AGE, 2016)

2.4.1.1 Quaternary alluvium/Regolith

Ashton is overlain by Quaternary alluvium associated with the HR, BC and GC. The Bowmans Creek Alluvium (BCA) and Glennies Creek Alluvium (GCA) are in direct connection to the Hunter River alluvium (HRA). The Quaternary/recent aged alluvium/colluvium along the HR, GC and BC flood plains comprises two distinct depositional units; a surficial fine-grained sediment and a coarser basal material. The surficial alluvium comprises shallow sequences of clay, silty sand and sands. Along the minor drainage lines, the surficial alluvium is typically constrained within 500 m of the creeks and is between 7 m to 15 m thick.

Away from the floodplain areas, the Permian coal measures sequence is overlain by a layer of regolith, comprising colluvium/eluvium, and completely weathered rock that collectively have soil rather than rock properties and interface with the alluvium at the flanks of the floodplain areas. The regolith layer varies in thickness, though is typically 15 m to 20 m thick above rock.

2.4.1.2 Permian strata

The Wittingham Coal Measures comprise Permian aged coal seams interbedded with siltstone, sandstone, shales and conglomerates. The Wittingham Coal Measures are up to 400 m thick at Ashton, but regionally they range from approximately 250 m to 600 m thickness. At Ashton, the lower portion of the Wittingham Coal Measures is present on site. The profile extends from above the Bayswater seam to the Hebden seam (Figure 2.2).

Locally, the Wittingham Coal Measures are further divided to (AGE, 2016):

- four main target coal seams – PG, ULD, ULLD and the LB;
- a large number of coal seams and plies of varying thickness, including the Bayswater seam, up to 20 Lemington seam plies, the Arties seam, and a number of Liddell seam and Barrett seam plies that are not proposed to be mined in the Ashton underground mine; and
- interburden sediments comprising siltstone, sandstone, conglomerate and claystone.

Over 20 plies of the Lemington seam profile and the overlying Bayswater seam are present within the PG seam overburden. The largest Lemington seam plies are of similar thickness as the four target seams and may have similar hydraulic properties.

2.4.2 Recharge

Recharge is interpreted to occur from direct rainfall to the ground surface, infiltrating into the formations through the thin soil cover and regolith. The coal measures also occur at subcrop in localised zones beneath the HRA, GCA, and the BCA. In these areas, the Permian coal measures are interpreted to be recharged by downward seepage and then downdip flow along the most permeable strata in the sequence, primarily the coal seams (Aquaterra, 2009 and AGE, 2016).

The combined surface water catchment area potentially providing recharge to the Ashton area is significantly greater in size than the mine area itself. Ashton is located immediately adjacent the confluences of the Hunter River with Bowmans and Glennies Creeks. The Ashton surface and underground infrastructure is located entirely within the Bowmans and Glennies Creek catchments, which extend approximately 30 km and 45 km to the north of Ashton, respectively.

Bowmans and Glennies Creek have up to fourth order tributaries up-stream of the site and rainfall falling within the respective catchments flows through the Ashton area. The Bowmans and Glennies Creeks catchments span approximately 300 km^2 and 600 km^2, respectively.

2.4.3 Groundwater flow

The Quaternary alluvium and regolith combined is interpreted (AGE, 2016) to be an unconfined groundwater system that is recharged by rainfall infiltration, streamflow and upward leakage from the underlying stratigraphy, particularly along GC and BC.

The water table in the alluvium/regolith is a subdued reflection of topography. Groundwater within the HRA flows generally in an easterly direction, while groundwater within GCA and the BCA flows generally in a southerly direction towards the HR, with local flow towards the respective river/creeks.

The direction of groundwater flow for the coal seams is influenced by the local geomorphology and structural geology as well as the long history of mining within the region. Groundwater flow within the Permian coal measures is understood to be to the south-west consistent with the dip direction of the coal seams.

The mining of the PG seam and ULD seam has impacted the groundwater regime at Ashton. Mining has induced subsidence cracking that extends to the ground surface above parts of Ashton, and to a lesser height above the goaf in other areas where the cover depth above the PG seam is greater (i.e. near the western side of the mine area). It is likely that in areas of shallower cover depth, this cracking has penetrated both the overburden of the PG, along with the BCA. Surface cracking is also visible along and across the longwall panel areas immediately following subsidence. This surface cracking is expected to extend for only a limited depth below surface and may or may not intersect with the subsidence cracking emanating up from the goaf, depending on cover depth and subsidence magnitude.

There is also potential for recharge from the GCA through connectivity with the PG seam (AGE, 2016), which hydraulic testing showed was significantly more permeable close to outcrop than at depth (Peter Dundon and Associates, 2006). Inflows into the workings during mining of LW1 were not significantly greater than during mining of LW1 tailgate (TG1A). This would indicate that mining of LW1 did not increase the connectivity or flow from the PG seam in subcrop beneath the GCA. Although inflows were higher during mining of TG1A than subsequent inflows from subsided strata during extraction of LW1, the total inflows to the end of LW1 were below predicted inflows, and the observed impacts on GCA were less than predicted, confirming that the proximity to Glennies Creek has not resulted in an unexpected level of connectivity and inflows from the Glennies Creek floodplain.

The presence of subsidence cracking over parts of the underground mine increases the potential connectivity of the mine with the water within the creeks and associated alluvium. Planned LW panels within the underlying ULLD and LB seams may allow for reactivation of subsidence and subsidence related fracturing within these areas (AGE, 2016).

The conceptual hydrogeology is depicted in Figure 2.3.

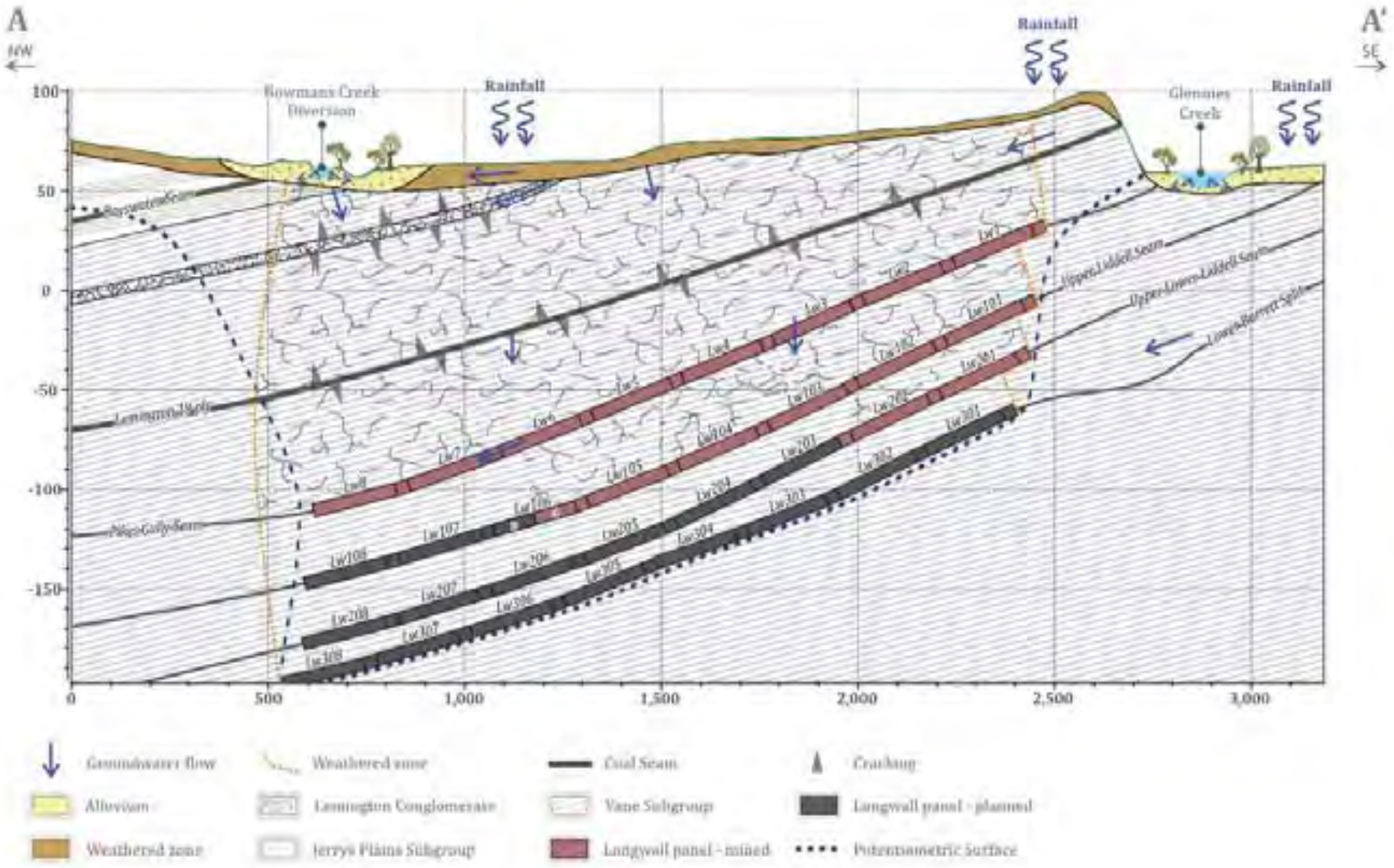


Figure 2.3 Conceptual hydrogeology – north-west to south-east – not to scale

3 Groundwater management plan

The previous WMP (2016) was updated and submitted to DPI Water for approval in June 2017. The updated WMP (2018) (herein referred to as WMP) includes a slightly modified monitoring network that includes alluvial and coal measure bores east of Glennies Creek. The WMP includes a wider array of monitoring bores in the network, and targeted water quality triggers. Details of these monitoring locations are summarised in Appendix D. The groundwater monitoring plan, including monitoring parameters and frequency, is summarised in Appendix B. The WMP received approval in March 2018, therefore, groundwater monitoring in 2019 was conducted as per WMP version 10, 2018.

3.1 Groundwater monitoring network

The ACOL groundwater monitoring network consists of more than 100 monitoring bores. Of these, 64 bores and ten vibrating wire piezometer (VWP) installations are monitored as part of the WMP throughout monthly, quarterly, and annual campaigns (Appendix A). The WMP outlines the monitoring plan and key monitoring locations in areas potentially sensitive to mining impacts.

Monitoring of groundwater levels, VWP pressure heads, and water quality parameters at these bores sufficiently captures the lateral groundwater system behaviour of the alluvial aquifers, the interburden and the coal seam aquifers at the site. The current groundwater monitoring network is considered suitable to detect changes to groundwater across the site.

The WMP monitoring locations and respective monitoring targets are presented in Figure 3.1. Details of these monitoring locations are summarised in Appendix A (Table A1).

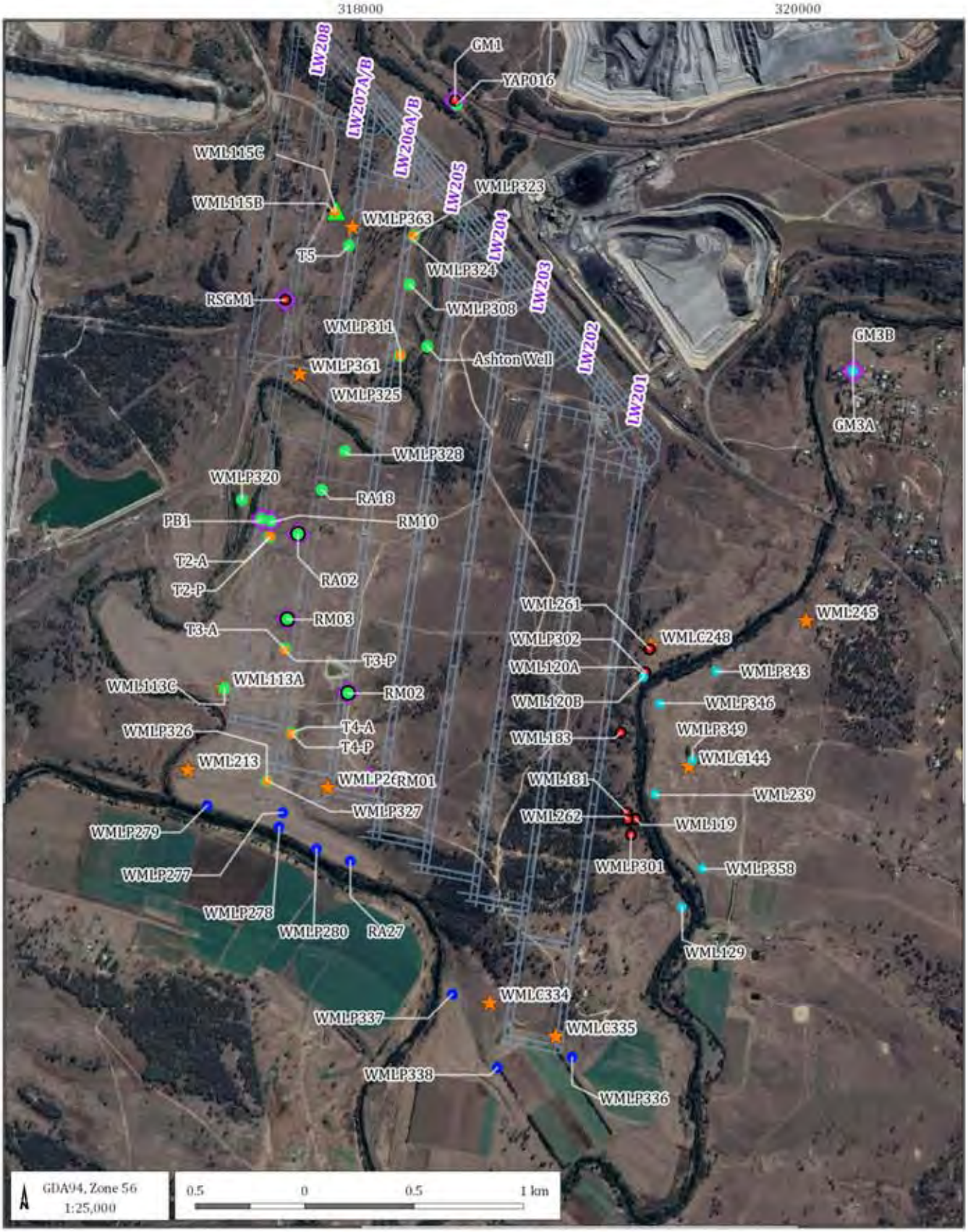
The groundwater monitoring program includes the monitoring of:

- groundwater levels;
- groundwater (piezometric) pressures;
- field water quality parameters – pH, EC, temperature and total dissolved solids (TDS);
- groundwater sampling for minor chemical lab analysis (including pH, EC, TDS, major ions (calcium, magnesium, sodium, potassium, chloride and sulfate as SO4) and alkalinity);
- groundwater sampling for comprehensive chemical lab analysis (including pH, EC, TDS, major ions, alkalinity, cations/anions, arsenic, cadmium, chromium, copper, iron, lead, manganese, nickel, selenium, zinc, turbidity, cyanide, nitrate, nitrite, Kjeldahl nitrogen, total nitrogen and total phosphorous); and
- monitoring of groundwater levels and EC as required by Environmental Protection Licence (EPL) 11879.

Monitoring frequency is as follows (Appendix B):

- monthly monitoring at selected alluvial piezometers for water level and field water quality;
- monthly monitoring of water level and piezometric pressure in longwall-specific piezometers during active extraction at relevant longwalls;
- quarterly monitoring at selected piezometers for water level, field water quality and minor chemical analysis;
- biannual monitoring for bores specified by EPL 11879; and
- annual sampling at selected piezometers for minor and comprehensive chemical analysis.

The groundwater monitoring plan, including monitoring parameters and frequencies, is summarised in Appendix B (Table B1).



LEGEND

- Longwall panels (ULLD)
- Bowmans Creek Alluvium
- Bowmans Creek Alluvium and Coal Measure Overburden
- Bowmans Creek Colluvium
- Coal measure
- Coal measure overburden
- EPL bores
- Glennies Creek Alluvium
- Hunter River Alluvium
- VWPs

Yancoal Ashton - AGMR 2019 (G1922H)

WMP groundwater monitoring network

DATE: 07/01/2020

FIGURE No: **3.1**

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3.2 Trigger values

The WMP outlines trigger values for groundwater level and quality for monitoring bores in the Bowmans Creek Alluvium (BCA), Glennies Creek Alluvium (GCA) and the Hunter River Alluvium (HRA).

A recorded water level below the defined trigger level at a monitoring bore at any time between March 2018 and the end of mining of LW204 in the ULLD, sustained for three consecutive months, would trigger a response under the WMP. Groundwater elevation trigger levels are summarised in Table 3.1. Groundwater quality trigger levels are summarised in Table 3.2. As for groundwater elevation, three consecutive measurements outside of these values trigger a response under the WMP. In addition, if a recorded value at a monitoring bore differs extremely from the preceding three readings at that location and there are no unusual events that could have caused the difference, a response would be triggered. The WMP groundwater response plan, for cases where trigger values are exceeded, is summarised in Appendix C.

Table 3.1 Groundwater elevation trigger levels for alluvial monitoring bores

Aquifer	Monitoring bore	Base of alluvium elevation (mAHD)	Assigned trigger value end of mining in LW204 (Upper Lower Liddell Seam) (mAHD)
BCA*	WMLP311	55.64	57.5
	WMLP323	59.47	59.2
	WMLP328	49.42	55.15
	T2A	49.69	54.17
GCA	WML120B	51.12	51.45
	WML129	45.44	49.8
	WML239	50.82	49.78
	WMLP343	50	51.33
	WMLP346	49.18	51.35
	WMLP349	48.84	50.82
	WMLP358	50.16	50.79[$]
HRA	WMLP279	45.1	48.82
	WMLP280	44.92	48.63
	WMLP337	48.05	47.73
	WMLP336	47.87	48.15

Notes: ** Bowmans Creek alluvium is approved to be dewatered in areas above the mine plan by end of mining of the Upper Liddell seam (Aquaterra 2009). Trigger values are therefore intended as a guide representing updated, more conservative, impact predictions from the updated groundwater model (AGE, 2016).*

[$] This water level trigger is based on the second lowest water level measured, as the lowest measured water level is an outlier in the dataset.

Table 3.2 Groundwater quality trigger levels for alluvial monitoring bores

Aquifer	Monitoring bore	Groundwater pH trigger - Lower (5th percentile)	Groundwater pH trigger - Upper (95th percentile)	Groundwater EC trigger (µS/cm) (95th percentile)
BCA	WMLC113C	6.6	7.4	1445
	WMLP311	6.5	8	1289
	WMLP323	6.5	8.1	1241
	WMLP326	6.6	7.5	2078
	WMLP328	6.6	8.2	1175
	T2A	6.7	7.7	1422
GCA	WML120B	6.4	7.7	1387
	WML129	6.7	8	740
	WML239	6.3	7.4	984
	WMLP343	6.2#	8#	1059&
	WMLP346			1005&
	WMLP349			2900&
	WMLP358			600&
HRA	WMLP279	6.3	7.5	1276
	WMLP280	6.6	7.9	2034
	WMLP337	6.8	7.8	3254
	WMLP336	6.2	8.2	1708

Notes: *Data reviewed for trigger derivation includes historical data to June 2017.*

 # Temporary triggers – the new bore additions to the Glennies Creek alluvium monitoring network have minimal historical pH monitoring data. In these cases, rather than establishing a statistically based trigger, the previous Glennies Creek alluvium quality triggers have been maintained. These triggers will be adjusted in future based on data collected under this WMP.

& Temporary triggers – the new bore additions to the Glennies Creek alluvium monitoring network have minimal historical monitoring data. In these cases, rather than establishing a statistically based trigger based on the 95th percentile, a temporary trigger has been established as 200 µS/cm above the highest measured EC value. These triggers will be adjusted in future based on data collected under this WMP.

3.3 Sampling methods

Groundwater sampling at Ashton in 2019 adhered to the following standards and procedures:

- Australian Government – National Water Commission (2012). *"Minimum Construction Requirements for Water Bores in Australia".* Third edition ISBN 978-0-646-56917-8.
- Standards Australia (1998). *"Water Quality – Sampling. Part 1: Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples".* Australian/New Zealand Standard 5667.1:1998.
- Sundaram, B. (2009). *"Groundwater Sampling and Analysis – A Field Guide",* Australian Government – Geoscience Australia. GeoCat 60901.

Groundwater levels/pressure heads at Ashton in 2019 were measured as follows:

- manual measurements using a water level dipper;
- download of VWP data;
- downloadable pressure transducer (PT); and
- telemetric PT.

Groundwater quality field parameters were measured using a calibrated water quality meter. Water quality laboratory analysis is conducted by National Association of Testing Authorities (NATA) accredited group Australian Laboratory Services (ALS).

Throughout 2019, groundwater sampling was conducted by AGE Hydrogeologist, Walter Rowlands.

4 Groundwater monitoring results

Groundwater monitoring and sampling was conducted at the locations and frequencies outlined in the WMP (Section 7.3). Groundwater levels and quality trends for alluvial bores are presented in Figure 4.1 through Figure 4.22. Groundwater levels and quality data for non-alluvial monitoring locations are presented in Figure 4.23 through Figure 4.30.

4.1 Alluvium monitoring

4.1.1 WMP compliance groundwater levels

The groundwater level trends and trigger levels for the BCA, GCA and HRA compliance monitoring bores are presented in Figure 4.1, Figure 4.2, Figure 4.3 and Figure 4.4, respectively. Daily rainfall measurements and CRD have also been plotted and used to compare water level trends. The river and creek water levels (sourced from WaterNSW online database[2]) are presented graphically in Figure 4.5.

The following observations can be noted for 2019:

- BCA regulatory bore water levels declined throughout 2019 (Figure 4.1). Over the course of the year, two of the four BCA trigger bores ran dry; T2A during May and WMLP311 during August. All BCA trigger bores were recorded below respective trigger values over three consecutive measurements, triggering the response protocol outlined in the WMP (Appendix C). An investigation into declining groundwater levels in T2A was undertaken (AGE, 2019 – Appendix G). It was concluded that monitoring bore T2A was the first of a group of bores likely to soon be dry in the BCA if prevailing drought conditions continued. Numerous other BCA bores were observed to be dry in 2019 including; PB1, RA18 and WMLP311. Groundwater level decline within these bores corresponds to a declining CRD. Unlike the GCA and HRA, the BCA is not a regulated stream. It should be noted that ACP is approved to intercept the BCA groundwater resource under DA 309-11-2011-i MOD 5.
- GCA groundwater levels were generally stable throughout the year (Figure 4.2 and Figure 4.3). A minor decline in groundwater levels was recorded between January to September 2019. Water levels rose in response to increased storage water release from Lake St Clair over the last quarter of 2019.
- HRA regulatory bore water levels were relatively steady throughout the year, with overall variation within ±0.2 m (Figure 4.4). The stability of HRA water levels can be partly attributed to controlled releases upstream of the HR section that traverses ACP.
- Surface water elevation in Bowmans Creek remained dry at WaterNSW gauges over 2019 (Figure 4.5). The Glennies Creek water level was relatively steady throughout the year, with several sharp declines being suspected false readings recorded at the gauge. Hunter River elevation was stable during 2019. One large spike was observed following high rainfall in March, and a separate spike was recorded in December. The December spike may be an artefact as there was no recorded rainfall at this time.

The site area has experienced a period of prolonged below average rainfall over the last 12+ months, as indicated by a declining CRD. Groundwater levels, not associated with regulated water bodies, are declining primarily due to decreased rainfall recharge. No mining impacts outside of predictions are noted in the alluvium.

[2] WaterNSW (2019). Real-time water data. Available at: http://realtimedata.water.nsw.gov.au/water

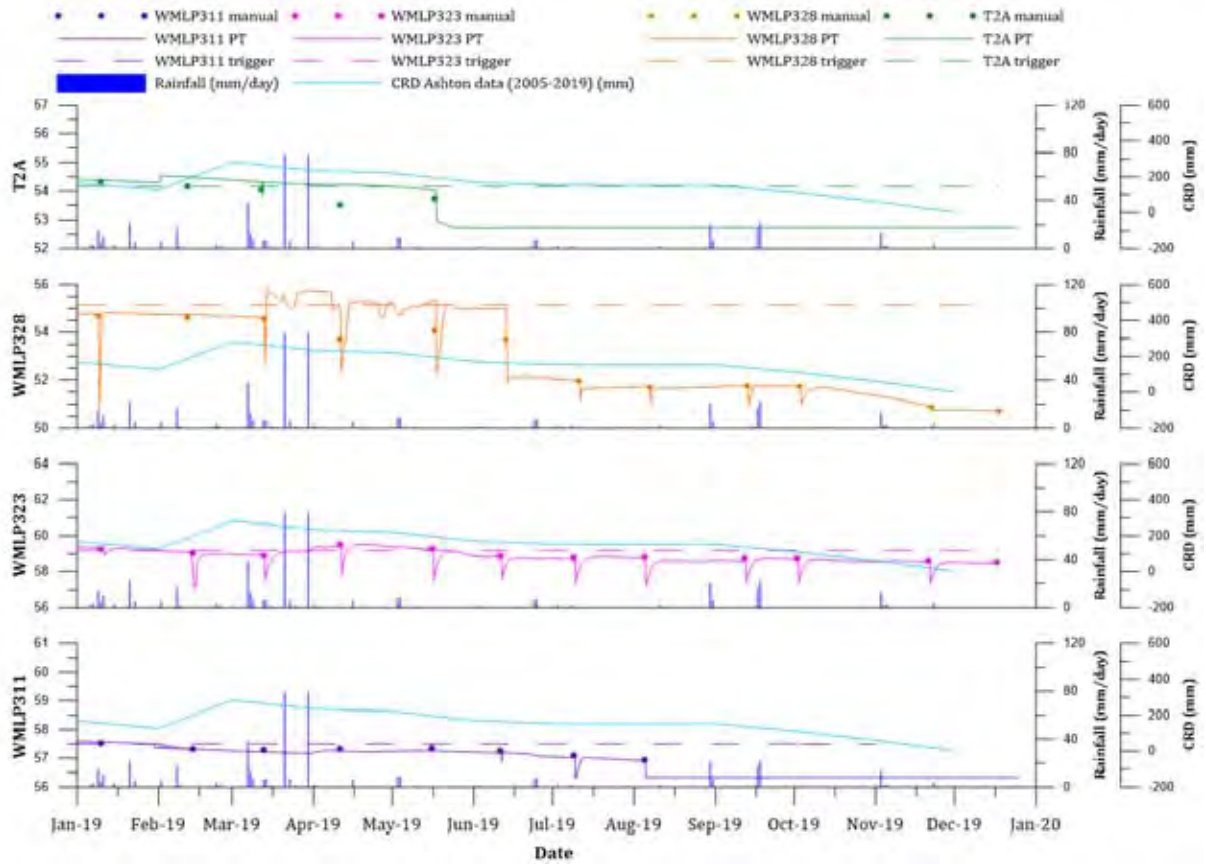

Figure 4.1 Bowmans Creek alluvium trigger bore hydrographs

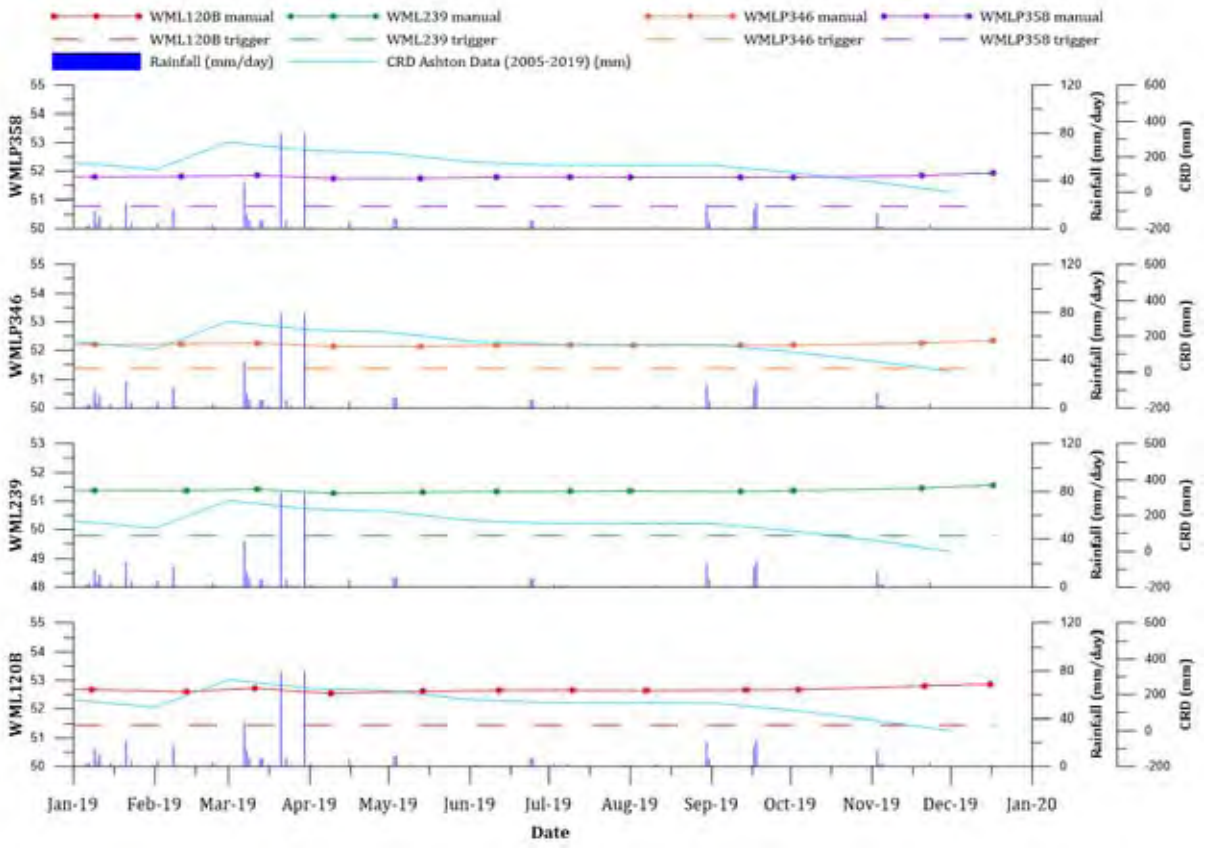

Figure 4.2 Glennies Creek alluvium trigger bore hydrographs (1)

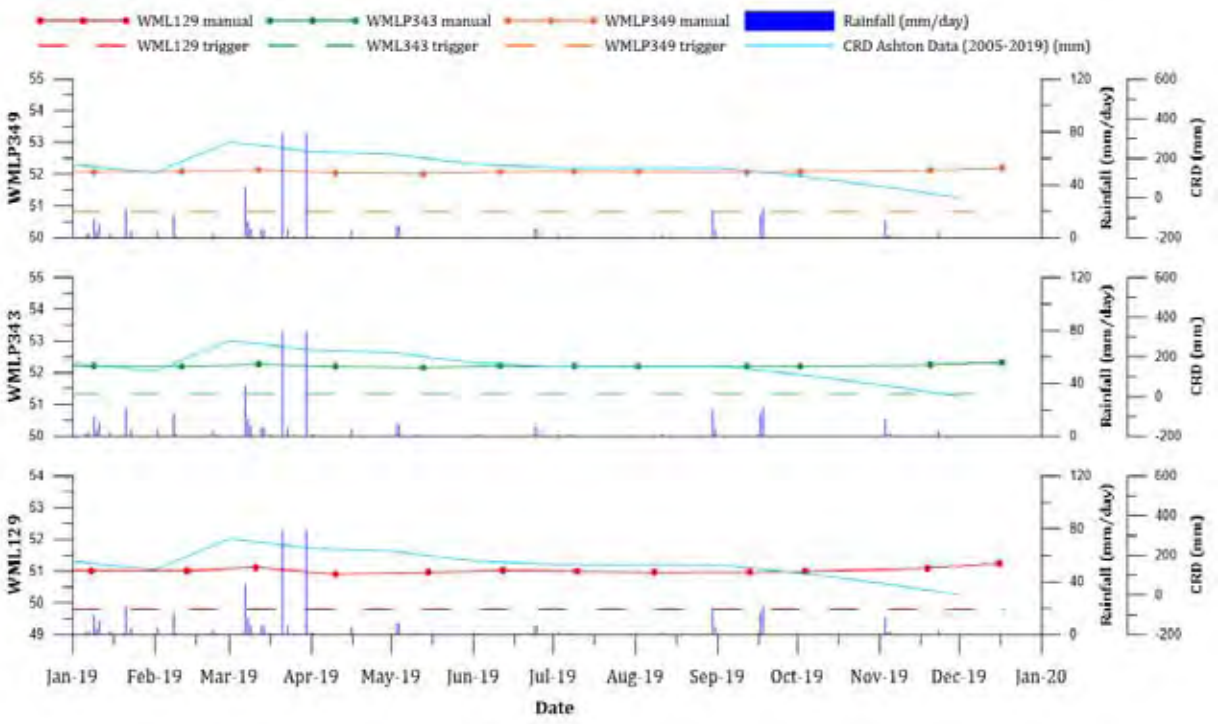

Figure 4.3 Glennies Creek alluvium trigger bore hydrographs (2)

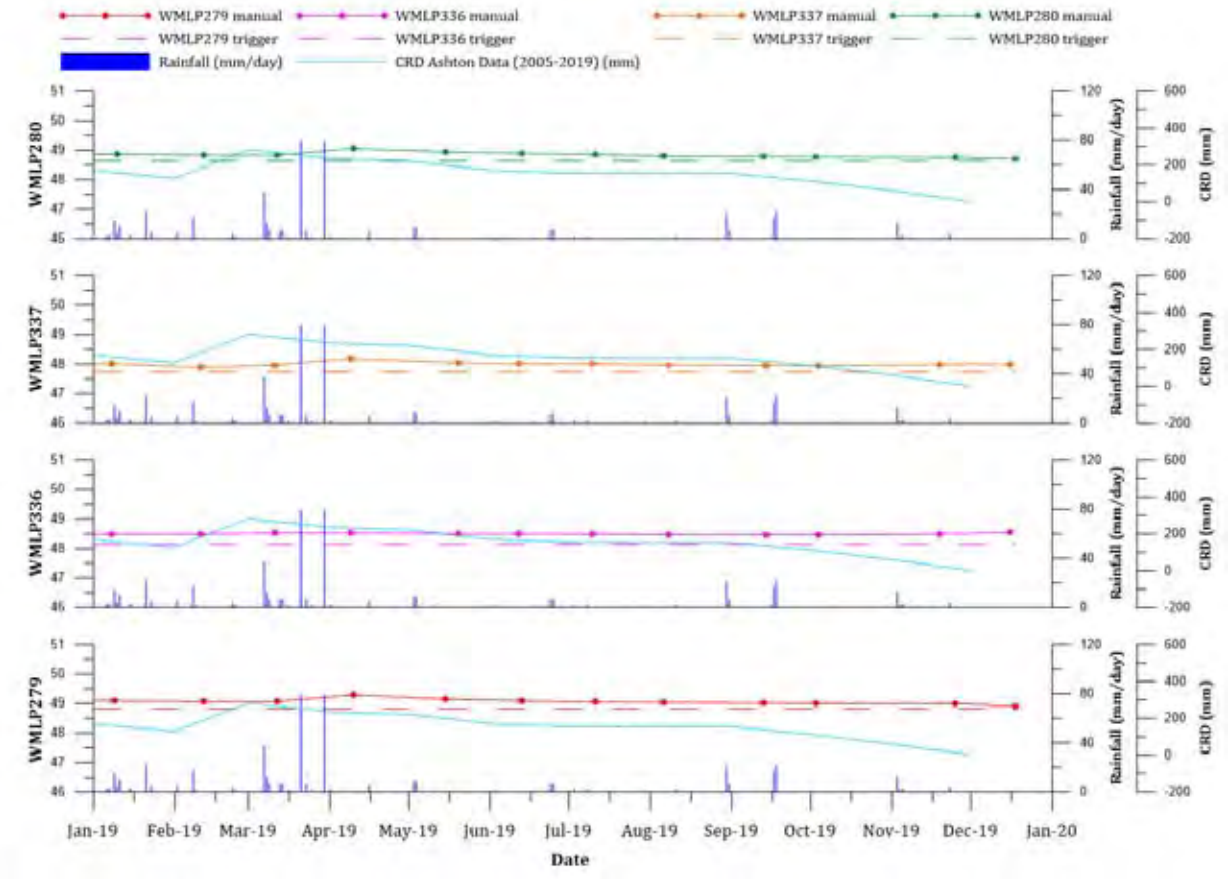

Figure 4.4 Hunter River alluvium trigger bore hydrographs

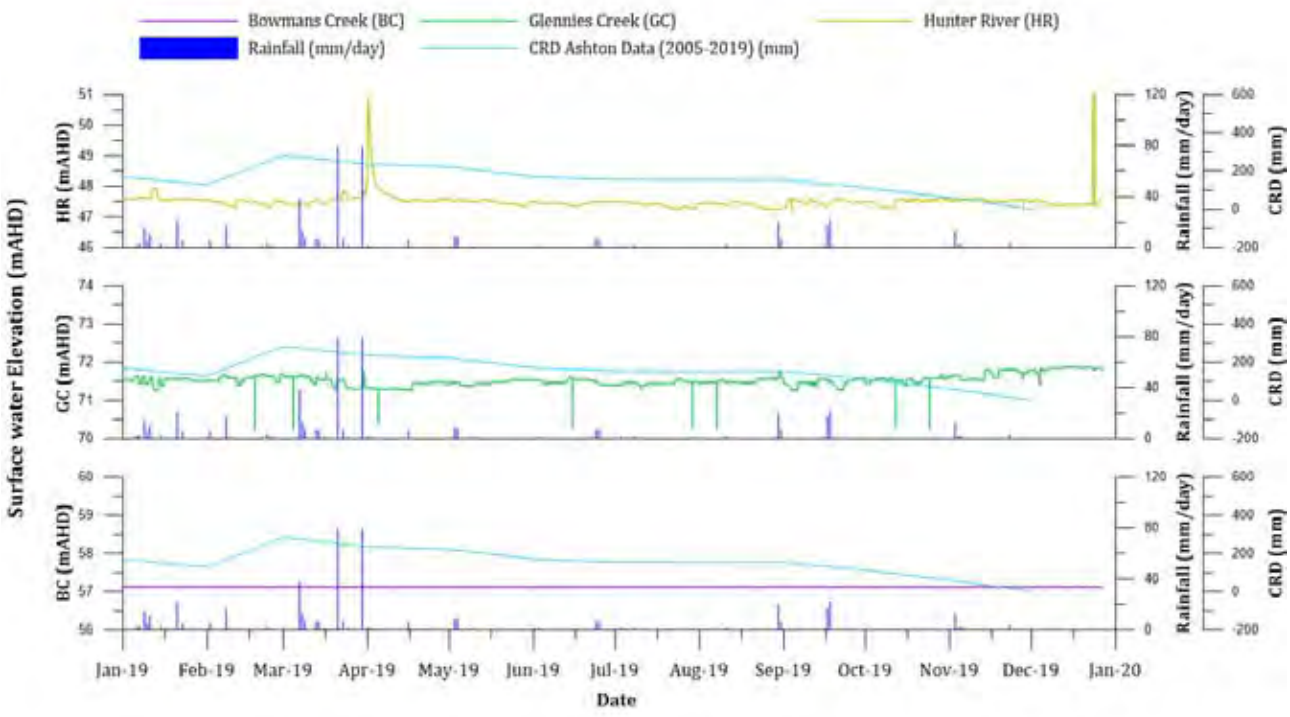

Figure 4.5 Surface water level hydrographs

4.1.2 Other alluvium groundwater levels

Groundwater level trends observed in 2019 for other BCA and HRA monitoring bores across the monitoring network are presented in Figure 4.6 and Figure 4.7, respectively. Daily rainfall measurements and CRD have been plotted and used to assess water level trends. As for the BCA regulatory bores, the other BCA alluvial bores also recorded an overall decline in water levels. Monitoring bores PB1 and RA18 were observed to be dry during October 2019. With the exception of a period of heavy rainfall in March/April, WML113C was also dry throughout 2019. HRA trigger bores recorded water levels that varied by no more than ±0.2 m. The HRA bores responded to increased rainfall throughout March. No mining impacts outside of predictions are noted.

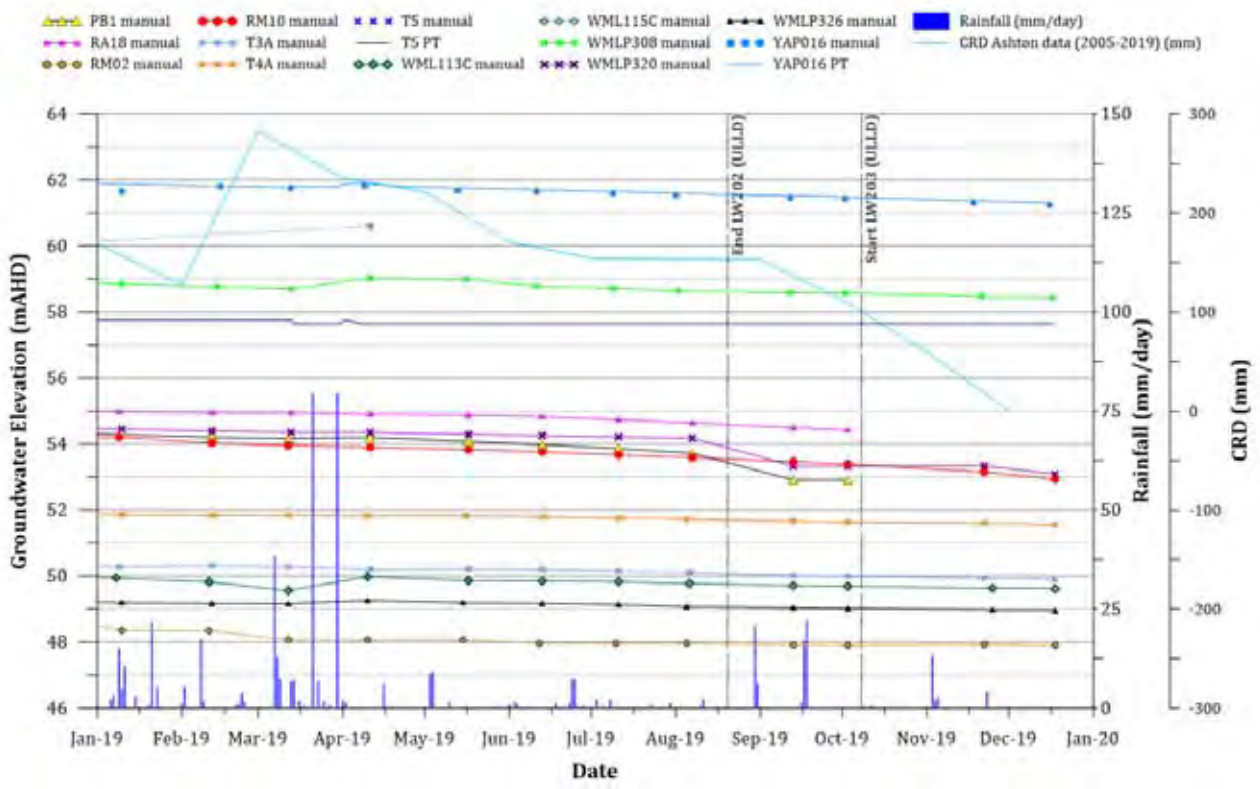

Figure 4.6 Other Bowmans Creek alluvium monitoring bore hydrographs

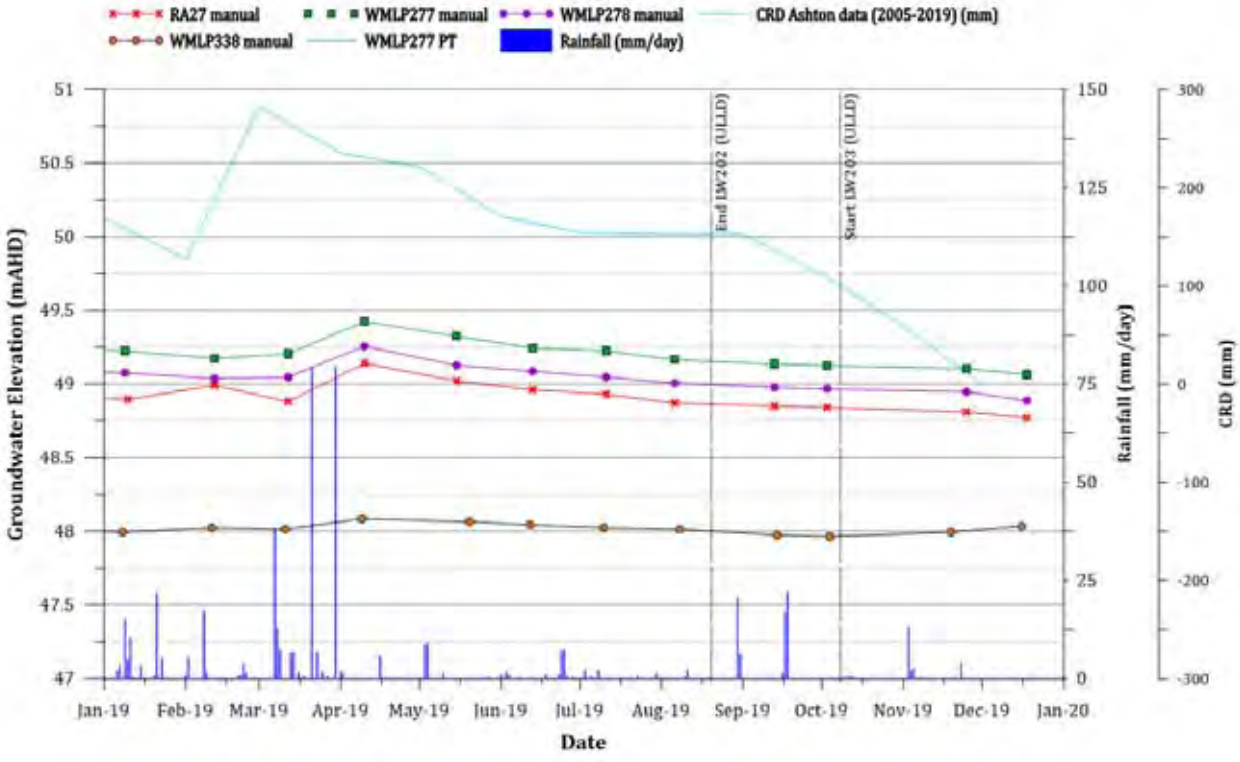

Figure 4.7 Other Hunter River alluvium monitoring bore hydrographs

4.1.3 pH, electrical conductivity and major ions

All alluvial bores across the ACP monitoring network were sampled for pH, EC and major ions throughout 2019, and the results are presented graphically in Figure 4.8 through to Figure 4.22. A complete table of results for the aforementioned parameters is presented in **Error! Reference source not found.**; together with comprehensive analysis measurements recorded during annual sampling in August 2019. All associated laboratory files can be found in Appendix F.

As has been the case in preceding years, groundwater pH in alluvial bores was slightly acidic to neutral in 2019. Three bores recorded an exceedance of pH trigger values throughout the year (T2A, WML113C and WML129), however the events were not consecutive and as such did not require a response under the WMP. Values for pH were stable in 2019, generally ranging from pH 6.5 to 7.5, with only a few outliers outside this range. Discrepancies in pH were minor and considered within natural variation. The specific pH ranges measured within the BCA, GCA and HRA in 2019 were:

- BCA – pH 6.37 (T3A) to 8.66 (RA18);
- GCA – pH 6.09 (WML129) to 7.69 (WMLP343); and
- HRA – pH 6.58 (WMLP336) to 7.48 (WMLP279).

Groundwater EC was fresh to slightly brackish across the BCA, GCA and HRA monitoring network over 2019; mirroring the conditions in previous years. Three bores exceeded EC triggers over three consecutive periods during 2019 – monitoring bores WMLP311, WMLP323 and WMLP328. These bores are all BCA bores and have been investigated on two recent occasions (AGE, 2018 (Appendix H); AGE, 2018a, AGE, 2019). These investigations concluded that BCA EC levels have increased as a result of reduced rainfall recharge. This trend is expected to continue without significant rainfall recharge in the BCA.

GCA and HRA EC levels in 2019 were steady overall, with only minor fluctuations occurring throughout the year. HRA Monitoring bore WMLP338 recorded a significantly higher EC than previous measurements during November 2019. However, a significant amount of organic matter enters this bore given the lack of a monument and the occasional displacement of the well lid by cattle. It is possible that EC was influenced by external material in this bore. This noted, no EC exceedances were observed for GCA or HRA trigger bores in 2019. For alluvial bores, the observed EC ranges in 2019 were:

- BCA – 964 (WML113C) to 2,627 µS/cm (WMLP326);
- GCA – 316 (WML129) to 1,034 µS/cm (WMLP349); and
- HRA – 615 (WMLP336) to 2,957 µS/cm (WMLP337).

River and creek EC levels (sourced from the WaterNSW online database) were also examined over 2019. Bowmans Creek remained dry at the gauge throughout 2019. Glennies Creek EC was stable, with sudden groundwater level declines likely due to an issue with the gauge. Hunter River EC oscillated over the course of 2019, with fluctuations remaining within historic ranges.

The major ion content of each alluvial system was also assessed in 2019 as shown in the classification table and Piper diagram from August 2019 (Appendix E). The cation water type in all monitoring bores was Na and Mg dominant. With respect to anions, Cl dominates over the SO_4 ions in the alluvial monitoring bores. The BCA and HRA water types are similar and can be distinguished from the GCA water types due to the water source and the recharge/discharge mechanism associated with each body.

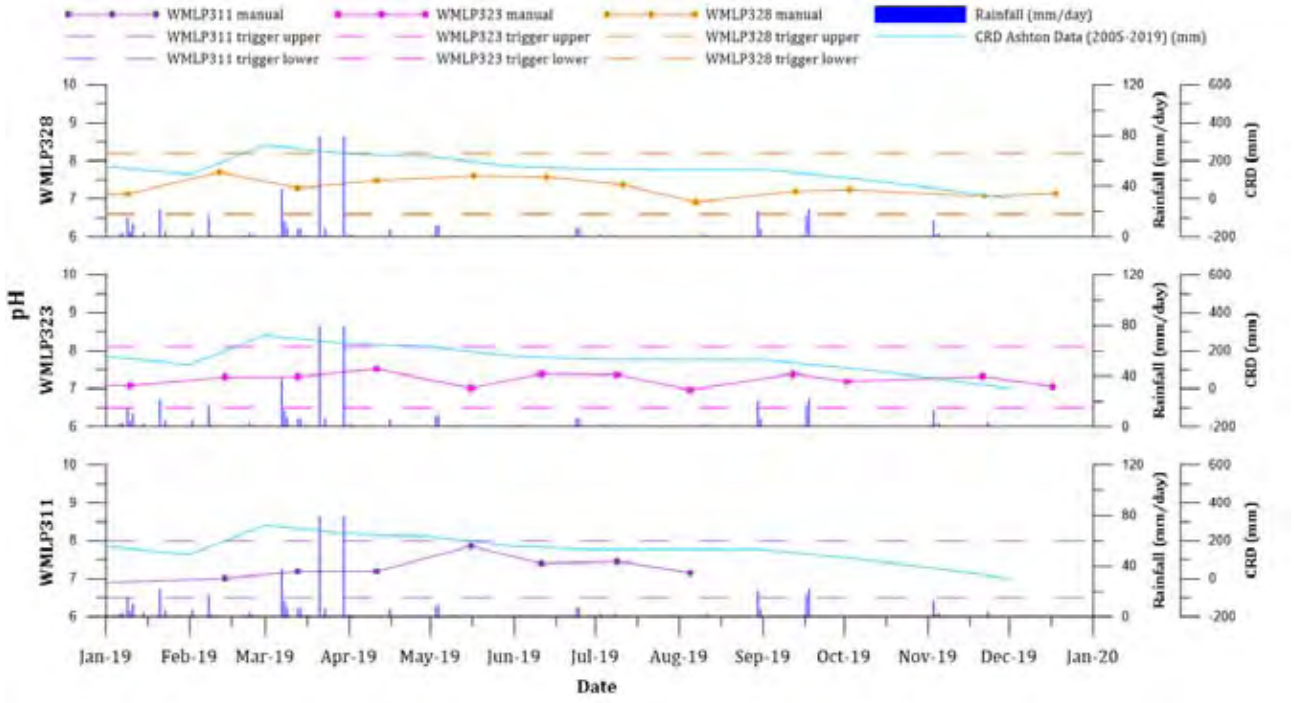

Figure 4.8 Bowmans Creek alluvium trigger bore pH trends (1)

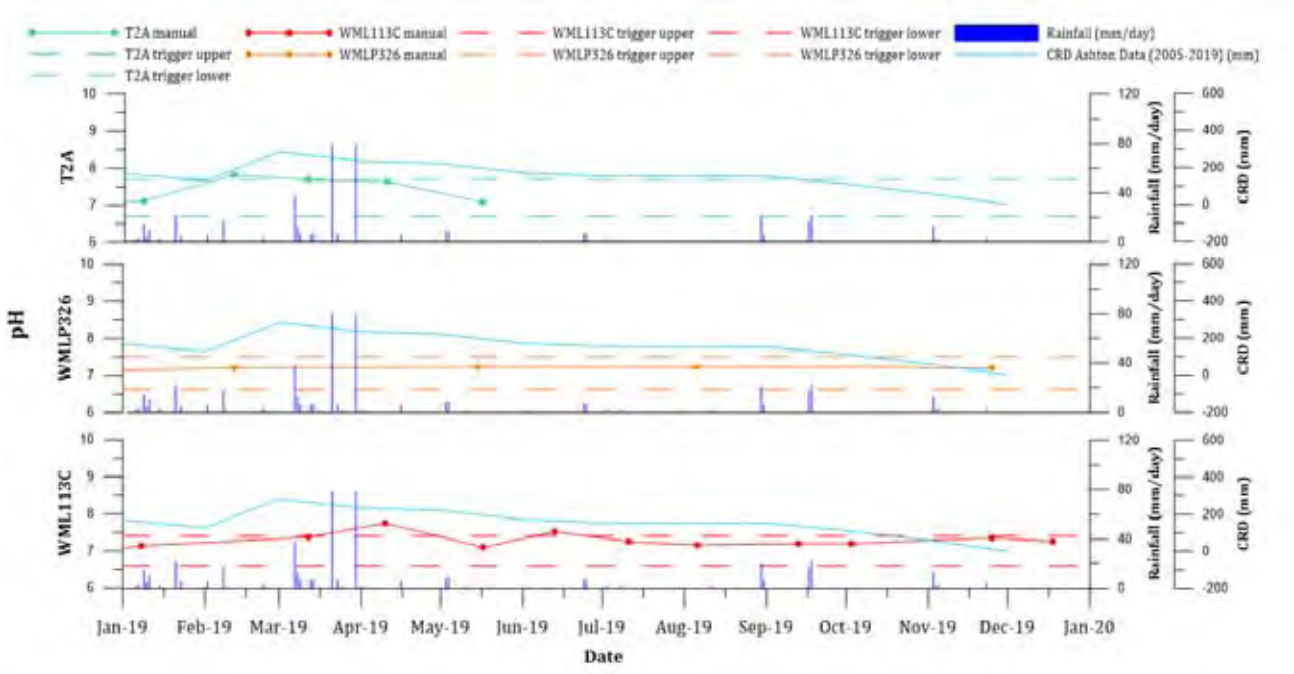

Figure 4.9 Bowmans Creek alluvium trigger bore pH trends (2)

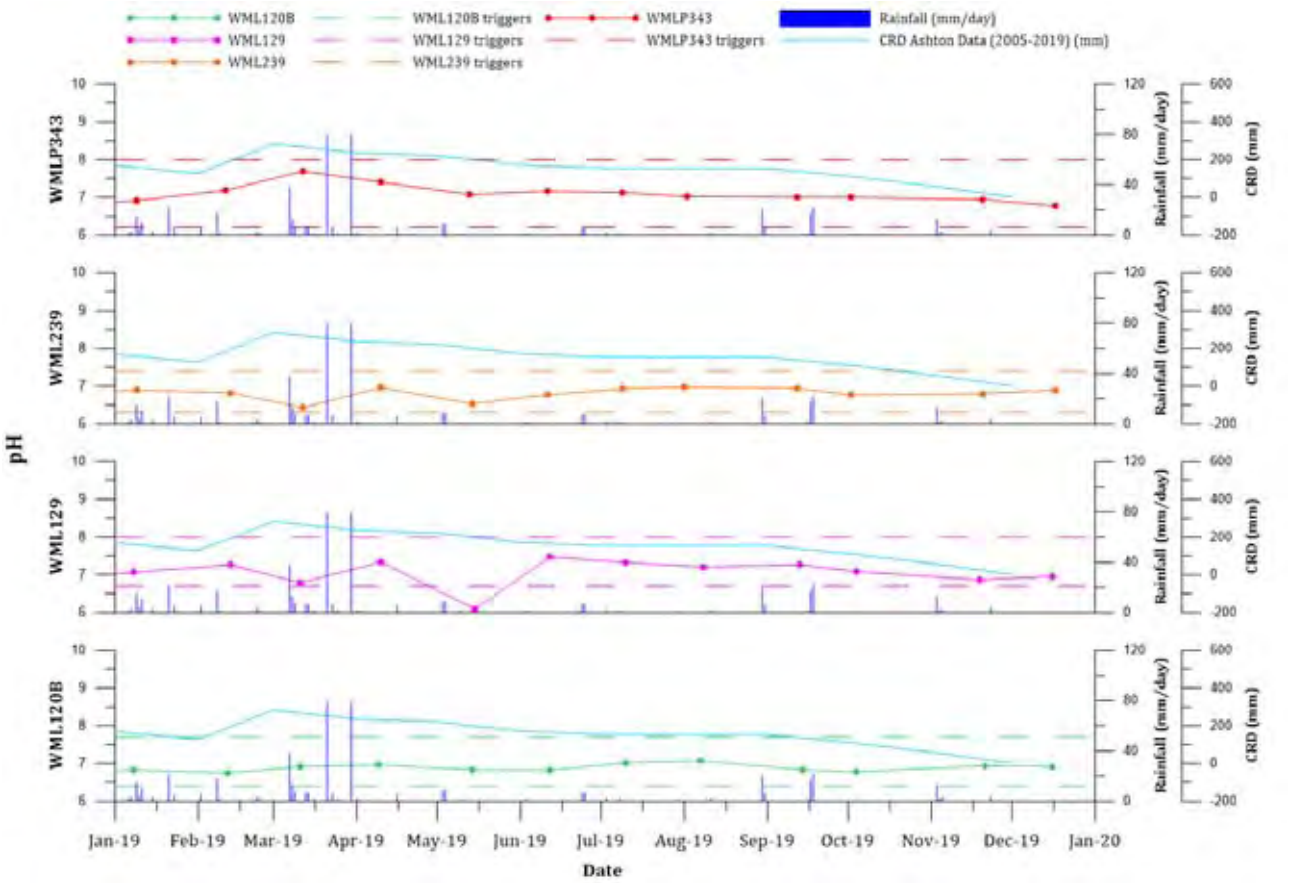

Figure 4.10 Glennies Creek alluvium trigger bore pH trends (1)

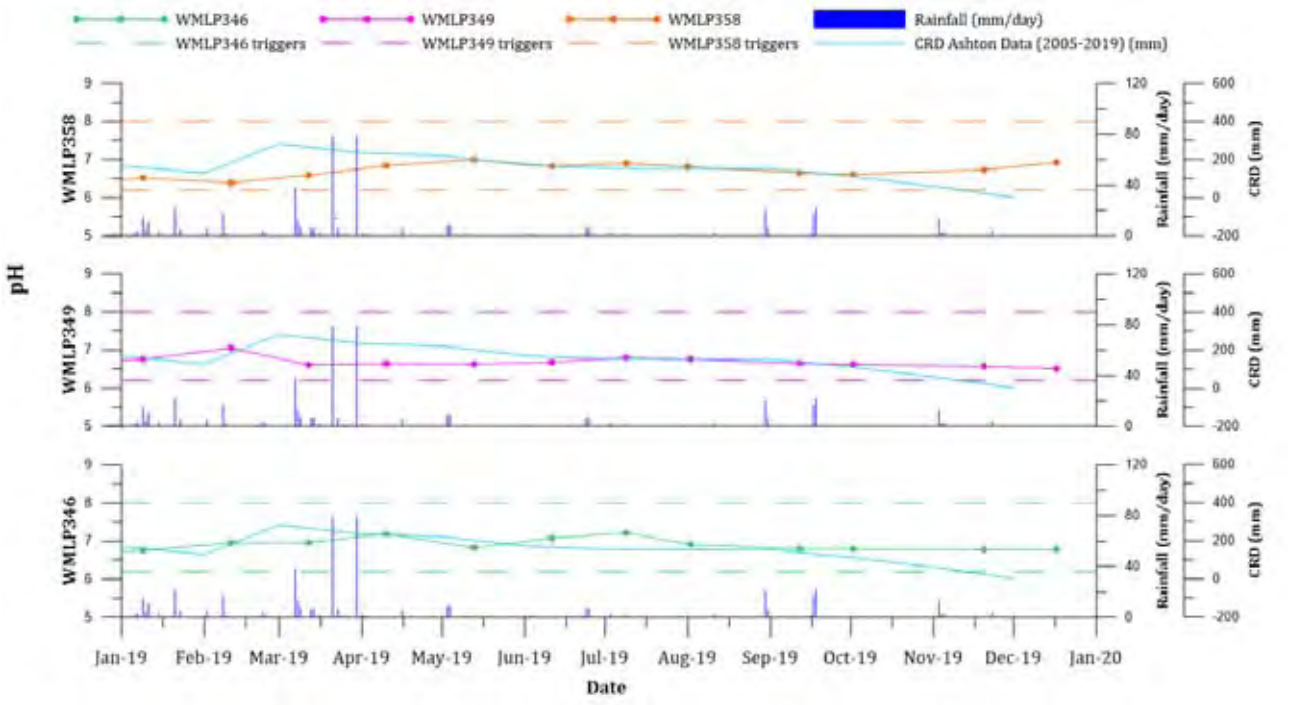

Figure 4.11 Glennies Creek alluvium trigger bore pH trends (2)

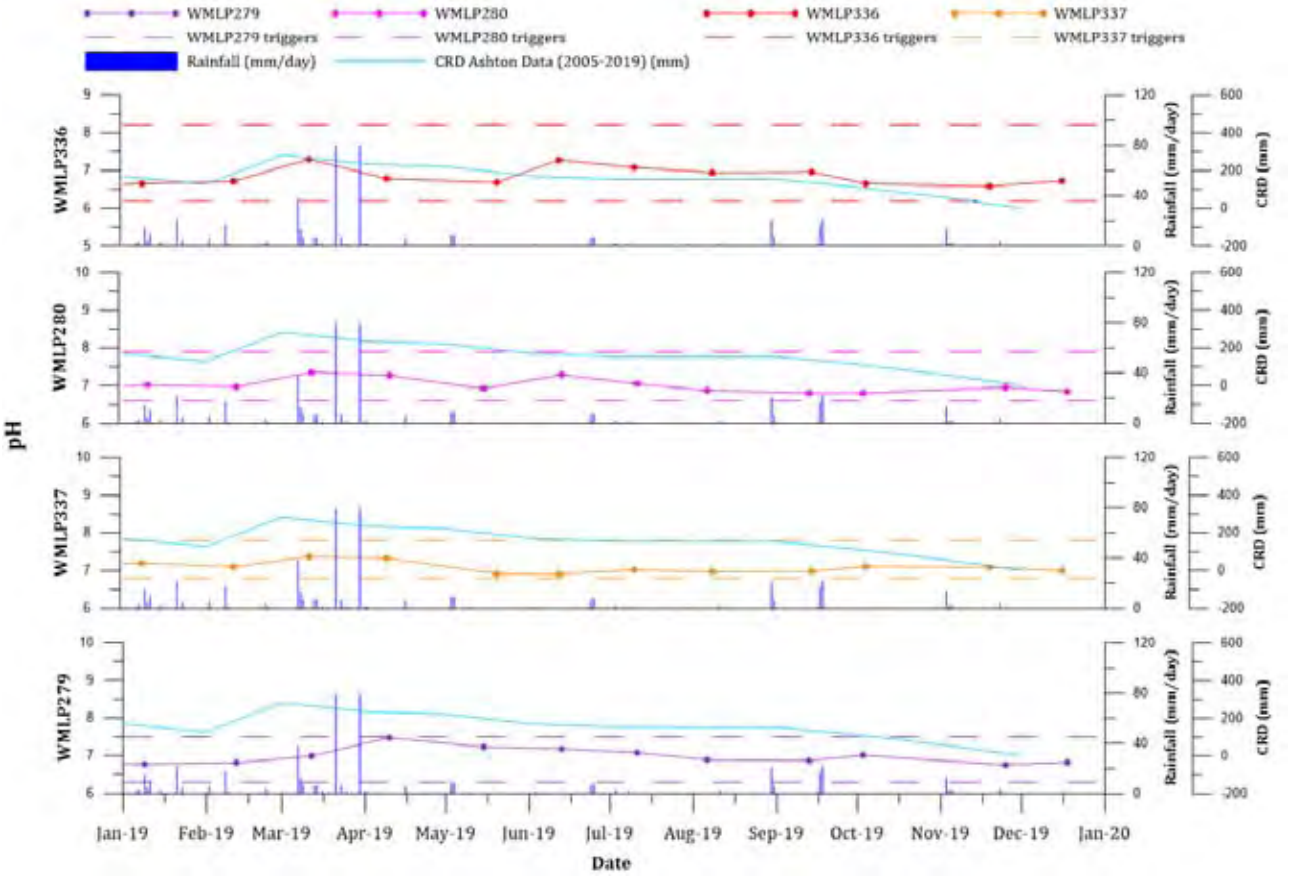

Figure 4.12 Hunter River alluvium trigger bore pH trends

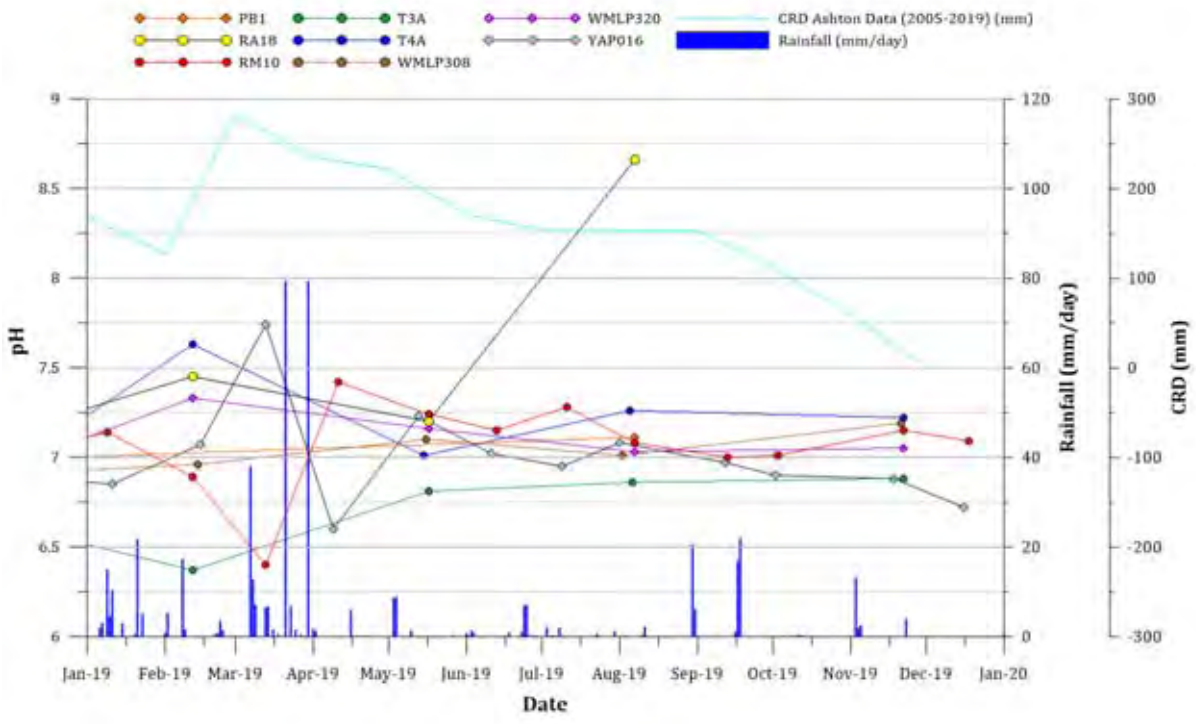

Figure 4.13 Other Bowmans Creek alluvium bore pH trends

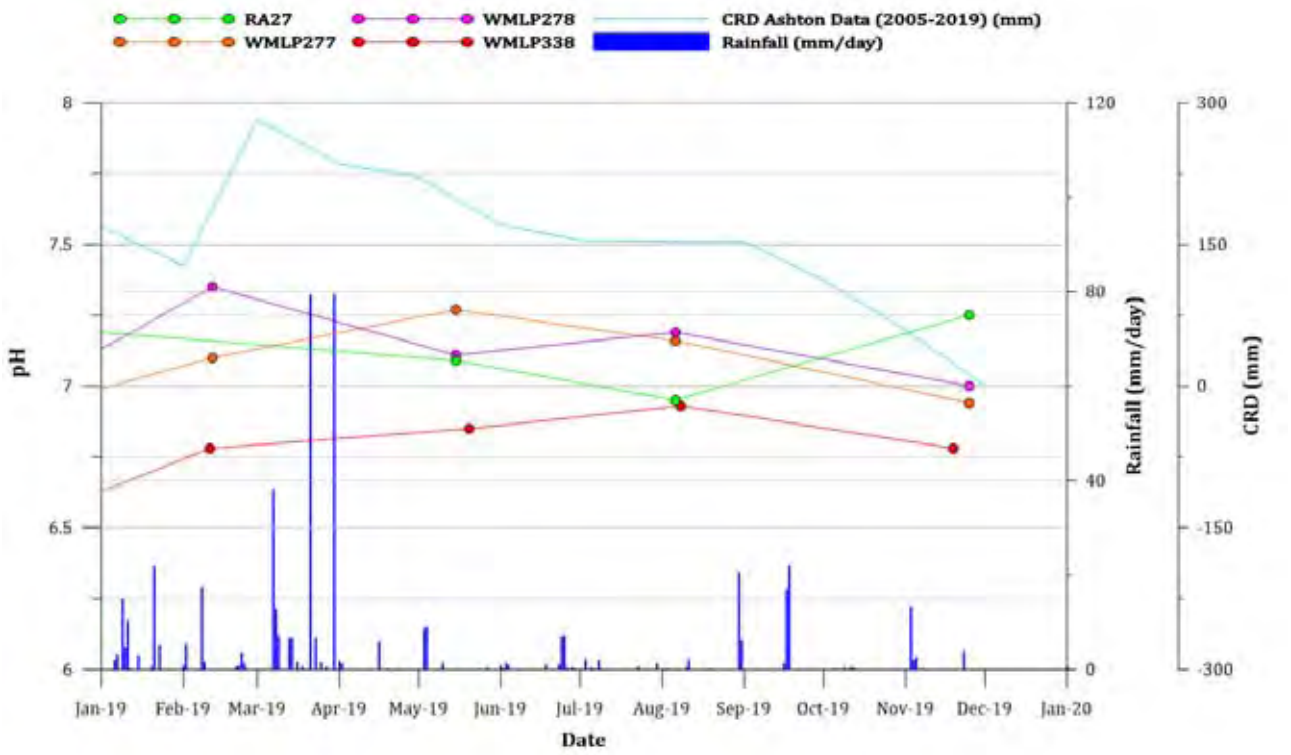

Figure 4.14 Other Hunter River alluvium bore pH trends

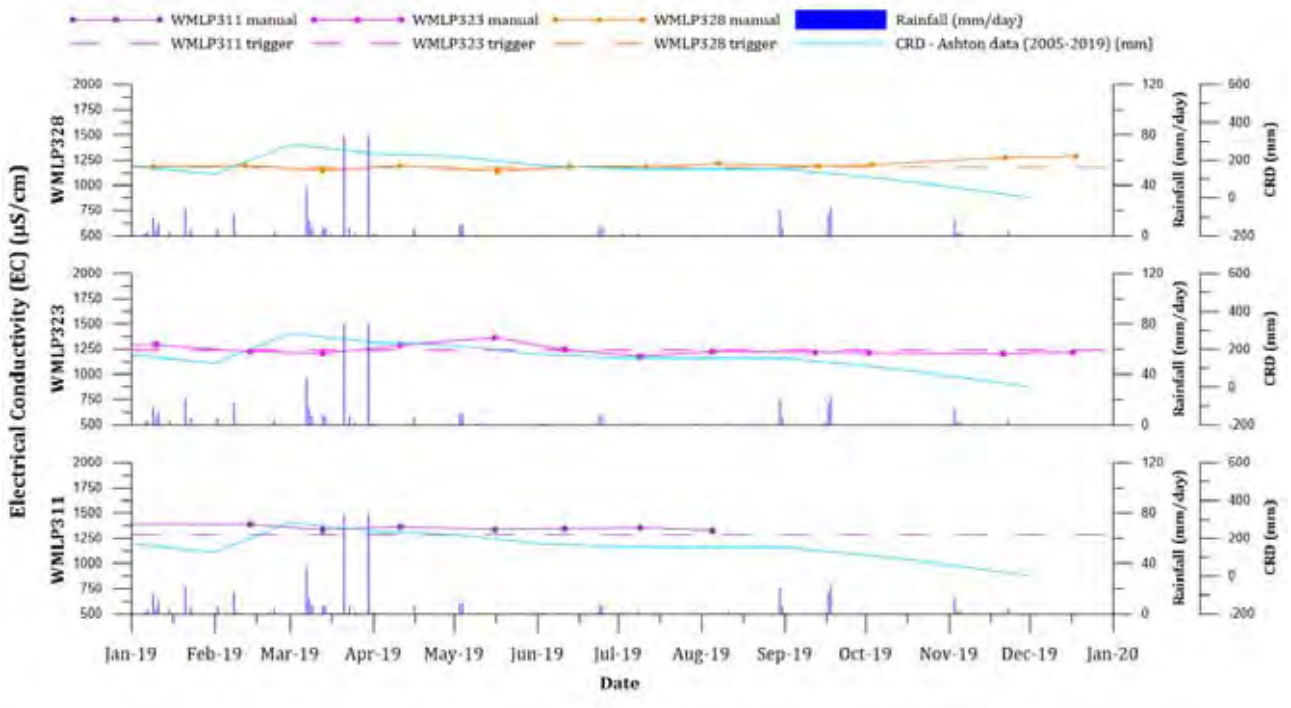

Figure 4.15 Bowmans Creek alluvium trigger bore EC trends (1)

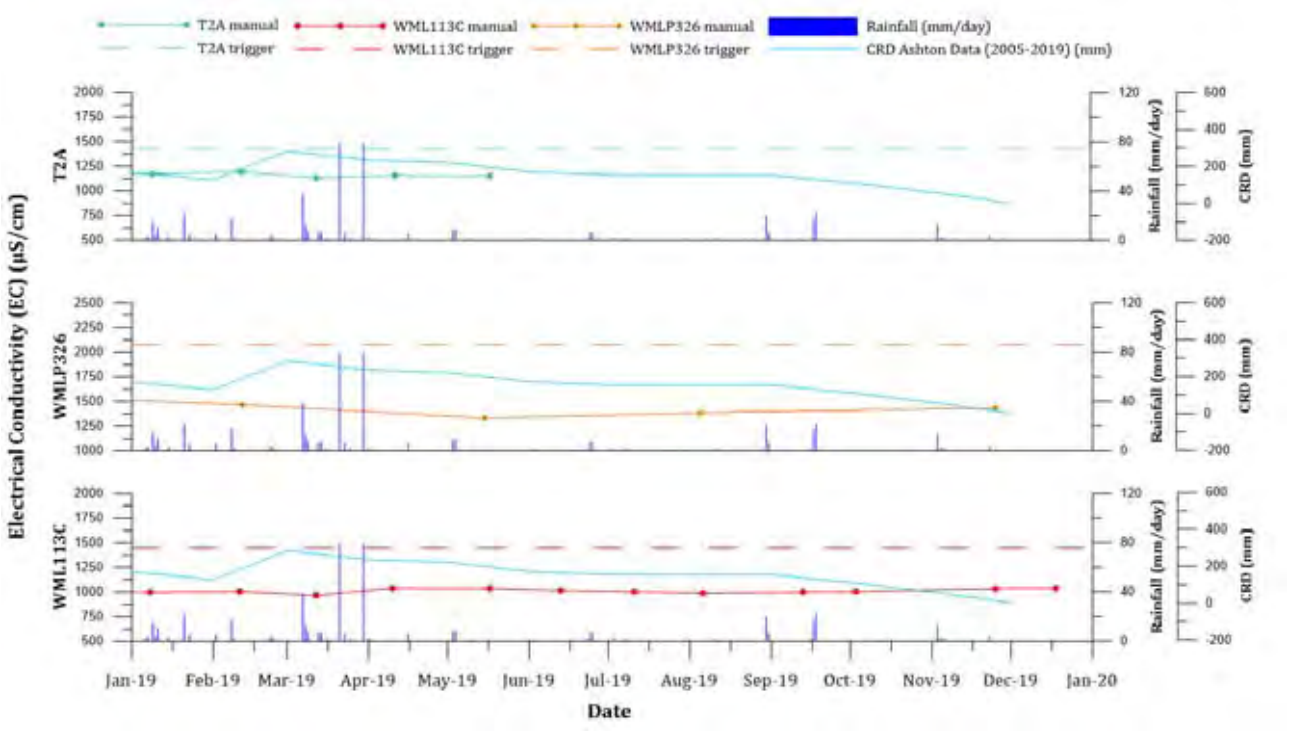

Figure 4.16 Bowmans Creek alluvium trigger bore EC trends (2)

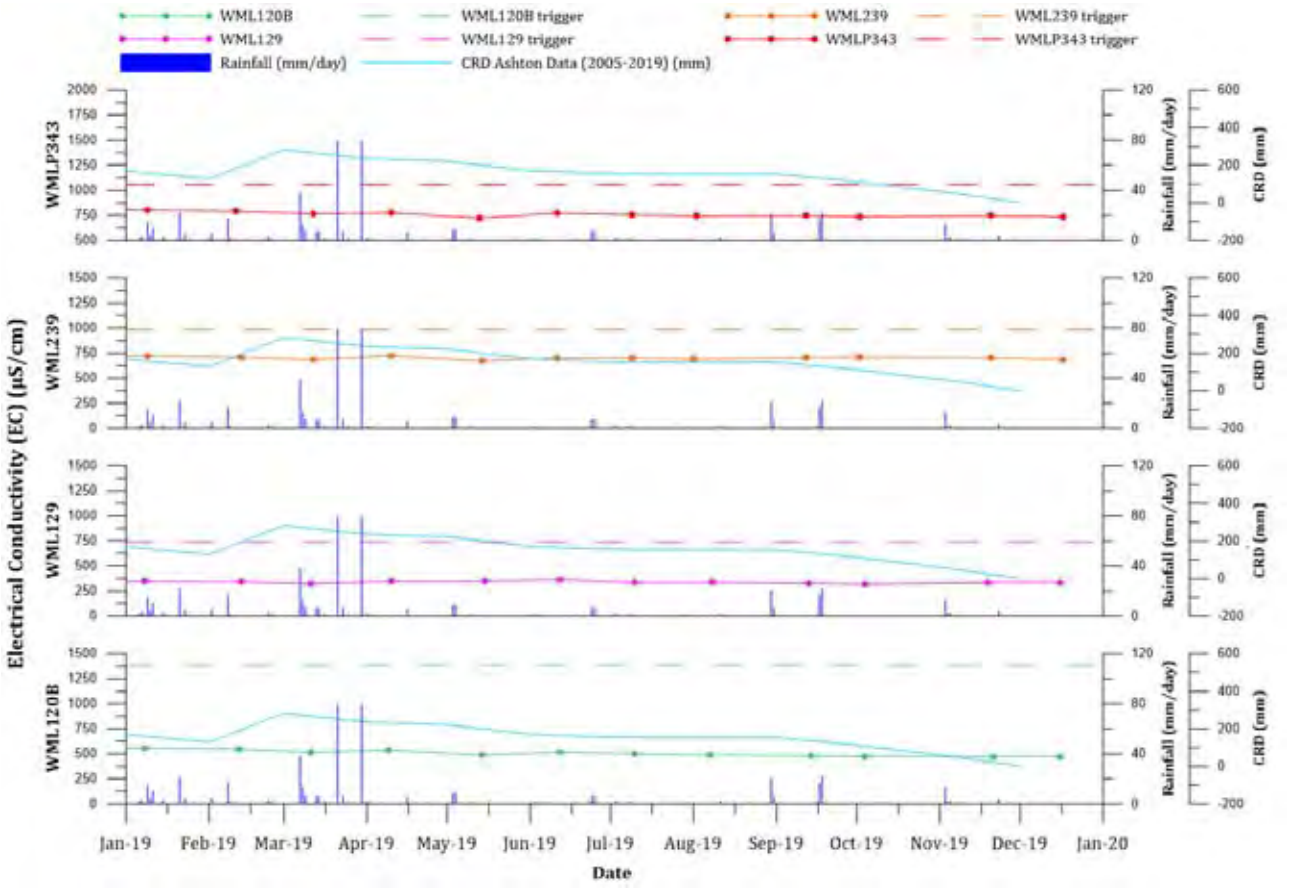

Figure 4.17 Glennies Creek alluvium trigger bore EC trends (1)

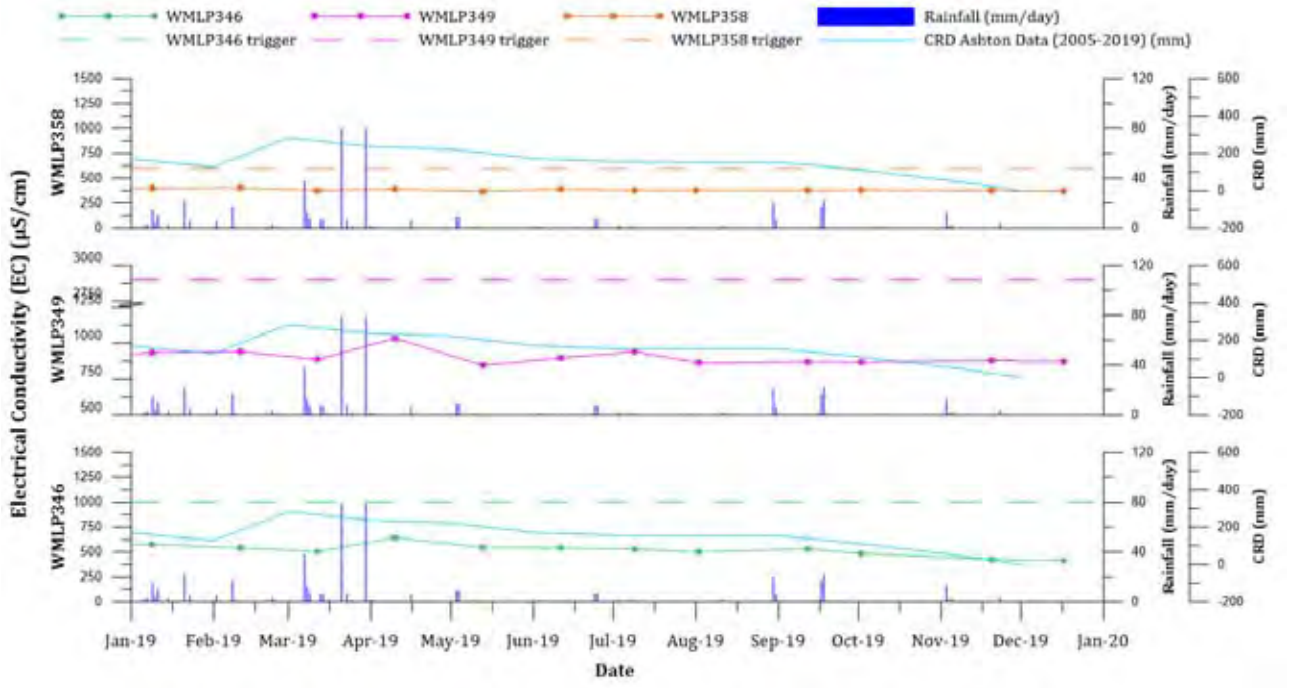

Figure 4.18 Glennies Creek alluvium trigger bore EC trends (2)

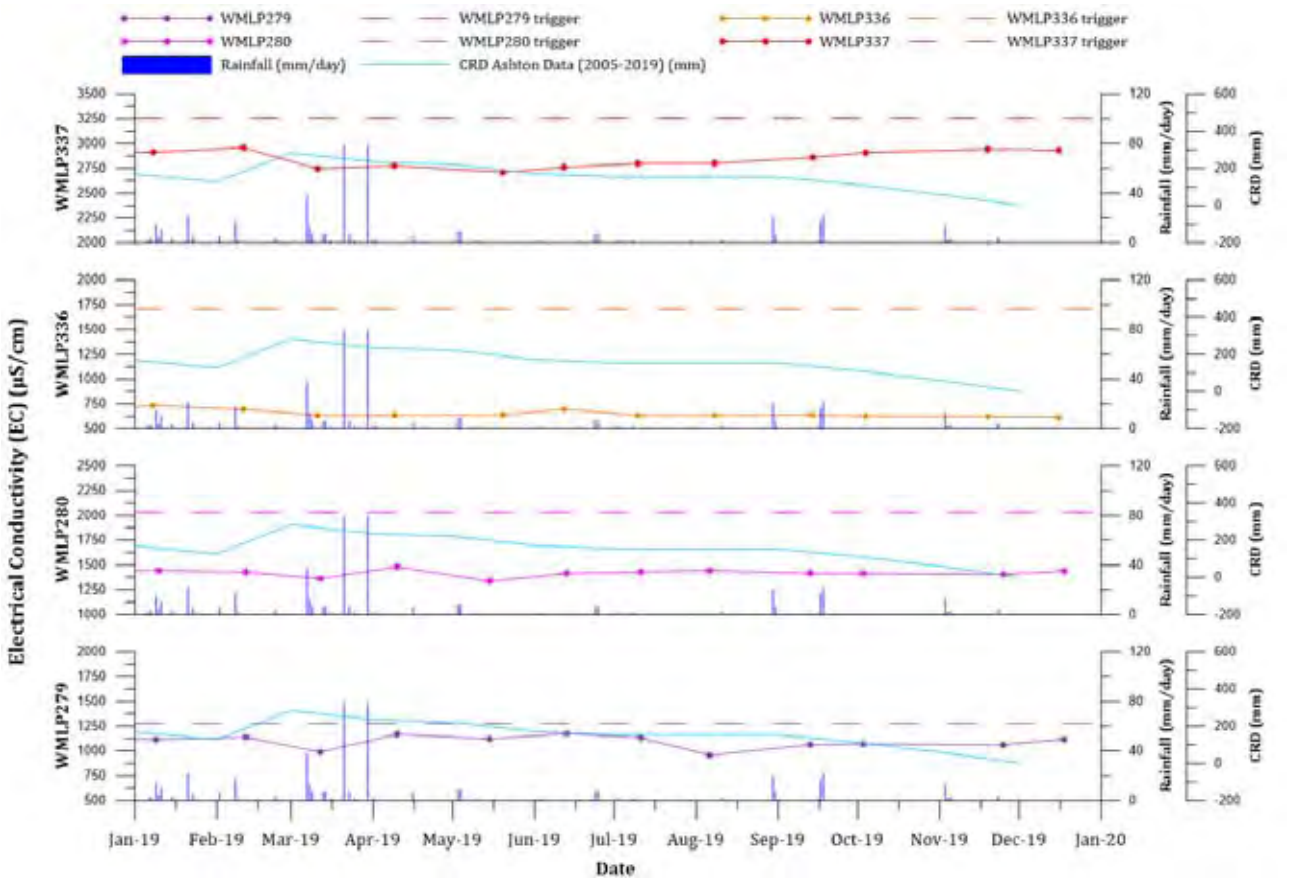

Figure 4.19 Hunter River alluvium trigger bore EC trends

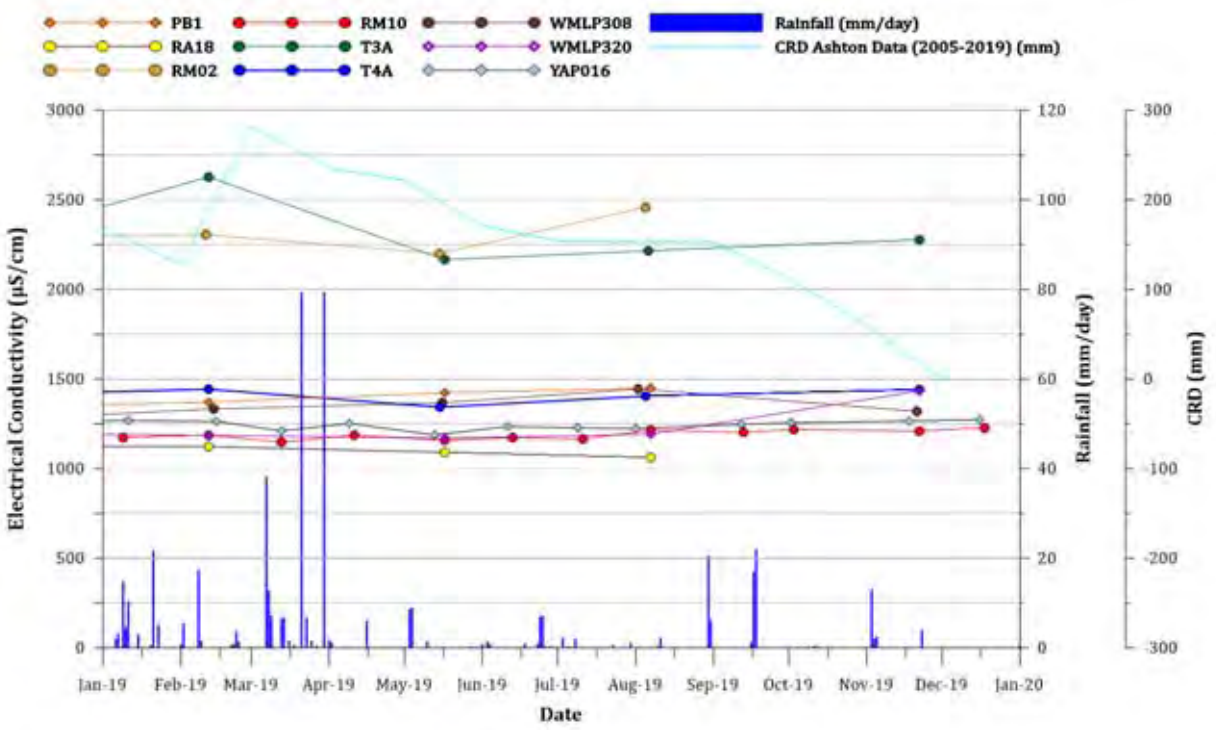

Figure 4.20 Other Bowmans Creek alluvium bore EC trends

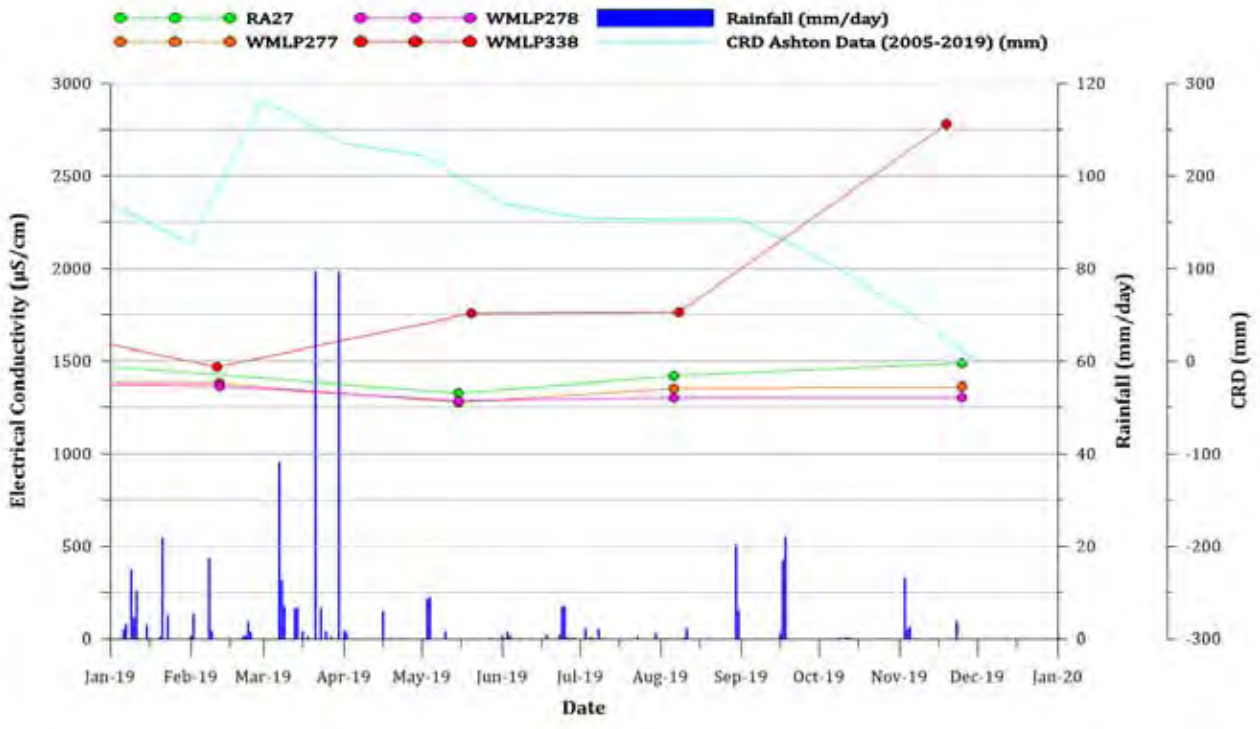

Figure 4.21 Other Hunter River alluvium bore EC trends

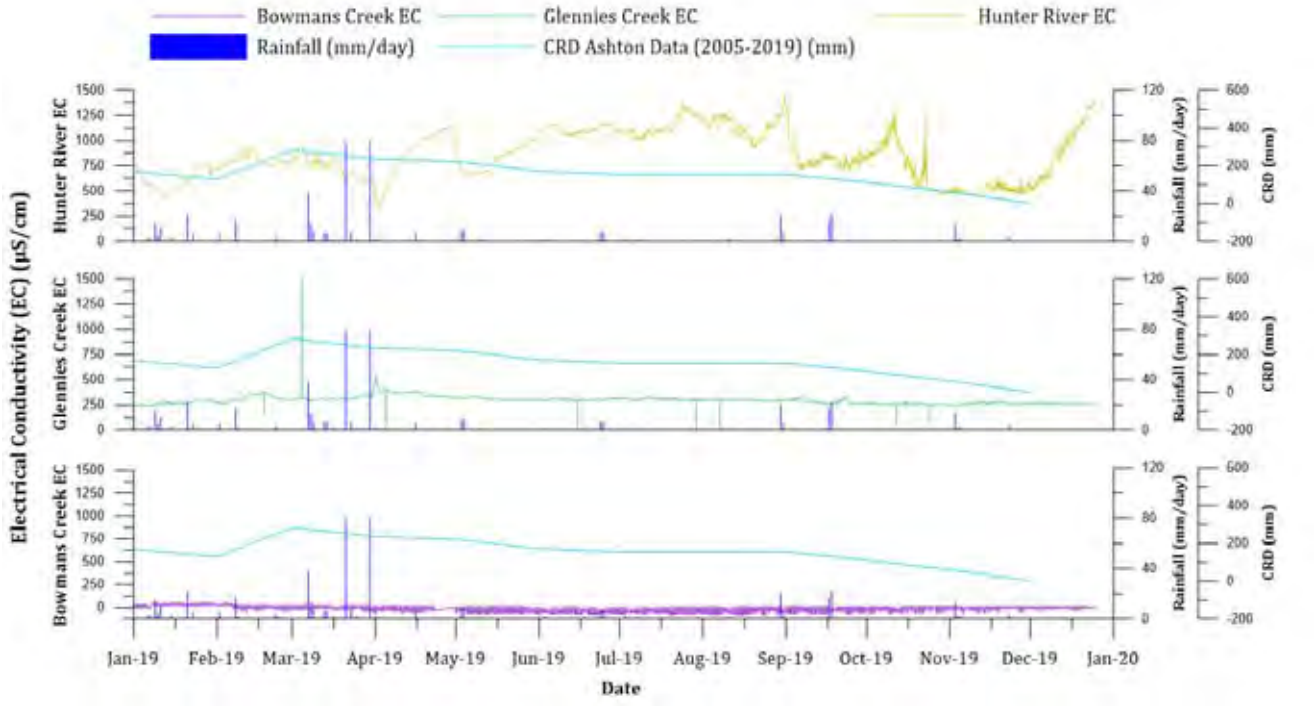

Figure 4.22 Surface water EC trends

4.1.4 *Dissolved metals, select nutrients, turbidity and cyanide*

Comprehensive lab analysis during August 2019 incorporated the measurement of select dissolved metals, select nutrients, turbidity and cyanide as tabulated in Appendix D. Dissolved metals concentrations were compared against ANZECC|ARMCANZ livestock limits (ANZECC & ARMCANZ, 2000), revealing no breaches for any of the metals assessed (arsenic, cadmium, chromium, copper, lead, nickel, selenium and zinc). Manganese and iron were detected at very low concentrations, though neither of these metals are regarded as specifically toxic at such concentrations; and no ANZECC|ARMCANZ livestock limit is established for these metals.

Select nutrients analysis included nitrite and nitrate as N, total Kjeldahl nitrogen as N, total nitrogen as N and total phosphorous as P. All N related concentrations were low, and no nitrate concentration was close to 400 mg/L. Nor was any nitrite concentration near 30 mg/L as defined in the ANZECC|ARMCANZ livestock standards. Total N figures were significantly less than the short-term trigger range of 25- 125 mg/L. Several bores exceeded the lower trigger of P concentration (0.8-12 mg/L), however it is outlined in the guidelines that the value or range for P needs to be determined specific to a site. No site- specific analysis has been conducted at Ashton to define an appropriate P trigger at this time. Turbidity does not have a defined livestock limit for comparison, though analysis of the results indicates that bores that are typically hand bailed rather than pumped yield the greatest turbidity. Cyanide concentrations were so low across samples that no reading was detected above the limit of reporting (LOR). Cyanide levels did not breach any outlined standards.

4.2 Coal measure and coal measure overburden (CMOB) aquifer monitoring

Groundwater level and quality measurements for coal measure and CMOB monitoring bores were taken throughout 2019. Longwall specific VWP pressure heads were also recorded. Hydrographs for these bores are presented in Figure 4.23 through to Figure 4.32.

4.2.1 *Coal measure and CMOB aquifer groundwater levels*

The groundwater level trends for coal measure and CMOB monitoring bores are presented in Figure 4.23 and Figure 4.24, respectively. Groundwater level measurements for LW202 specific monitoring bores are presented in Figure 4.25, and groundwater trends for the recently started longwall LW203 are depicted in Figure 4.26. Longwall specific VWP readings for LW202 are shown in Figure 4.27 and LW203 specific measurements are presented in Figure 4.29. Daily rainfall measurements and CRD have also been plotted and used to compare water level trends.

The following observations can be noted for 2019:

- Water levels were relatively stable in coal measure bores, excepting monitoring bore WML262 which decreased nearly 5 m overall (Figure 4.23).
- Groundwater elevation in CMOB bores display a general decline in 2019, which corresponds to a declining CRD (Figure 4.24).
- Groundwater levels in monitoring bores within the vicinity of LW202 and LW203 remained stable over 2019, with the exception of WML262 (Figure 4.25 and Figure 4.26, respectively). Monitoring bore WML262 (ULD seam) decreased almost 5 m over six months, with the rate of decline increasing notably from June 2019 onwards. This bore has shown an enhanced rate of decline since late 2011 and appears to have been impacted by mining.
- VWP measurements in WMLC248 (adjacent LW201/202) remained stable throughout the year with the exception of readings in the ULLD seam which declined overall (Figure 4.27).

- VWP measurements in WMLP269 (adjacent LW203/204) demonstrated various trends over 2019 (Figure 4.28). Pressure heads measured by the Lemington 5, Lemington 7 and Lemington 8-9 sensors remained stable. Pressure head increases were observed for Lemington 11-12 and Lemington 15 sensors overall, whilst the Lemington 19 sensor noticeably declined. No impacts associated with mining of LW203 are evident from VWP monitoring between October and December 2019. However, it should be noted that VWP WMLP269 is not situated particularly close to LW203 and is only used as the monitoring reference as it is the closest proximity VWP to current mining operations.
- Overall, coal measure and CMOB bores did not appear to be impacted by mining outside of predictions in 2019 – except for monitoring bore WML262 in the ULD seam which demonstrated a significantly larger rate of decline than surrounding bores from June 2019 onwards.

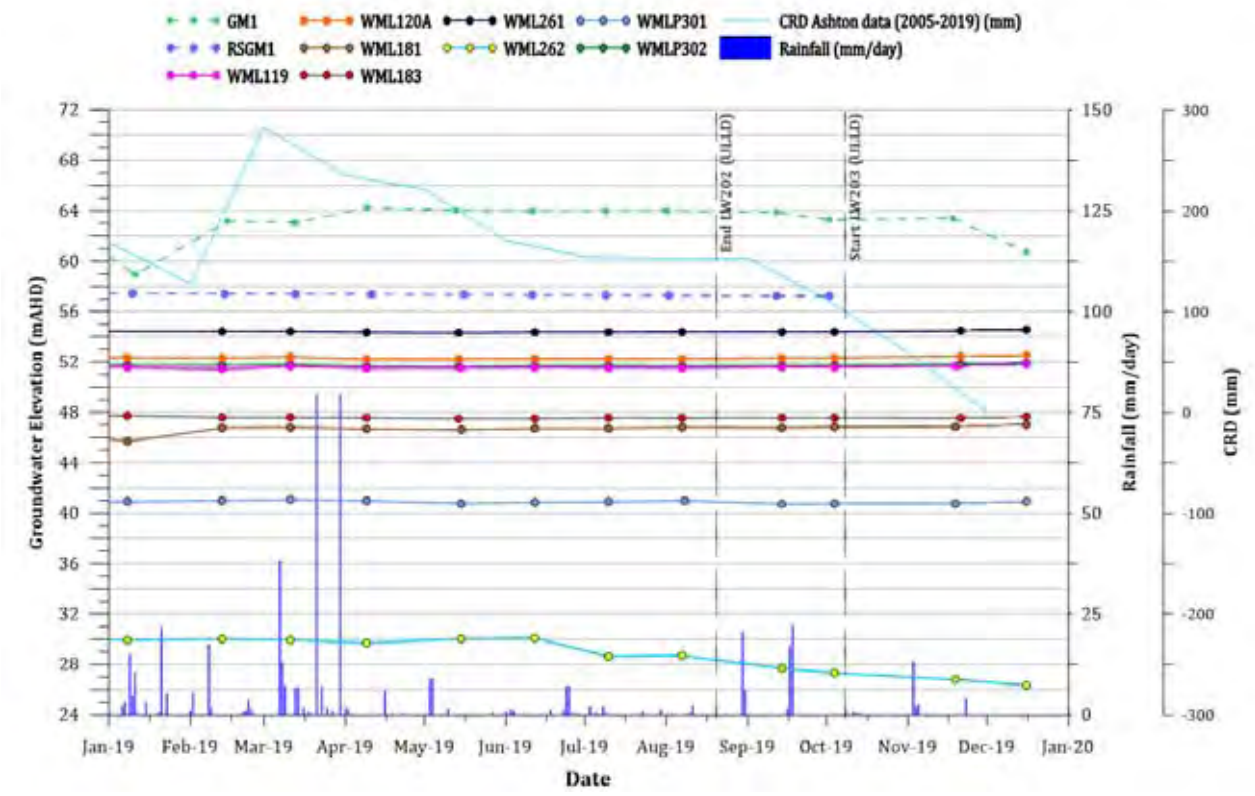

Figure 4.23 Coal measure bore hydrographs

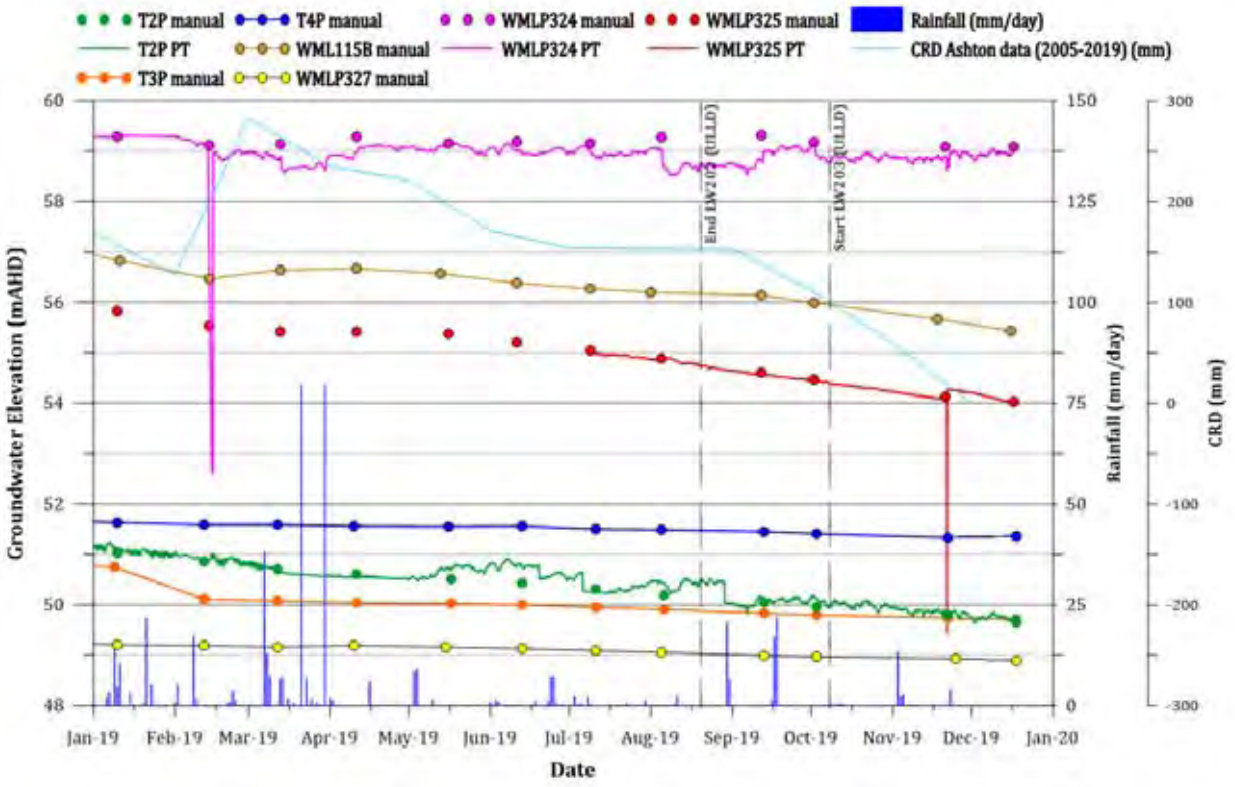

Figure 4.24 Coal measure overburden bore hydrographs

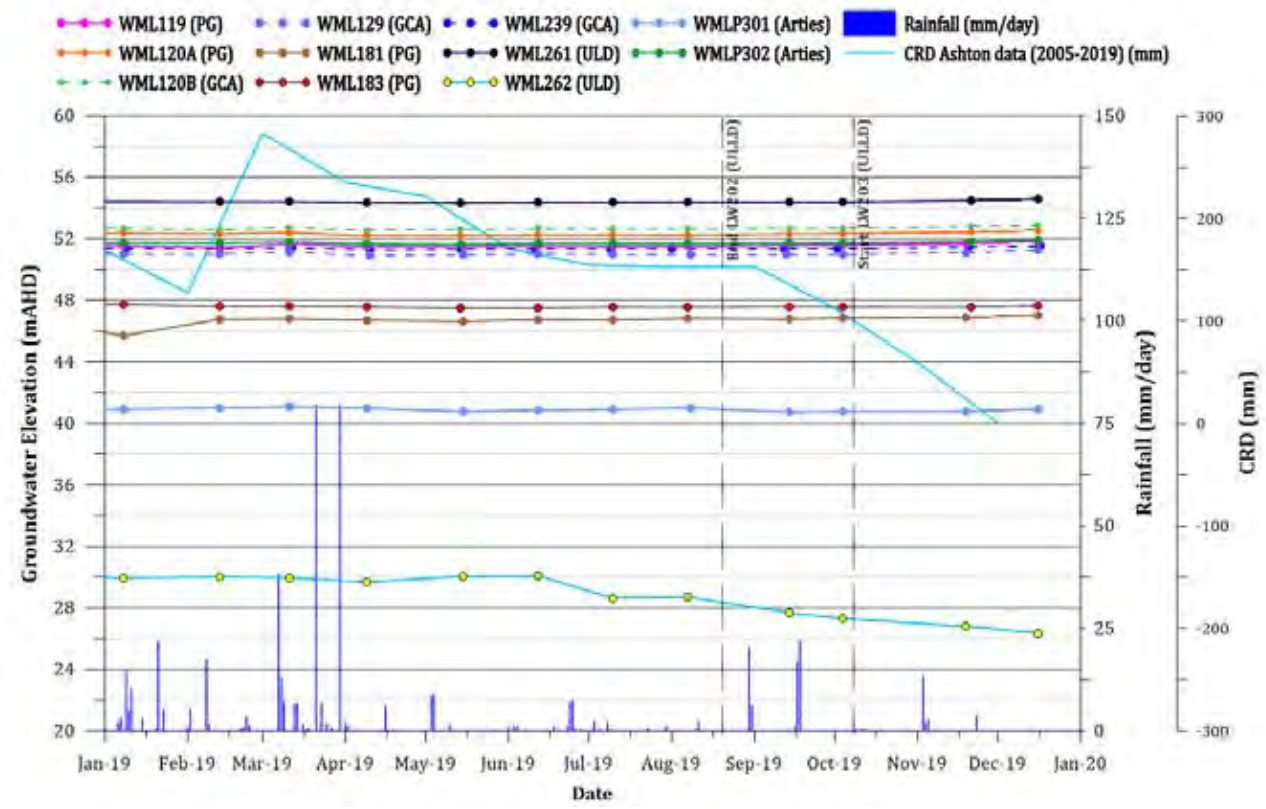

Figure 4.25 Hydrographs for monitoring bores in vicinity of LW202

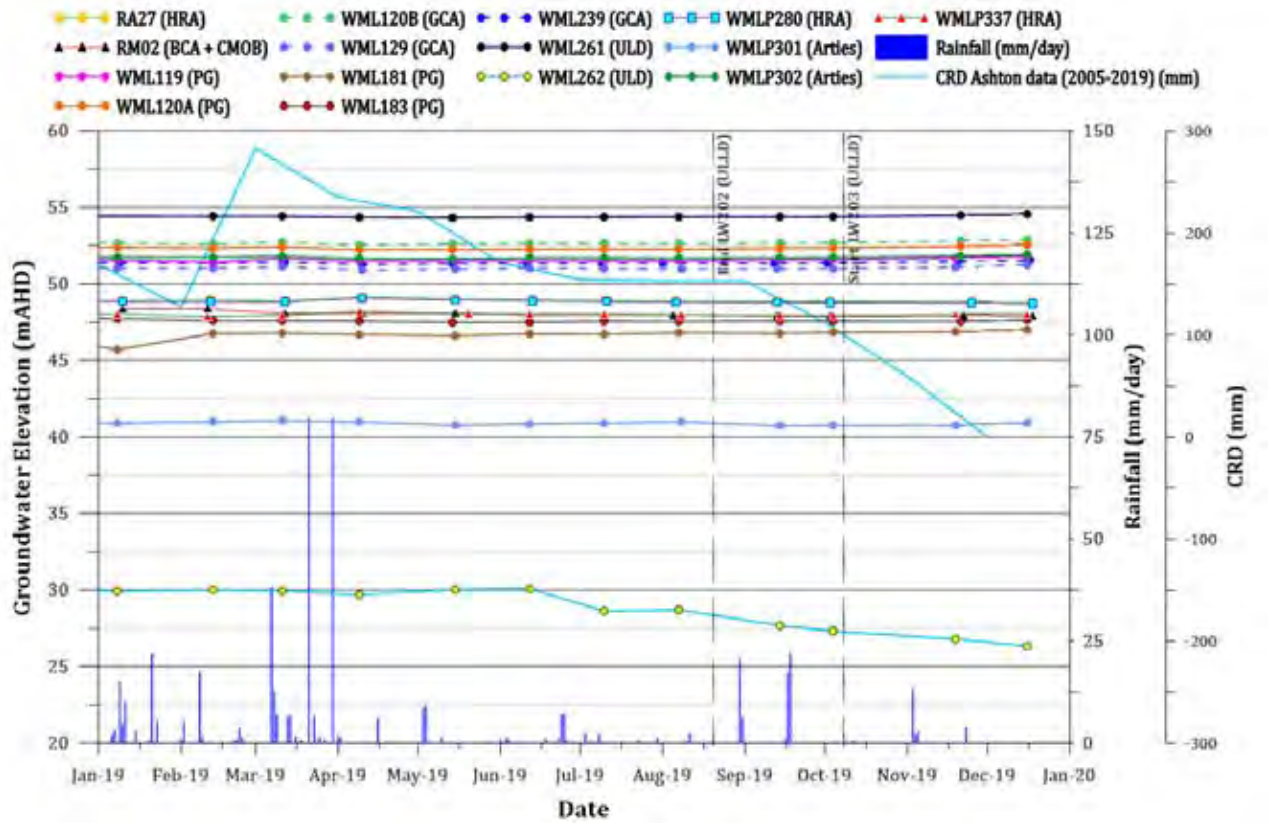

Figure 4.26 Hydrographs for monitoring bores in vicinity of LW203

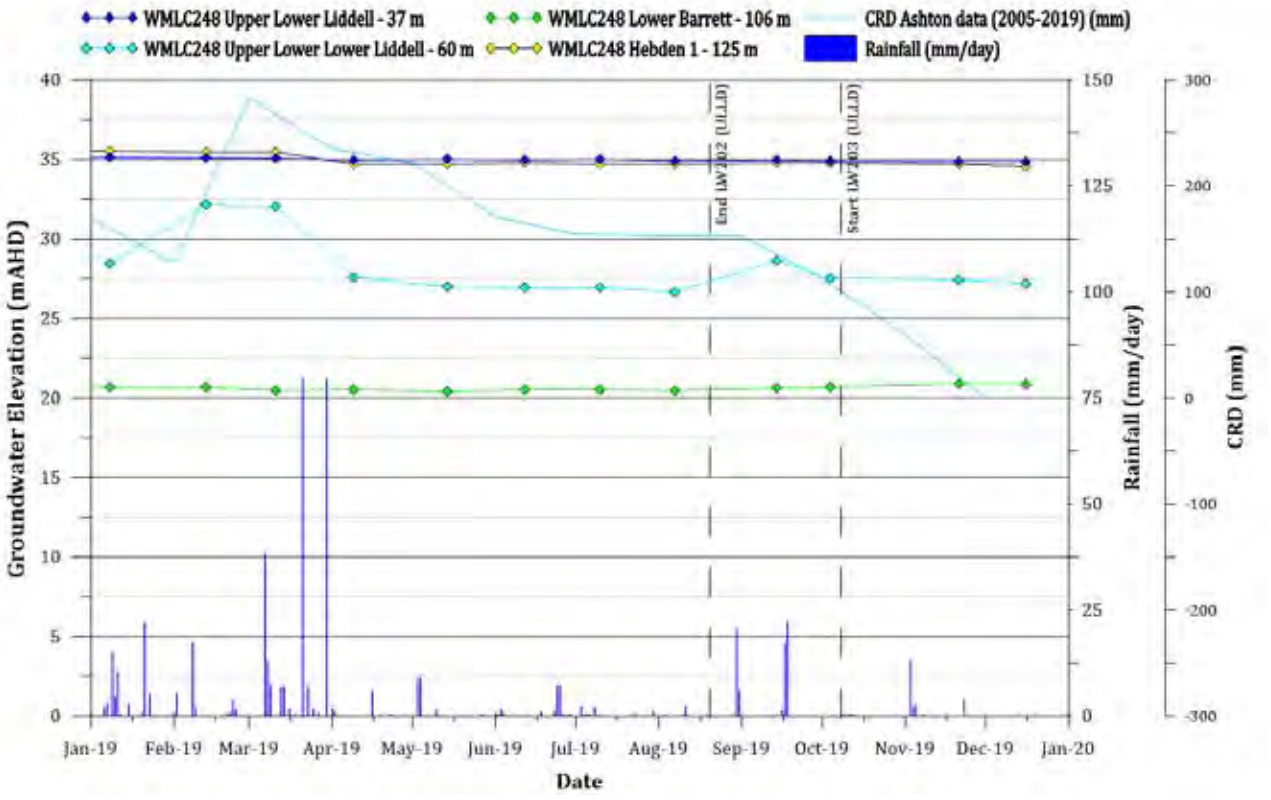

Figure 4.27 Hydrographs for VWP WMLC248 in vicinity of LW202

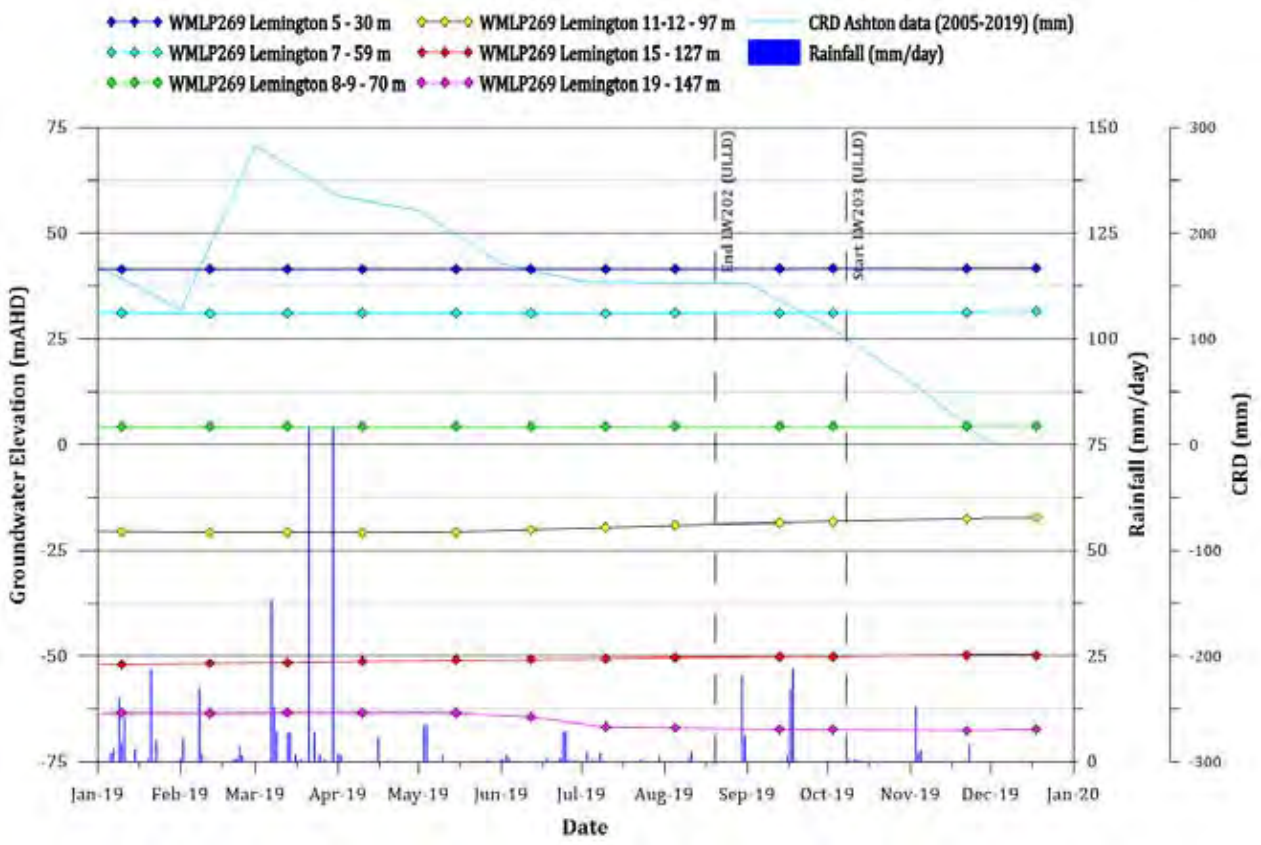

Figure 4.28 Hydrographs for VWP WMLP269 in vicinity of LW203

4.2.2 pH, electrical conductivity and major ions

Coal measure and CMOB bores across the ACP monitoring network were sampled for pH, EC and major ions during 2019, and the results are presented graphically in Figure 4.29 through to Figure 4.32. A complete table of results for the aforementioned parameters is presented in Appendix D; together with comprehensive analysis measurements recorded during annual sampling in August 2019. All associated laboratory files can be found in Appendix F.

Groundwater pH in coal measure and CMOB bores was generally neutral to slightly alkaline in 2019, as has been the case in previous years. pH was stable over 2019, predominantly ranging from pH 6.75 to 8. Exceptions to the outlined pH range were few and minor, with the degree of variation considered within natural variation. The specific pH ranges measured within coal measure and CMOB bores in 2019 were:

- Coal measure – pH 5.64 (WML119) to 8.20 (WML262); and
- CMOB – pH 6.63 (WML115B) to 7.67 (T4P).

Groundwater EC was fresh to brackish across the coal measure and CMOB monitoring network in 2019. EC levels were relatively steady throughout 2019, with no prevailing trend being evident. Minor fluctuations occurred during the year, though the overall trend was stable. EC ranges for coal measure and CMOB bores in 2019 were:

- Coal measure – 749 (WML120A) to 4,458 µS/cm (WML183); and
- CMOB – 1,019 (T2P) to 3,203 µS/cm (WML115B).

The major ion content for coal measure and CMOB bores was also assessed in 2019 (Appendix E). The cation water type in all monitoring bores was Na and Mg dominant. With respect to anions, Cl dominates SO_4 ions in coal measure and CMOB monitoring bores. The coal measure water types are easily distinguished from the CMOB water types with coal measure bores bearing greater Mg concentration, whilst CMOB bores contained higher Ca concentrations.

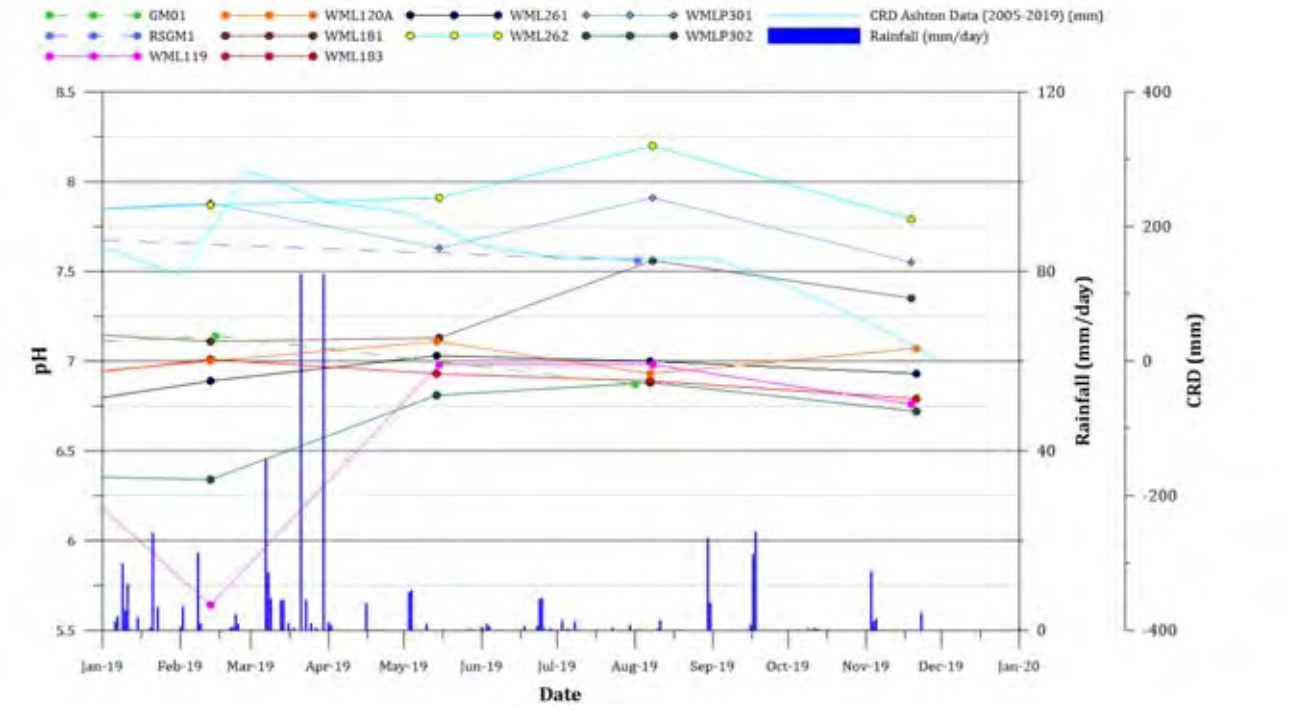

Figure 4.29 Coal measure bore pH trends

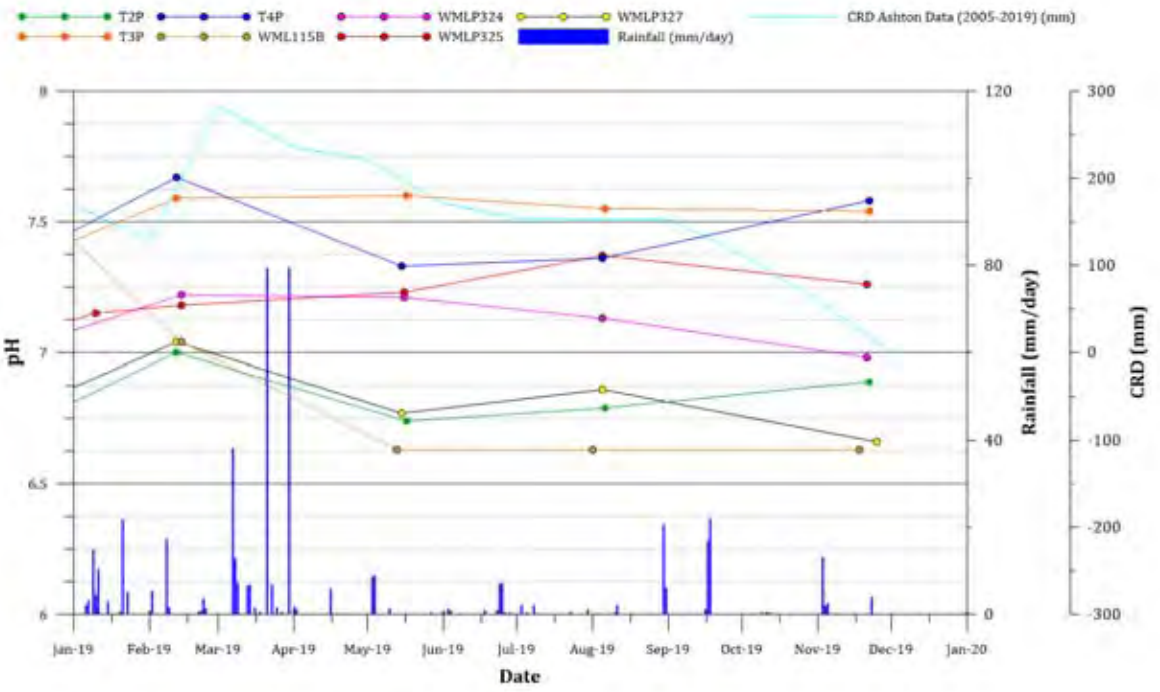

Figure 4.30 Coal measure overburden bore pH trends

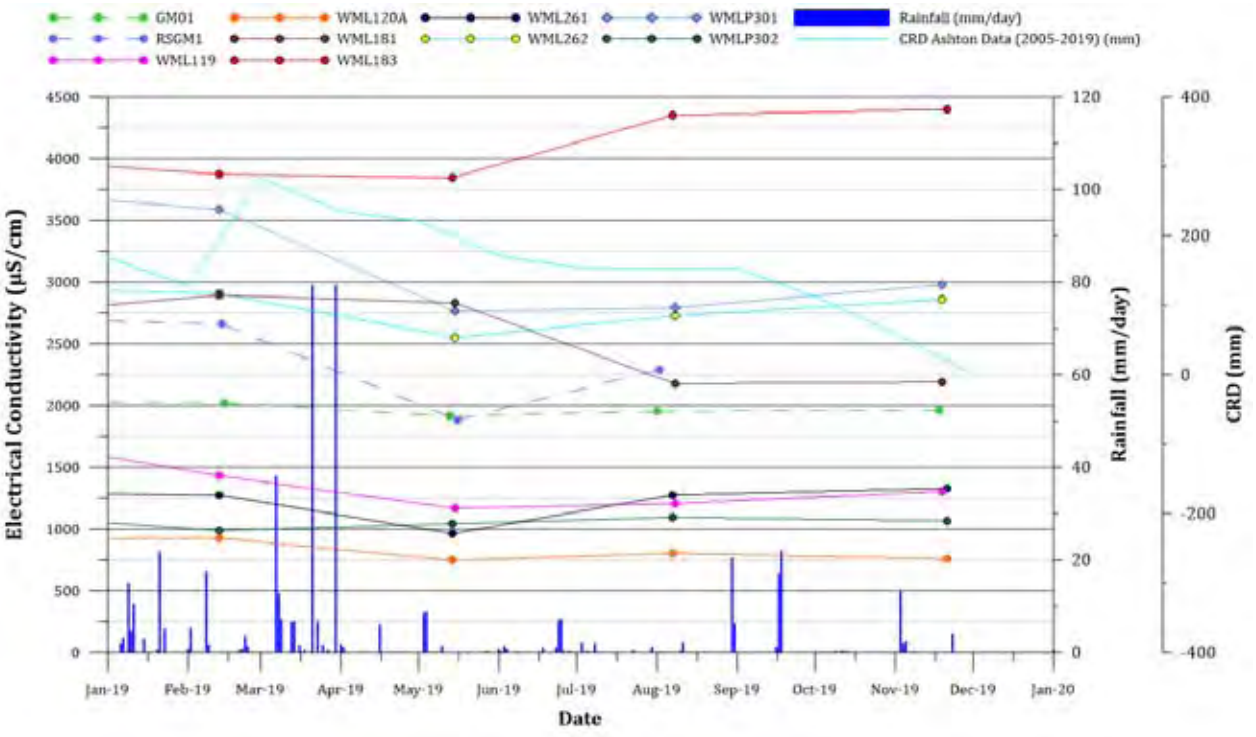

Figure 4.31 Coal measure bore EC trends

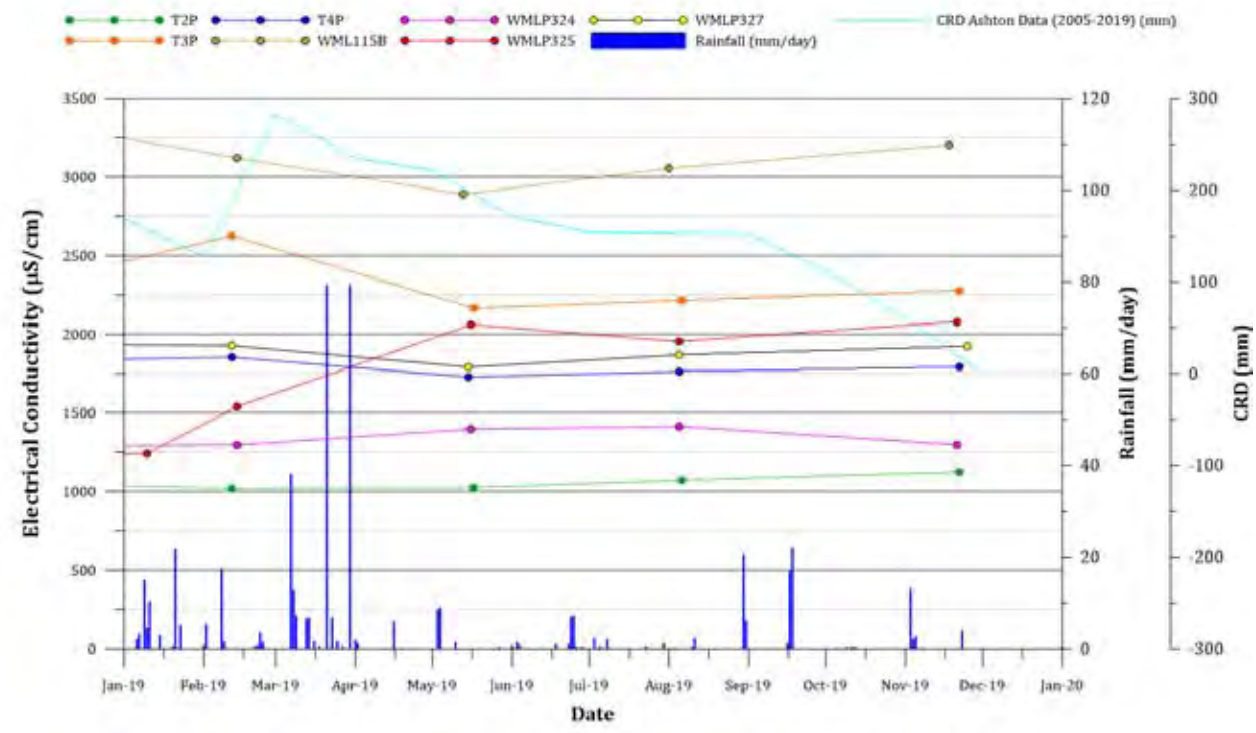

Figure 4.32 Coal measure overburden bore EC trends

4.2.3 Dissolved metals, select nutrients, turbidity and cyanide

Comprehensive lab analysis during August 2019 incorporated the measurement of select dissolved metals, select nutrients, turbidity and cyanide as tabulated in Appendix D.

. Dissolved metals concentrations were compared against ANZECC|ARMCANZ livestock limits (ANZECC & ARMCANZ, 2000), revealing no breaches for any of the metals assessed (arsenic, cadmium, chromium, copper, lead, nickel, selenium and zinc). Manganese and iron were detected at very low concentrations, though neither of these metals are regarded as specifically toxic at such concentrations; and no ANZECC|ARMCANZ livestock limit is established for these metals.

Select nutrients analysis included nitrite and nitrate as N, total Kjeldahl nitrogen as N, total nitrogen as N and total phosphorous as P. All N related concentrations were low, and no nitrate concentration was close to the livestock drinking water guideline of 400 mg/L, nor was any nitrite concentration near 30 mg/L as defined in the ANZECC|ARMCANZ livestock standards. Total N figures fell well below the short-term trigger range of 25-125 mg/L stipulated in the standards. Several bores exceeded the lower trigger of P concentration (0.8-12 mg/L), however it is outlined in the guidelines that the value or range for P needs to be determined specific to a site. No site-specific analysis has been conducted at Ashton to define an appropriate P trigger at this time. Turbidity does not have a defined livestock limit for comparison, though analysis of the results demonstrates that bores that are typically hand bailed rather than pumped yield the greatest turbidity. Cyanide concentrations were so low across samples that no reading was detected above the limit of reporting (LOR). Cyanide levels did not breach any outlined standards.

5 EPL 11879 monitoring bores

Results for 2019 monitoring of EPL 11879 monitoring bores (per Licence Variation March 2019) are summarised in Table 5.1 (levels) and Table 5.2 (EC). Several of the monitoring bores listed in EPL 11879 have been destroyed (RA02, RM04, RM05, RM06, RM07 and RM09) and can no longer be monitored.

Table 5.1 EPL 11879 monitoring bore groundwater levels (2019)

Bore ID	Feb 2019	Aug 2019	Dec 2019
	Groundwater levels (mTOC)		
GM1	10.27	9.44	12.72
GM3A	dry$	7.59	7.61
GM3B	dry$	15.62	15.66
PB1	6.90	7.38	dry
RA02	destroyed	destroyed	destroyed
RM01	dry	dry	dry
RM02	12.71	13.09	13.15
RM03	dry	dry	dry
RM04	destroyed	destroyed	destroyed
RM05	destroyed	destroyed	destroyed
RM06	destroyed	destroyed	destroyed
RM07	destroyed	destroyed	destroyed
RM09	destroyed	destroyed	destroyed
RM10	7.52	7.96	8.62
RSGM1	8.20	8.31	dry

Notes: *$ Water level tagged was below the screen, so declared 'effectively dry'.*
mtoc = metres top of casing.

Table 5.2 EPL 11879 monitoring bore groundwater EC measurements (2019)

Bore ID	Feb 2019	Aug 2019	Dec 2019
	Groundwater EC (µS/cm)		
GM1	2,021	1,952	1,961
GM3A	dry[$]	-[#]	-[#]
GM3B	dry[$]	6,944	-[#]
PB1	1,371	1,449	dry
RA02	destroyed	destroyed	destroyed
RM01	dry	dry	dry
RM02	2,306	2,458	-[#]
RM03	dry	dry	dry
RM04	destroyed	destroyed	destroyed
RM05	destroyed	destroyed	destroyed
RM06	destroyed	destroyed	destroyed
RM07	destroyed	destroyed	destroyed
RM09	destroyed	destroyed	destroyed
RM10	1,186	1,215	1,227
RSGM1	2,660	2,290	dry

Notes: *[$] Water level tagged was below the screen, so declared 'effectively dry'.*

[#] Registered a water level, but insufficient water to sample.

6 Mine inflow

Ashton underground mine inflows are calculated through a review of dewatering abstraction volumes and a water balance assessment. The water balance assessment is the most appropriate tool to assess mine inflows as the volume of abstracted water comprises water from a number of sources, including but not limited to groundwater, surface water, incidental take and groundwater transitioning from the point of entry to the abstraction point. The transition time of this "stored" water is assumed to be in the order of years and is normally not considered inflow that has occurred in the past year. It is considered that the stored water is largely from the groundwater sources (predominantly hardrock) rather than surface water. A proportion of abstracted water is understood to have in-flowed prior to 2019 and was stored temporarily in the goaf. A proportion of the 2019 incidental take has continued to be stored underground or was lost through coal moisture and water vapour via outgoing air.

Data utilised in the assessment includes:

- metered water volumes pumped to the mine from the various sources;
- metered water abstracted from the mine;
- partitioned water takes (from the groundwater modelling) from the surface water sources and the separate groundwater sources; and
- estimate of stored water pumped from the mine.

These volumes are summarised in Table 6.1. During 2019, Ashton abstracted 393.9 ML of water via borehole 5 (BH5), borehole 6 (BH6) and the underground portal. Of that volume, 188.6 ML was introduced into the mine as operational water; therefore, the difference of 205.3 ML is considered a portion of the incidental water take. The remainder of the predicted incidental water (215.7 ML) is considered to be stored in the underground workings or to have been lost through the coal moisture and water vapour via out-by air. The value for estimated stored volume of incidental take of 215.7 ML is considered large and the water level in the underground workings has not increased recently. Therefore, we suggest that this value is not entirely representative of the inflow and that further investigation needs to be undertaken. Additionally, the site abstraction rate and metering should also be reviewed.

The groundwater model (AGE, 2016) predicted that the underground inflow rate into the mine for the period of 2019 would have been 13.3 L/sec. The average 2019 water abstraction rate was 12.5 L/sec.

Table 6.1 Breakdown of abstracted water volumes (2019)

Total water abstracted from mine via BH5, BH6 and Portal	393.9 ML	Mine water input (metered)	188.6 ML		
		Estimate of abstracted water considered inflow water	205.3 ML	421.0 ML	Total predicted incidental water-take for 2019 (from 2016 GW model – Scenario 5: mining LW101-106A, followed by LW201-LW204)
		Portion of incidental water take considered stored in underground and/or lost via coal moisture and water vapour in out-by air	215.7 ML		

7 Summary

Groundwater monitoring over the 2019 reporting period was consistent with the requirements outlined in the WMP. A summary of the findings of this report is as follows:

- Numerous water level and EC trigger exceedances were observed during 2019, prompting enactment of WMP protocol. All water level and EC exceedances occurred in BCA bores. Data from the previous BCA EC investigation (AGE, 2018) was reviewed, and a new investigation was undertaken in response to declining groundwater levels in monitoring bore T2A (AGE, 2019). These previous investigations indicate that a lack of rainfall recharge is the main driver of these BCA exceedances, which are likely exacerbated by underground mining at ACP. It should be noted that ACP is approved to intercept the BCA groundwater resource under DA 309-11-2011-i MOD 5.
- All BCA regulatory bore water levels were measured below trigger values over the year. Two of four BCA trigger bores ran dry throughout 2019; T2A during May and WMLP311 during August. This is chiefly attributed to prevailing drought conditions in the region, coupled with drawdown from underground operations.
- GCA groundwater levels increased overall in 2019. GCA elevation was stable, declining slightly at some locations between January and September 2019. Groundwater elevation in the GCA is closely correlated with water release from Lake St Clair.
- HRA regulatory bore water levels were relatively steady in 2019, varying ±0.2 m overall.
- Bowmans Creek remained dry at the gauge throughout 2019. Glennies Creek and Hunter River water levels were relatively steady over the year, with sudden water level changes considered to be false readings.
- Water levels in coal measure bores were stable during 2019, with the exception of WML262 which decreased nearly 5 m overall. This bore continues to decline at a notably higher rate than surrounding bores. A preliminary analysis of groundwater level decline in this bore has been undertaken. The cause of decline in this bore should be investigated further should this trend continue.
- Groundwater elevation in CMOB bores generally decreased over the year. This decline is attributed to long term drought conditions.
- Groundwater elevations in longwall specific VWP WMLC248 (adjacent LW201/202) remained stable throughout 2019, with the exception of pressure head in the ULLD seam which slightly declined. Longwall specific VWP WMLP269 (adjacent LW203/204) displayed variable groundwater elevation trends over 2019. Groundwater elevation measured by the Lemington 5, 7 and 8-9 sensors were stable; whilst the Lemington 11-12 and 15 sensors displayed an increase in pressure head. Pressure head in the Lemington 19 sensor declined. Overall, the groundwater impacts associated with mining of LW202/203 were within those predicted.
- Groundwater pH measurements were stable during 2019. No consecutive pH exceedances occurred, and slight changes in pH are attributed to natural variation.
- BCA EC levels increased in 2019 due to a decline in BCA water levels. This trend is expected to persist if the BCA resource continues to decline.
- GCA, HRA, coal measure and CMOB EC levels were relatively steady over the year. Minor fluctuations were noted, though no significant trends were identified.
- Major ion analysis indicated that the CMOB, BCA and HRA water types are similar and can be distinguished from the GCA and the coal measure water types, which is due to the water source and the recharge/discharge mechanism associated with each body.

- Dissolved metals, select nutrients, turbidity and cyanide concentrations within ACP monitoring bores were compared against ANZECC|ARMCANZ livestock limits (ANZECC & ARMCANZ, 2000), revealing no breaches for any of the analytes assessed. Several bores exceeded the lower trigger of phosphorous concentration (0.8-12 mg/L), however it is outlined in the guidelines that the value or range for phosphorous needs to be determined specific to a site. No site-specific analysis has been conducted at Ashton to define an appropriate phosphorous trigger at this time.
- EPL 11879 listed monitoring bore water levels declined overall throughout 2019. EC in some EPL 11879 bores increased, while in others EC decreased overall.
- Underground mine inflows are within predicted limits, but a review of site data is recommended to confirm the accuracy of abstraction volume estimates.

Generally, the site has experienced no mining impacts to the GCA and HRA alluvial aquifers and impacts are within predictions in the coal measures. A lack of rainfall recharge has impacted groundwater levels in the BCA and shallow CMOB bores.

8 References

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Appendix A Summary of WMP monitoring locations

Table A1 GWMP monitoring bore locations

ID	Type	Easting (GDA94 Z56)	Northing (GDA94 Z56)	Top of casing (mAHD)	Depth (m)
Ashton Well	Monitoring bore	318355	6406029	62	-
GM1	EPL Monitoring bore^	318431	6407214	67	203
GM3A	EPL Monitoring bore^	320246.5	6405976.9	59	16.2
GM3B	EPL Monitoring bore^	320250.9	6405976.7	59	7.5
PB1	EPL Monitoring bore^	317545	6405301	61.1	7.8
RA02	EPL Monitoring bore^	317712.8	6405233	55.2	11.3
RA18	Monitoring bore	317821.8	6405434.2	62.6	8.5
RA27	Monitoring bore	317952.1	6403738	61.6	15.5
RM01	EPL Monitoring bore^	318041	6404109.5	69.4	10.8
RM02	EPL Monitoring bore^	317942	6404506	61.1	12.9
RM03	EPL Monitoring bore^	317667	6404844.5	62.1	11
RM10	EPL Monitoring bore^	317589	6405292	61.6	10.8
RSGM1	EPL Monitoring bore^	317655	6406302	65.6	8.5
T2-A	Monitoring bore	317583.3	6405217.4	60.8	8.9
T2-P	Monitoring bore	317587	6405222	60.7	14.9
T3-A	Monitoring bore	317654.2	6404708	59.9	10.8
T3-P	Monitoring bore	317650	6404702	59.8	30.5
T4-A	Monitoring bore	317685.8	6404323.1	58.6	10.7
T4-P	Monitoring bore	317683	6404319	58.5	31.9
T5	Monitoring bore	317946.1	6406549.4	65.3	8.8
WML113A	Vibrating wire piezometer	317369	6404529	60.2	-
WML113C	Monitoring bore	317377	6404526	60.2	50
WML115B	Monitoring bore	317881	6406704	66.4	40
WML115C	Monitoring bore	317888	6406710	66.2	6.2
WML119	Monitoring bore	319255.3	6403930.1	61.5	35
WML120A	Monitoring bore	319292	6404579.6	60.4	20
WML120B	Monitoring bore	319293.6	6404587.5	60.1	9
WML129	Monitoring bore	319468.4	6403527.8	55.3	7
WML181	Monitoring bore	319215	6403958.3	64.3	32
WML183	Monitoring bore	319188.2	6404325.2	76.7	45.5
WML213	Vibrating wire piezometer	317210	6404154	61.5	316
WML239	Monitoring bore	319345	6404044.8	58.8	13.5
WML245	Vibrating wire piezometer	320035	6404835	64.9	101
WML261	Monitoring bore	319320.2	6404705.9	58.7	39

ID	Type	Easting (GDA94 Z56)	Northing (GDA94 Z56)	Top of casing (mAHD)	Depth (m)
WML262	Monitoring bore	319220.1	6403927.7	63.2	60.3
WMLP269	Vibrating wire piezometer	317850	6404073	65.5	65.5
WMLC144	Vibrating wire piezometer	319500	6404170	59.3	132
WMLC248	Vibrating wire piezometer	319326	6404721	58.5	144.6
WMLC334	Vibrating wire piezometer	318589	6403088	75.9	218.5
WMLC335	Vibrating wire piezometer	318892	6402936	64.5	200.5
WMLP277	Monitoring bore	317643.2	6403958.5	59	13
WMLP278	Monitoring bore	317626.3	6403894.2	62.3	12.5
WMLP279	Monitoring bore	317298.9	6403991.8	62.7	17.4
WMLP280	Monitoring bore	317797.6	6403793.4	62.5	16
WMLP301	Monitoring bore	319235	6403858	60.2	10
WMLP302	Monitoring bore	319299.6	6404600.2	59.7	10.5
WMLP308	Monitoring bore	318222.7	6406373	65.7	9.1
WMLP311	Monitoring bore	318178.9	6406047.9	63.6	7.6
WMLP320	Monitoring bore	317457.2	6405388	61.5	8
WMLP323	Monitoring bore	318242.2	6406594.7	64.5	7.3
WMLP324	Monitoring bore	318240	6406594	64.5	14.1
WMLP325	Monitoring bore	318181	6406050	63.7	14.6
WMLP326	Monitoring bore	317571	6404103.2	59.3	11.2
WMLP327	Monitoring bore	317573	6404103	59.4	18
WMLP328	Monitoring bore	317927.3	6405611.6	62.8	12.1
WMLP336	Monitoring bore	318965.4	6402841.9	60.6	15.5
WMLP337	Monitoring bore	318418	6403129	59.9	13.5
WMLP338	Monitoring bore	318624.7	6402794	58.8	12.9
WMLP343	Monitoring bore	319623	6404606	61	11.9
WMLP346	Monitoring bore	319366.5	6404457.2	60.68	12.5
WMLP349	Monitoring bore	319516	6404198	58.3	10
WMLP358	Monitoring bore	319560	6403704	59.49	9.66
WMLP361	Vibrating wire piezometer	317722	6405962	62.9	191
WMLP363	Vibrating wire piezometer	317963	6406634	66	164
YAP016	Monitoring bore	318438	6407195	66.8	7.3

Notes: * *Resurveyed post mining.*

^ *Field coordinates not surveyed.*

Appendix B Summary of GWMP Plan – parameters and frequency

Table B1 Summary of groundwater monitoring program

ID	Type	Data recording method	Targets	Monthly	Quarterly	Annually
Ashton Well	Monitoring bore	-	BCA	Water level only	Monthly plus field parameters	Quarterly plus minor lab analysis
GM1	EPL Monitoring bore*	-	197-203m deep (BAR seam?)	Water level only	Monthly plus field EC only	Quarterly plus field parameters and **comprehensive** analysis
GM3A	EPL Monitoring bore*	-	GCA	Water level only	Monthly plus field parameters	Quarterly plus minor lab analysis
GM3B	EPL Monitoring bore*	-	GCA	Water level only	Monthly plus field parameters	Quarterly plus minor lab analysis
PB1	EPL Monitoring bore*	-	BCA	Water level only	Monthly plus field EC only	Quarterly plus minor lab analysis
RA02	EPL Monitoring bore*	-	BCA + CMOB	Water level only	Monthly plus field EC only	Quarterly plus field parameters and **comprehensive** analysis
RA18	Monitoring bore	-	BCA	Water level only	Monthly plus field parameters	Quarterly plus minor lab analysis
RA27	Monitoring bore	-	HRA	Water level only	Monthly plus field parameters	Quarterly plus **comprehensive** analysis
RM01	EPL Monitoring bore*	-	BCA	Water level only	Monthly plus field EC only	Quarterly plus minor lab analysis
RM02	EPL Monitoring bore*	-	BCA + CMOB	Water level only	Monthly plus field EC only	Water level and field EC only
RM03	EPL Monitoring bore*	-	BCA + CMOB	Water level only	Monthly plus field EC only	Quarterly plus minor lab analysis
RM10	Monitoring bore	-	BCA + CMOB	Water level and field parameters	Monthly plus minor lab analysis	Quarterly plus minor lab analysis
RSGM1	EPL Monitoring bore*	-	Coal measure (BWS)	Water level only	Monthly plus field EC only	Quarterly plus field parameters and **comprehensive** analysis
T2-A	Monitoring bore	Pressure transducer	BCA	Water level and field parameters	Monthly plus minor lab analysis	Quarterly plus **comprehensive** analysis

ID	Type	Data recording method	Targets	Monthly	Quarterly	Annually
T2-P	Monitoring bore	Pressure transducer	CMOB	Water level only	Monthly plus field parameters and minor lab analysis	Quarterly plus **comprehensive** analysis
T3-A	Monitoring bore	-	BCA	Water level only	Monthly plus field parameters	Quarterly plus **comprehensive** analysis
T3-P	Monitoring bore	-	CMOB	Water level only	Monthly plus field parameters	Quarterly plus **comprehensive** analysis
T4-A	Monitoring bore	-	BCA + BWS	Water level only	Monthly plus field parameters and minor lab analysis	Quarterly plus **comprehensive** analysis
T4-P	Monitoring bore	-	CMOB	Water level only	Monthly plus field parameters and minor lab analysis	Quarterly plus **comprehensive** analysis
T5	Monitoring bore	Pressure transducer	BCA	Water level only	Monthly plus field parameters	Quarterly plus **comprehensive** analysis
WML113A	Vibrating wire piezometer	-	BW2, Lem4, Lem9, Lem11-12, Lem15	Pressure head	Pressure head	Pressure head
WML113C	Monitoring bore	-	BCA	Water level and field parameters	Monthly plus minor lab analysis	Quarterly plus **comprehensive** analysis
WML115B	Monitoring bore	-	CMOB & Lem3-4	Water level only	Monthly plus field parameters	Quarterly plus minor lab analysis
WML115C	Monitoring bore	-	BCA	Water level only	Monthly plus field parameters	Quarterly plus minor lab analysis
WML119	Monitoring bore	-	PG	Water level only	Monthly plus field parameters and minor lab analysis	Quarterly plus **comprehensive** analysis
WML120A	Monitoring bore	-	PG	Water level only	Monthly plus field parameters and minor lab analysis	Quarterly plus **comprehensive** analysis
WML120B	Monitoring bore	-	GCA	Water level and field parameters	Monthly plus minor lab analysis	Quarterly plus **comprehensive** analysis
WML129	Monitoring bore	-	GCA	Water level and field parameters	Monthly plus minor lab analysis	Quarterly plus **comprehensive** analysis

ID	Type	Data recording method	Targets	Monthly	Quarterly	Annually
WML181	Monitoring bore	-	PG	Water level only	Monthly plus field parameters and minor lab analysis	Quarterly plus **comprehensive** analysis
WML183	Monitoring bore	-	PG	Water level only	Monthly plus field parameters and minor lab analysis	Quarterly plus **comprehensive** analysis
WML213	Vibrating wire piezometer	-	BWS, Lem 8-9, Lem 15, Lem 19, PG, ULD, ULLD, LB	Pressure head	Pressure head	Pressure head
WML239	Monitoring bore	-	GCA	Water level and field parameters	Monthly plus minor lab analysis	Quarterly plus **comprehensive** analysis
WML245	Vibrating wire piezometer	-	ULD, MLD, LB, LB-HEB int	Pressure head	Pressure head	Pressure head
WML261	Monitoring bore	-	ULD	Water level only	Monthly plus field parameters and minor lab analysis	Quarterly plus **comprehensive** analysis
WML262	Monitoring bore	-	ULD	Water level only	Monthly plus field parameters and minor lab analysis	Quarterly plus **comprehensive** analysis
WMLP269	Vibrating wire piezometer	-	Lem 5, Lem 7, Lem 8-9, Lem 11-12, Lem 15, Lem 19	Pressure head	Pressure head	Pressure head
WMLC144	Vibrating wire piezometer	-	ULD, MLD1, MLD2, ULLD, LLLD, UBS, LB	Pressure head	Pressure head	Pressure head
WMLC248	Vibrating wire piezometer	-	ULLD, ULLL, LB, HEB	Pressure head	Pressure head	Pressure head
WMLC334	Vibrating wire piezometer	-	Lem 13, Lem 15, Lem 18/19, Art, ULD, ULLD, UB, LB	Pressure head	Pressure head	Pressure head
WMLC335	Vibrating wire piezometer	-	Lem 15B, Lem 17, PG Upper, Art, ULDB, LLLD, UB, LB	Pressure head	Pressure head	Pressure head
WMLP277	Monitoring bore	Pressure transducer	HRA	Water level only	Monthly plus field parameters	Quarterly plus **comprehensive** analysis
WMLP278	Monitoring bore	-	HRA	Water level only	Monthly plus field parameters	Quarterly plus **comprehensive** analysis

ID	Type	Data recording method	Targets	Monthly	Quarterly	Annually
WMLP279	Monitoring bore	-	HRA	Water level and field parameters	Monthly plus minor lab analysis	Quarterly plus **comprehensive** analysis
WMLP280	Monitoring bore	-	HRA	Water level and field parameters	Monthly plus minor lab analysis	Quarterly plus **comprehensive** analysis
WMLP301	Monitoring bore	-	Arties Seam	Water level only	Monthly plus field parameters and minor lab analysis	Quarterly plus **comprehensive** analysis
WMLP302	Monitoring bore	-	Arties Seam	Water level only	Monthly plus field parameters and minor lab analysis	Quarterly plus **comprehensive** analysis
WMLP308	Monitoring bore	-	BCA	Water level only	Monthly plus field parameters	Quarterly plus **comprehensive** analysis
WMLP311	Monitoring bore	Pressure transducer	BCA	Water level and field parameters	Monthly plus minor lab analysis	Quarterly plus **comprehensive** analysis
WMLP320	Monitoring bore	-	BCA	Water level only	Monthly plus field parameters	Quarterly plus minor lab analysis
WMLP323	Monitoring bore	Pressure transducer	BCA	Water level and field parameters	Monthly plus minor lab analysis	Quarterly plus **comprehensive** analysis
WMLP324	Monitoring bore	Pressure transducer	CMOB	Water level only	Monthly plus field parameters and minor lab analysis	Quarterly plus **comprehensive** analysis
WMLP325	Monitoring bore	Pressure transducer	CMOB	Water level only	Monthly plus field parameters	Quarterly plus **comprehensive** analysis
WMLP326	Monitoring bore	-	BCA	Water level only	Monthly plus field parameters	Quarterly plus minor lab analysis
WMLP327	Monitoring bore	-	CMOB	Water level only	Monthly plus field parameters	Quarterly plus minor lab analysis
WMLP328	Monitoring bore	Pressure transducer	BCA	Water level and field parameters	Monthly plus minor lab analysis	Quarterly plus **comprehensive** analysis
WMLP336	Monitoring bore	-	HRA + CMOB	Water level and field parameters	Monthly plus minor lab analysis	Quarterly plus **comprehensive** analysis

ID	Type	Data recording method	Targets	Monthly	Quarterly	Annually
WMLP337	Monitoring bore	-	HRA	Water level and field parameters	Monthly plus minor lab analysis	Quarterly plus **comprehensive** analysis
WMLP338	Monitoring bore	-	HRA	Water level only	Monthly plus field parameters	Quarterly plus **comprehensive** analysis
WMLP343	Monitoring bore	Pressure transducer	GCA	Water level and field parameters	Monthly plus minor lab analysis	Quarterly plus **comprehensive** analysis
WMLP346	Monitoring bore	-	GCA	Water level and field parameters	Monthly plus minor lab analysis	Quarterly plus **comprehensive** analysis
WMLP349	Monitoring bore	-	GCA	Water level and field parameters	Monthly plus minor lab analysis	Quarterly plus **comprehensive** analysis
WMLP358	Monitoring bore	-	GCA	Water level and field parameters	Monthly plus minor lab analysis	Quarterly plus **comprehensive** analysis
WMLP361	Vibrating wire piezometer	VWP datalogger	Lem 5, Lem 8, Lem 15A, Art, ULD	Pressure head	Pressure head	Pressure head
WMLP363	Vibrating wire piezometer	VWP datalogger	CMOB, Lem 8, Lem 9-10 int, Lem 12, Lem 14, Lem 15, PG roof, ULD	Pressure head	Pressure head	Pressure head
YAP016	Monitoring bore	Pressure transducer	BCA	Water level and field parameters	Monthly plus minor lab analysis	Quarterly plus **comprehensive** analysis

Note: **Per EPL 11879.*

Appendix C Extract GWMP protocol for exceedance of groundwater trigger values (Yancoal, 2018)

In the event of a groundwater assessment criterion (Table 23 and Section 7.2) being exceeded, the following protocol will be followed:

1. Check and validate the data which indicates an exceedance of the criterion, including whether the exceedance is ongoing.
2. A preliminary investigation will be undertaken to establish the cause(s) and determine whether changes to the water management system or operations are required. This will involve the consideration of the monitoring results in conjunction with:
    a) site activities being undertaken at the time;
    b) activities at nearby operations (cumulative affects);
    c) groundwater extraction by others;
    d) baseline monitoring results and natural fluctuations;
    e) predictive modelling;
    f) groundwater monitoring at nearby locations;
    g) the prevailing and preceding meteorological and streamflow conditions; and
    h) changes to the land use/activities being undertaken nearby.
3. If the preliminary investigation shows that the impact is linked to activities undertaken by ACOL, a report will be emailed to the DPE and any other relevant department. Causal factors will be addressed and rectified if possible. Contingency measures will be developed in consultation with the DPE and any other relevant department and implemented in response to the outcomes of the investigation.
4. Remedial/compensatory measures will be developed in consultation with DPE and any other relevant department and implemented in response to the outcomes of the investigations.
5. Monitoring would be implemented as required to confirm the effectiveness of remedial measures.
6. Where required, an independent hydrogeologist will be engaged to conduct investigations. ACOL will seek the Secretary of DPE's approval in selecting a hydrogeologist.

Any exceedances and responses taken to ameliorate these exceedances will be reported in the Annual Review.

Appendix D Annual groundwater quality laboratory results 2019

Table D1 Annual groundwater quality results – field and laboratory (2019)

Bore ID	Geology	Laboratory ID	Date	pH Value (Field)	pH Value (Lab)	pH RPD	EC (Field)	EC (Lab)	EC RPD	Total Dissolved Solids (TDS)
Units				pH	pH	%	µS/cm	µS/cm	%	mg/L
Limit of Reporting (LOR)					0.01			1		10
ANZECC livestock limits							5970	5970*		4000
PB1	BCA	ES1925152-002	7/08/2019	7.11	7.97	-11.41	1449	1620	-11.14	1024
RA18	BCA	ES1925152-003	7/08/2019	8.66	7.92	8.93	1062	1250	-16.26	701
RM10	BCA	ES1925152-004	7/08/2019	7.08	7.94	-11.45	1215	1380	-12.72	854
T3A	BCA	ES1925150-003	6/08/2019	6.86	7.10	-3.44	2215	2510	-12.49	1240
T4A	BCA	ES1925152-009	5/08/2019	7.26	7.93	-8.82	1405	1610	-13.60	828
WML113C	BCA	ES1925150-005	6/08/2019	7.16	7.26	-1.39	986	1120	-12.73	568
WMLP308	BCA	ES1925151-008	2/08/2019	7.01	7.43	-5.82	1445	1730	-17.95	844
WMLP311	BCA	ES1925152-011	5/08/2019	7.15	7.21	-0.84	1325	1510	-13.05	728
WMLP320	BCA	ES1925152-006	7/08/2019	7.03	7.86	-11.15	1192	1360	-13.17	834
WMLP323	BCA	ES1925152-012	5/08/2019	6.96	7.29	-4.63	1223	1510	-21.00	696
WMLP326	BCA	ES1925152-007	5/08/2019	7.22	8.06	-10.99	1385	1590	-13.78	977
YAP016	BCA	ES1925151-010	1/08/2019	7.08	7.60	-7.08	1224	1410	-14.12	664
T2P	CMOB	ES1925150-002	6/08/2019	6.79	7.26	-6.69	1071	1210	-12.19	609
T3P	CMOB	ES1925150-004	6/08/2019	7.55	7.84	-3.77	1804	1840	-1.98	989
T4P	CMOB	ES1925152-010	5/08/2019	7.36	8.02	-8.58	1762	1990	-12.15	965
WML115B	CMOB	ES1925152-005	1/08/2019	6.63	7.79	-16.09	3055	3450	-12.14	2309
WMLP324	CMOB	ES1925152-013	5/08/2019	7.13	7.72	-7.95	1414	1570	-10.46	786
WMLP325	CMOB	ES1925152-014	5/08/2019	7.37	7.97	-7.82	1955	2330	-17.50	1140
WMLP327	CMOB	ES1925152-008	5/08/2019	6.86	7.98	-15.09	1869	2100	-11.64	1350
GM1	Coal	ES1925151-001	1/08/2019	6.87	7.48	-8.50	1952	2250	-14.18	1030
WML119	Coal	ES1925155-001	8/08/2019	6.98	7.07	-1.28	1205	1460	-19.14	739
WML120A	Coal	ES1925151-002	7/08/2019	6.93	7.53	-8.30	804	923	-13.78	473
WML181	Coal	ES1925155-003	8/08/2019	7.56	7.35	2.82	2176	2540	-15.44	1310
WML183	Coal	ES1925151-004	7/08/2019	6.89	7.63	-10.19	4351	5140	-16.63	2440
WML261	Coal	ES1925151-006	7/08/2019	7.00	7.42	-5.83	1275	1450	-12.84	720

Bore ID	Geology	Laboratory ID	Date	pH Value (Field)	pH Value (Lab)	pH RPD	EC (Field)	EC (Lab)	EC RPD	Total Dissolved Solids (TDS)
Units				pH	pH	%	µS/cm	µS/cm	%	mg/L
Limit of Reporting (LOR)					0.01			1		10
ANZECC livestock limits							5970	5970*		4000
WML262	Coal	ES1925155-004	8/08/2019	8.20	8.14	0.73	2726	3210	-16.31	1690
WMLP301	Coal	ES1925155-005	8/08/2019	7.91	8.18	-3.36	2793	3140	-11.70	1620
WMLP302	Coal	ES1925151-007	7/08/2019	6.88	7.09	-3.01	1095	1180	-7.47	746
GM3B	GCA	ES1925152-001	1/08/2019	7.65	8.11	-5.84	6944	7960	-13.63	5649
WML120B	GCA	ES1925151-003	7/08/2019	7.07	7.26	-2.65	487	553	-12.69	266
WML129	GCA	ES1925155-002	8/08/2019	7.20	7.20	0.00	337	373	-10.14	198
WML239	GCA	ES1925151-005	1/08/2019	6.98	7.48	-6.92	693	806	-15.08	408
WMLP343	GCA	ES1925154-001	2/08/2019	7.02	7.60	-7.93	743	866	-15.29	401
WMLP346	GCA	ES1925154-002	2/08/2019	6.91	7.43	-7.25	500	579	-14.64	277
WMLP349	GCA	ES1925154-003	2/08/2019	6.76	7.18	-6.03	864	984	-12.99	480
WMLP358	GCA	ES1925151-009	1/08/2019	6.81	7.11	-4.31	381	439	-14.15	255
RA27	HRA	ES1925150-001	6/08/2019	6.95	7.30	-4.91	1418	1570	-10.17	785
WMLP277	HRA	ES1925150-006	6/08/2019	7.16	7.47	-4.24	1353	1540	-12.93	775
WMLP278	HRA	ES1925150-007	6/08/2019	7.19	7.60	-5.54	1302	1480	-12.80	708
WMLP279	HRA	ES1925150-008	6/08/2019	6.89	7.38	-6.87	956	1060	-10.32	520
WMLP280	HRA	ES1925150-009	6/08/2019	6.87	7.54	-9.30	1444	1630	-12.10	780
WMLP336	HRA	ES1925155-006	8/08/2019	6.94	6.60	5.02	636	732	-14.04	370
WMLP337	HRA	ES1925155-007	8/08/2019	6.97	7.24	-3.80	2801	3260	-15.15	1880
WMLP338	HRA	ES1925155-008	8/08/2019	6.93	6.76	2.48	1763	2000	-12.60	1120

Bore ID	Geology	Laboratory ID	Calcium	Magnesium	Sodium	Potassium	Chloride
Units			mg/L	mg/L	mg/L	mg/L	mg/L
Limit of Reporting (LOR)			1	1	1	1	1
ANZECC livestock limits							
T3A	BCA	ES1925150-003	57	61	359	<1	614
T4A	BCA	ES1925152-009	56	30	205	1	290
WML113C	BCA	ES1925150-005	56	21	120	4	176
WMLP308	BCA	ES1925151-008	78	36	200	3	294
WMLP311	BCA	ES1925152-011	65	37	175	3	239
WMLP323	BCA	ES1925152-012	85	34	137	2	215
YAP016	BCA	ES1925151-010	26	19	218	2	202
T2P	CMOB	ES1925150-002	84	34	94	3	210
T3P	CMOB	ES1925150-004	45	39	297	4	352
T4P	CMOB	ES1925152-010	58	39	287	3	321
WMLP324	CMOB	ES1925152-013	82	43	164	3	220
WMLP325	CMOB	ES1925152-014	80	46	316	3	464
GM1	Coal	ES1925151-001	71	49	294	3	399
WML119	Coal	ES1925155-001	23	22	223	4	231
WML120A	Coal	ES1925151-002	35	28	93	2	133
WML181	Coal	ES1925155-003	11	10	476	2	478
WML183	Coal	ES1925151-004	125	188	713	9	860
WML261	Coal	ES1925151-006	36	35	191	2	261
WML262	Coal	ES1925155-004	10	10	640	3	444
WMLP301	Coal	ES1925155-005	5	4	665	3	459
WMLP302	Coal	ES1925151-007	28	31	154	2	199
WML120B	GCA	ES1925151-003	20	14	57	<1	60
WML129	GCA	ES1925155-002	15	8	40	2	39
WML239	GCA	ES1925151-005	46	19	74	1	117
WMLP343	GCA	ES1925154-001	51	23	75	<1	121
WMLP346	GCA	ES1925154-002	26	15	56	<1	63
WMLP349	GCA	ES1925154-003	33	20	119	<1	178
WMLP358	GCA	ES1925151-009	28	13	26	<1	58

Bore ID	Geology	Laboratory ID	Calcium	Magnesium	Sodium	Potassium	Chloride
Units			mg/L	mg/L	mg/L	mg/L	mg/L
Limit of Reporting (LOR)			1	1	1	1	1
ANZECC livestock limits							
RA27	HRA	ES1925150-001	43	29	220	<1	262
WMLP277	HRA	ES1925150-006	44	27	213	<1	259
WMLP278	HRA	ES1925150-007	59	28	185	<1	241
WMLP279	HRA	ES1925150-008	59	29	102	2	182
WMLP280	HRA	ES1925150-009	56	32	208	<1	282
WMLP336	HRA	ES1925155-006	36	18	64	1	102
WMLP337	HRA	ES1925155-007	103	123	346	5	694
WMLP338	HRA	ES1925155-008	82	58	213	7	416

Bore ID	Geology	Laboratory ID	Hydroxide Alkalinity as CaCO3	Carbonate Alkalinity as CaCO3	Bicarbonate Alkalinity as CaCO3	Total Alkalinity	Sulfate as SO4
Units			mg/L	mg/L	mg/L	mg/L	mg/L
Limit of Reporting (LOR)			1	1	1	1	1
ANZECC livestock limits							1000
T3A	BCA	ES1925150-003	<1	<1	139	139	112
T4A	BCA	ES1925152-009	<1	<1	205	205	88
WML113C	BCA	ES1925150-005	<1	<1	138	138	67
WMLP308	BCA	ES1925151-008	<1	<1	179	179	175
WMLP311	BCA	ES1925152-011	<1	<1	188	188	119
WMLP323	BCA	ES1925152-012	<1	<1	212	212	130
YAP016	BCA	ES1925151-010	<1	<1	208	208	108
T2P	CMOB	ES1925150-002	<1	<1	144	144	66
T3P	CMOB	ES1925150-004	<1	<1	307	307	65
T4P	CMOB	ES1925152-010	<1	<1	344	344	94
WMLP324	CMOB	ES1925152-013	<1	<1	238	238	187
WMLP325	CMOB	ES1925152-014	<1	<1	331	331	89
GM1	Coal	ES1925151-001	<1	<1	261	261	170
WML119	Coal	ES1925155-001	<1	<1	334	334	8
WML120A	Coal	ES1925151-002	<1	<1	189	189	11
WML181	Coal	ES1925155-003	<1	<1	467	467	<1
WML183	Coal	ES1925151-004	<1	<1	772	772	364
WML261	Coal	ES1925151-006	<1	<1	251	251	33
WML262	Coal	ES1925155-004	<1	36	767	890	<1
WMLP301	Coal	ES1925155-005	<1	39	773	805	<1
WMLP302	Coal	ES1925151-007	<1	<1	205	205	22
WML120B	GCA	ES1925151-003	<1	<1	124	124	14
WML129	GCA	ES1925155-002	<1	<1	90	90	7
WML239	GCA	ES1925151-005	<1	<1	155	155	13
WMLP343	GCA	ES1925154-001	<1	<1	182	182	7
WMLP346	GCA	ES1925154-002	<1	<1	145	145	<1
WMLP349	GCA	ES1925154-003	<1	<1	151	151	18

Bore ID	Geology	Laboratory ID	Hydroxide Alkalinity as CaCO3	Carbonate Alkalinity as CaCO3	Bicarbonate Alkalinity as CaCO3	Total Alkalinity	Sulfate as SO4
Units			mg/L	mg/L	mg/L	mg/L	mg/L
Limit of Reporting (LOR)			1	1	1	1	1
ANZECC livestock limits							1000
WMLP358	GCA	ES1925151-009	<1	<1	85	85	3
RA27	HRA	ES1925150-001	<1	<1	210	210	86
WMLP277	HRA	ES1925150-006	<1	<1	222	222	80
WMLP278	HRA	ES1925150-007	<1	<1	224	224	82
WMLP279	HRA	ES1925150-008	<1	<1	170	170	35
WMLP280	HRA	ES1925150-009	<1	<1	217	217	81
WMLP336	HRA	ES1925155-006	<1	<1	143	143	23
WMLP337	HRA	ES1925155-007	<1	<1	422	422	125
WMLP338	HRA	ES1925155-008	<1	<1	268	268	80

Bore ID	Geology	Laboratory ID	Arsenic	Cadmium	Chromium	Copper	Iron	Lead	Manganese	Nickel	Selenium	Zinc
Units			mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Limit of Reporting (LOR)			0.001	0.0001	0.001	0.001	0.05	0.001	0.001	0.001	0.01	0.005
ANZECC livestock limits			0.5	0.01	1	0.4		0.1		1	0.02	20
T3A	BCA	ES1925150-003	<0.001	<0.0001	0.004	<0.001	0.09	<0.001	0.050	<0.001	<0.01	0.006
T4A	BCA	ES1925152-009	<0.001	<0.0001	<0.001	<0.001	<0.05	<0.001	0.098	<0.001	<0.01	0.007
WML113C	BCA	ES1925150-005	<0.001	<0.0001	<0.001	<0.001	<0.05	<0.001	0.020	0.001	<0.01	0.019
WMLP308	BCA	ES1925151-008	<0.001	<0.0001	<0.001	<0.001	0.59	<0.001	0.081	0.433	<0.01	0.013
WMLP311	BCA	ES1925152-011	<0.001	<0.0001	<0.001	<0.001	0.17	<0.001	0.081	0.433	<0.01	0.013
WMLP323	BCA	ES1925152-012	0.003	<0.0001	<0.001	<0.001	<0.05	<0.001	0.305	0.002	<0.01	0.010
YAP016	BCA	ES1925151-010	<0.001	<0.0001	<0.001	<0.001	<0.05	<0.001	0.003	<0.001	<0.01	<0.005
T2P	CMOB	ES1925150-002	0.003	<0.0001	<0.001	<0.001	0.09	<0.001	0.266	0.002	<0.01	0.006
T3P	CMOB	ES1925150-004	<0.001	<0.0001	<0.001	<0.001	0.24	<0.001	0.049	<0.001	<0.01	<0.005
T4P	CMOB	ES1925152-010	<0.001	<0.0001	<0.001	<0.001	0.27	<0.001	0.035	<0.001	<0.01	0.007
WMLP324	CMOB	ES1925152-013	<0.001	<0.0001	<0.001	<0.001	0.12	<0.001	0.318	0.005	<0.01	0.009
WMLP325	CMOB	ES1925152-014	<0.001	<0.0001	0.010	<0.001	0.71	<0.001	0.314	0.001	<0.01	<0.005
GM1	Coal	ES1925151-001	<0.001	<0.0001	<0.001	<0.001	0.47	<0.001	0.454	<0.001	<0.01	0.035
WML119	Coal	ES1925155-001	<0.001	<0.0001	0.012	<0.001	1.10	<0.001	0.101	0.010	<0.01	0.011
WML120A	Coal	ES1925151-002	<0.001	<0.0001	<0.001	<0.001	0.66	<0.001	0.117	<0.001	<0.01	<0.005
WML181	Coal	ES1925155-003	<0.001	<0.0001	0.001	<0.001	0.44	<0.001	0.023	<0.001	<0.01	<0.005
WML183	Coal	ES1925151-004	<0.001	<0.0001	<0.001	<0.001	0.06	<0.001	0.108	0.002	<0.01	0.017
WML261	Coal	ES1925151-006	<0.001	<0.0001	<0.001	<0.001	0.98	0.001	0.036	<0.001	<0.01	<0.005
WML262	Coal	ES1925155-004	<0.001	<0.0001	<0.001	<0.001	0.15	<0.001	0.040	0.001	<0.01	0.007
WMLP301	Coal	ES1925155-005	<0.001	<0.0001	<0.001	<0.001	0.06	<0.001	0.015	<0.001	<0.01	0.005
WMLP302	Coal	ES1925151-007	<0.001	<0.0001	<0.001	<0.001	1.44	<0.001	0.025	<0.001	<0.01	0.005
WML120B	GCA	ES1925151-003	<0.001	<0.0001	<0.001	<0.001	<0.05	<0.001	0.004	<0.001	<0.01	<0.005
WML129	GCA	ES1925155-002	0.002	<0.0001	<0.001	<0.001	0.44	<0.001	0.170	0.001	<0.01	0.014
WML239	GCA	ES1925151-005	<0.001	<0.0001	<0.001	0.002	0.08	<0.001	0.015	<0.001	<0.01	0.010
WMLP343	GCA	ES1925154-001	<0.001	<0.0001	<0.001	0.002	<0.05	0.002	0.017	0.002	<0.01	0.053
WMLP346	GCA	ES1925154-002	<0.001	<0.0001	0.001	0.002	0.63	<0.001	0.070	0.002	<0.01	0.007
WMLP349	GCA	ES1925154-003	<0.001	<0.0001	<0.001	<0.001	0.72	<0.001	0.142	0.001	<0.01	0.008
WMLP358	GCA	ES1925151-009	<0.001	<0.0001	<0.001	<0.001	<0.05	<0.001	0.013	0.001	<0.01	0.019

Bore ID	Geology	Laboratory ID	Arsenic	Cadmium	Chromium	Copper	Iron	Lead	Manganese	Nickel	Selenium	Zinc
Units			mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Limit of Reporting (LOR)			0.001	0.0001	0.001	0.001	0.05	0.001	0.001	0.001	0.01	0.005
ANZECC livestock limits			0.5	0.01	1	0.4		0.1		1	0.02	20
RA27	HRA	ES1925150-001	<0.001	<0.0001	<0.001	0.003	0.10	0.006	0.037	0.003	<0.01	0.030
WMLP277	HRA	ES1925150-006	<0.001	<0.0001	<0.001	<0.001	<0.05	<0.001	0.218	0.002	<0.01	0.005
WMLP278	HRA	ES1925150-007	<0.001	<0.0001	<0.001	<0.001	<0.05	<0.001	0.060	0.001	<0.01	<0.005
WMLP279	HRA	ES1925150-008	<0.001	<0.0001	<0.001	<0.001	0.26	<0.001	0.200	<0.001	<0.01	<0.005
WMLP280	HRA	ES1925150-009	<0.001	<0.0001	<0.001	<0.001	0.14	<0.001	0.099	0.002	<0.01	0.007
WMLP336	HRA	ES1925155-006	<0.001	<0.0001	<0.001	<0.001	0.20	<0.001	0.057	0.003	<0.01	0.029
WMLP337	HRA	ES1925155-007	<0.001	<0.0001	<0.001	<0.001	<0.05	<0.001	0.183	0.004	<0.01	0.023
WMLP338	HRA	ES1925155-008	0.001	<0.0001	<0.001	<0.001	0.90	<0.001	0.659	0.006	<0.01	0.102

Bore ID	Geology	Laboratory ID	Turbidity	Total Cyanide	Nitrite + Nitrate as N	Total Kjeldahl Nitrogen as N	Total Nitrogen as N	Total Phosphorous as P	Total Anions	Total Cations	Ionic Balance
Units			NTU	mg/L	mg/L	mg/L	mg/L	mg/L	meq/L	meq/L	%
Limit of Reporting (LOR)			0.1	0.004	0.01	0.1	0.1	0.01	0.01	0.01	0.01
ANZECC livestock limits											
T3A	BCA	ES1925150-003	483	<0.004	2.34	0.9	3.2	0.44	22.40	23.50	2.29
T4A	BCA	ES1925152-009	22.2	<0.004	0.72	1.1	1.8	0.96	14.10	14.20	0.34
WML113C	BCA	ES1925150-005	876	<0.004	0.65	0.5	1.2	0.50	9.12	9.84	3.84
WMLP308	BCA	ES1925151-008	70	<0.004	0.14	0.4	0.5	0.15	15.50	15.60	0.38
WMLP311	BCA	ES1925152-011	239	<0.004	0.25	0.5	0.8	0.16	13.00	14.00	3.72
WMLP323	BCA	ES1925152-012	620	<0.004	0.32	1.0	1.3	0.36	13.00	13.00	0.16
YAP016	BCA	ES1925151-010	1.3	<0.004	0.08	<0.01	<0.1	0.02	12.10	12.40	1.19
T2P	CMOB	ES1925150-002	34.8	<0.004	0.26	1.7	2.0	0.27	10.20	11.20	4.60
T3P	CMOB	ES1925150-004	15.3	<0.004	0.09	1.6	0.5	0.11	17.40	18.50	2.95
T4P	CMOB	ES1925152-010	6.8	<0.004	<0.01	0.3	0.3	0.02	17.90	18.70	2.13
WMLP324	CMOB	ES1925152-013	3560	<0.004	0.02	0.7	0.8	0.15	14.80	14.80	0.04
WMLP325	CMOB	ES1925152-014	76	<0.004	0.02	0.6	0.6	0.15	21.60	21.60	0.10
GM1	Coal	ES1925151-001	71.8	<0.004	0.01	0.3	0.3	0.34	20.00	20.40	1.07
WML119	Coal	ES1925155-001	23.2	<0.004	<0.01	1.6	1.6	0.15	13.40	12.80	2.28
WML120A	Coal	ES1925151-002	10.3	<0.004	<0.01	0.1	0.1	0.05	7.76	8.15	2.45
WML181	Coal	ES1925155-003	19.8	<0.004	<0.01	0.8	0.8	0.05	22.80	22.10	1.53
WML183	Coal	ES1925151-004	183	<0.004	<0.01	1.5	1.5	0.16	47.30	53.00	5.68
WML261	Coal	ES1925151-006	9.5	<0.004	<0.01	0.2	0.2	0.04	13.14	13.00	0.11
WML262	Coal	ES1925155-004	129	<0.004	<0.01	6.9	6.9	2.30	30.30	29.20	1.80
WMLP301	Coal	ES1925155-005	260	<0.004	<0.01	2.4	2.4	0.51	29.00	29.60	0.94
WMLP302	Coal	ES1925151-007	2.4	<0.004	0.01	0.2	0.2	0.05	10.20	10.70	2.54
WML120B	GCA	ES1925151-003	5.8	<0.004	0.03	<0.01	<0.1	0.05	4.46	4.63	1.85
WML129	GCA	ES1925155-002	174	<0.004	0.02	0.4	0.4	0.56	3.04	3.20	2.46
WML239	GCA	ES1925151-005	14.6	<0.004	<0.01	<0.01	<0.1	0.04	6.67	7.10	3.16
WMLP343	GCA	ES1925154-001	354	<0.004	0.66	0.8	1.5	0.26	7.20	7.70	3.39
WMLP346	GCA	ES1925154-002	0.8	<0.004	<0.01	<0.1	<0.1	0.05	4.67	4.97	3.04
WMLP349	GCA	ES1925154-003	7.2	<0.004	<0.01	<0.1	<0.1	0.05	8.41	8.47	0.33

Bore ID	Geology	Laboratory ID	Turbidity	Total Cyanide	Nitrite + Nitrate as N	Total Kjeldahl Nitrogen as N	Total Nitrogen as N	Total Phosphorous as P	Total Anions	Total Cations	Ionic Balance
Units			NTU	mg/L	mg/L	mg/L	mg/L	mg/L	meq/L	meq/L	%
Limit of Reporting (LOR)			0.1	0.004	0.01	0.1	0.1	0.01	0.01	0.01	0.01
ANZECC livestock limits											
WMLP358	GCA	ES1925151-009	59.2	<0.004	0.06	<0.1	<0.1	0.20	3.40	3.60	2.88
RA27	HRA	ES1925150-001	119	<0.004	0.46	0.2	1.7	0.40	13.40	14.10	2.64
WMLP277	HRA	ES1925150-006	966	<0.004	0.21	0.8	1.0	1.24	13.40	13.70	1.02
WMLP278	HRA	ES1925150-007	183	<0.004	0.49	0.9	1.4	0.90	13.00	13.30	1.20
WMLP279	HRA	ES1925150-008	572	<0.004	0.10	0.7	0.8	2.17	9.26	9.82	2.93
WMLP280	HRA	ES1925150-009	80.2	<0.004	0.23	0.5	0.7	0.42	14.00	14.50	1.75
WMLP336	HRA	ES1925155-006	5.9	<0.004	0.78	<0.1	0.8	0.07	6.21	6.09	1.02
WMLP337	HRA	ES1925155-007	3990	<0.004	0.12	1.2	1.3	1.48	30.60	30.40	0.28
WMLP338	HRA	ES1925155-008	4240	<0.004	0.58	11.4	12.0	3.04	18.80	18.30	1.20

Appendix E Groundwater chemistry – aquifer speciation

Table E1 August 2019 Ashton monitoring bore water classifications

Bore ID	Geology	Individual Water Type	General Water Type
T2P	CMOB	Ca-Na-Mg-Cl-HCO3	Ca-Na
WMLP358	GCA	Ca-Na-Mg-Cl-HCO3	
T4A	BCA	Na-Ca-Cl-HCO3	Na-Ca
WML113C	BCA	Na-Ca-Cl-HCO3	
WMLP278	HRA	Na-Ca-Cl-HCO3	
WMLP280	HRA	Na-Ca-Cl-HCO3	
WMLP308	BCA	Na-Ca-Cl-SO4	
WML239	GCA	Na-Ca-Mg-Cl-HCO3	
WMLP279	HRA	Na-Ca-Mg-Cl-HCO3	
WMLP311	BCA	Na-Ca-Mg-Cl-HCO3	
WMLP336	HRA	Na-Ca-Mg-Cl-HCO3	
WMLP343	GCA	Na-Ca-Mg-Cl-HCO3	
WMLP349	GCA	Na-Ca-Mg-Cl-HCO3	
WMLP323	BCA	Na-Ca-Mg-Cl-HCO3-SO4	
WMLP324	CMOB	Na-Ca-Mg-Cl-HCO3-SO4	
WML129	GCA	Na-Ca-Mg-HCO3-Cl	
WMLP346	GCA	Na-Ca-Mg-HCO3-Cl	
RA27	HRA	Na-Cl-HCO3	Na-Cl
T3P	CMOB	Na-Cl-HCO3	
T4P	CMOB	Na-Cl-HCO3	
WML119	Coal	Na-Cl-HCO3	
WML181	Coal	Na-Cl-HCO3	
WMLP277	HRA	Na-Cl-HCO3	
WMLP301	Coal	Na-Cl-HCO3	
WMLP325	CMOB	Na-Cl-HCO3	
YAP016	BCA	Na-Cl-HCO3	
WML262	Coal	Na-HCO3-Cl	Na-HCO3
WML120A	Coal	Na-Mg-Ca-Cl-HCO3	Na-Mg
WMLP338	HRA	Na-Mg-Ca-Cl-HCO3	
WML120B	GCA	Na-Mg-Ca-HCO3-Cl	
T3A	BCA	Na-Mg-Cl	
GM1	Coal	Na-Mg-Cl-HCO3	
WML183	Coal	Na-Mg-Cl-HCO3	
WML261	Coal	Na-Mg-Cl-HCO3	
WMLP302	Coal	Na-Mg-Cl-HCO3	
WMLP337	HRA	Na-Mg-Cl-HCO3	

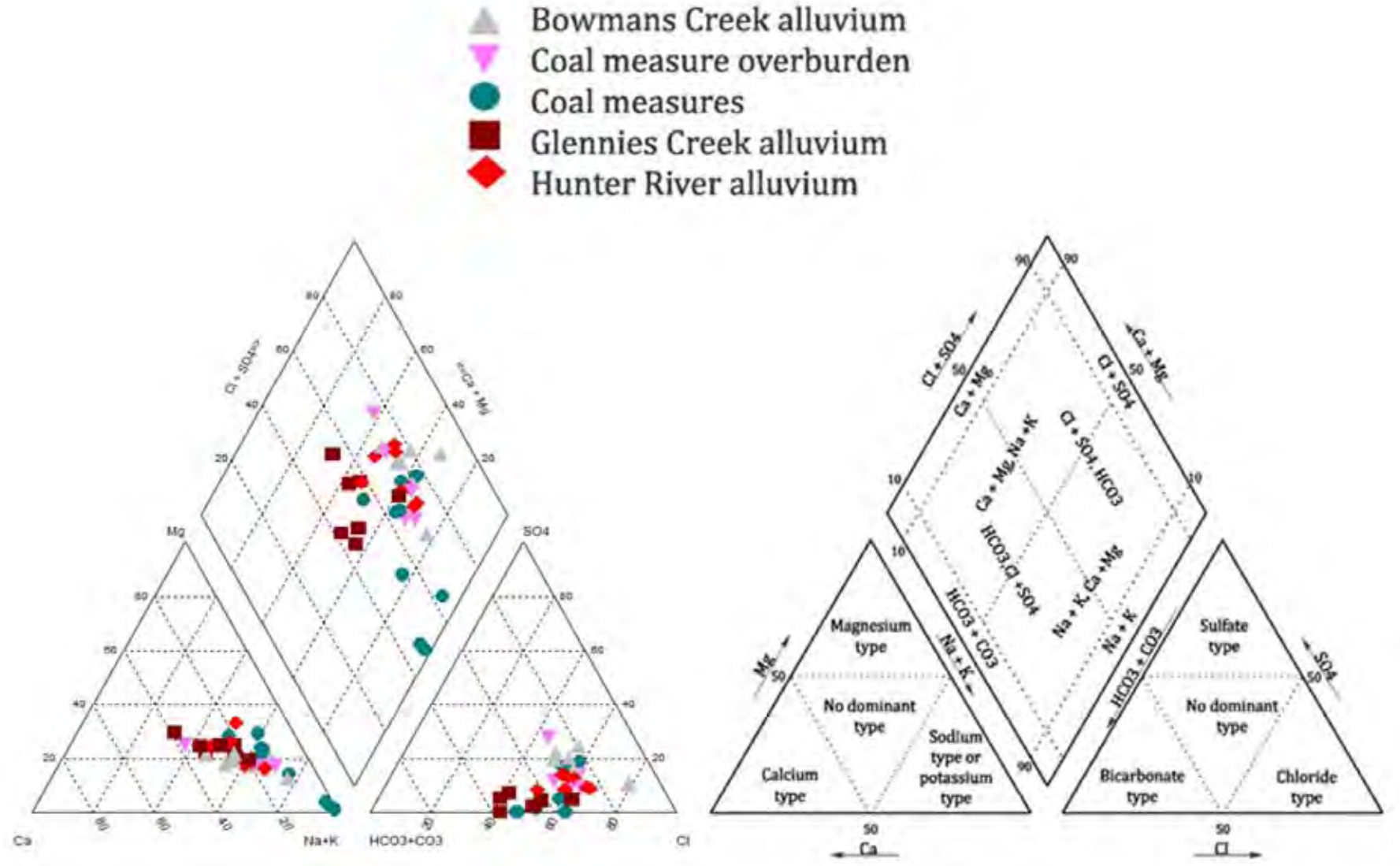

Figure E1 August 2019 Ashton monitoring bore Piper Diagram

Appendix F Laboratory certificate of analysis and chain of custody documents (August 2019)

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES1925150**	Page	: 1 of 6
Client	: **AUSTRALASIAN GROUNDWATER AND ENVIRONMENTAL CONSULTANTS PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: COSTANTE CONTE	Contact	: Customer Services ES
Address	: 4 HUDSON STREET HAMILTON NSW 2303	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: G1922H ASHTON ANNUAL SAMPLING	Date Samples Received	: 08-Aug-2019 16:47
Order number	: ----	Date Analysis Commenced	: 08-Aug-2019
C-O-C number	: ----	Issue Date	: 15-Aug-2019 14:58
Sampler	: WALTER ROWLANDS		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 9		
No. of samples analysed	: 9		

Accreditation No. 825
Accredited for compliance with ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	RA27	T2-P	T3-A	T3-P	WML113C
			Client sampling date / time	06-Aug-2019 07:45	06-Aug-2019 15:05	06-Aug-2019 13:20	06-Aug-2019 14:00	06-Aug-2019 12:30
Compound	CAS Number	LOR	Unit	ES1925150-001	ES1925150-002	ES1925150-003	ES1925150-004	ES1925150-005
				Result	Result	Result	Result	Result
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	7.30	7.26	7.10	7.84	7.26
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	1570	1210	2510	1840	1120
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Total Dissolved Solids @180°C	----	10	mg/L	785	609	1240	989	568
EA045: Turbidity								
Turbidity	----	0.1	NTU	119	34.8	483	15.3	876
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	210	144	139	307	138
Total Alkalinity as CaCO3	----	1	mg/L	210	144	139	307	138
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	86	66	112	65	67
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	262	210	614	352	176
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	43	84	57	45	56
Magnesium	7439-95-4	1	mg/L	29	34	61	39	21
Sodium	7440-23-5	1	mg/L	220	94	359	297	120
Potassium	7440-09-7	1	mg/L	<1	3	<1	4	4
EG020F: Dissolved Metals by ICP-MS								
Arsenic	7440-38-2	0.001	mg/L	<0.001	0.003	<0.001	<0.001	<0.001
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.004	<0.001	<0.001
Copper	7440-50-8	0.001	mg/L	0.003	<0.001	<0.001	<0.001	<0.001
Lead	7439-92-1	0.001	mg/L	0.006	<0.001	<0.001	<0.001	<0.001
Manganese	7439-96-5	0.001	mg/L	0.037	0.266	0.050	0.049	0.020
Nickel	7440-02-0	0.001	mg/L	0.003	0.002	<0.001	<0.001	0.001
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	7440-66-6	0.005	mg/L	0.030	0.006	0.006	<0.005	0.019
Iron	7439-89-6	0.05	mg/L	0.10	2.38	0.09	0.24	<0.05
EK026SF: Total CN by Segmented Flow Analyser								
Total Cyanide	57-12-5	0.004	mg/L	<0.004	<0.004	<0.004	<0.004	<0.004

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	RA27	T2-P	T3-A	T3-P	WML113C
				Client sampling date / time	06-Aug-2019 07:45	06-Aug-2019 15:05	06-Aug-2019 13:20	06-Aug-2019 14:00	06-Aug-2019 12:30
Compound	CAS Number	LOR	Unit		ES1925150-001	ES1925150-002	ES1925150-003	ES1925150-004	ES1925150-005
					Result	Result	Result	Result	Result
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	0.02	<0.01	<0.01	<0.01
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		0.46	0.24	2.34	0.09	0.65
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		0.46	0.26	2.34	0.09	0.65
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		0.2	1.7	0.9	1.6	0.5
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ Total Nitrogen as N	----	0.1	mg/L		0.7	2.0	3.2	1.7	1.2
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		0.40	0.27	0.44	0.11	0.50
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		13.4	10.2	22.4	17.4	9.12
ø Total Cations	----	0.01	meq/L		14.1	11.2	23.5	18.5	9.84
ø Ionic Balance	----	0.01	%		2.64	4.60	2.29	2.95	3.84

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	WMLP277	WMLP278	WMLP279	WMLP280	----
			Client sampling date / time	06-Aug-2019 09:25	06-Aug-2019 10:35	06-Aug-2019 11:20	06-Aug-2019 08:40	----
Compound	CAS Number	LOR	Unit	ES1925150-006	ES1925150-007	ES1925150-008	ES1925150-009	--------
				Result	Result	Result	Result	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**7.47**	**7.60**	**7.38**	**7.54**	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**1540**	**1480**	**1060**	**1630**	----
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Total Dissolved Solids @180°C	----	10	mg/L	**775**	**708**	**520**	**780**	----
EA045: Turbidity								
Turbidity	----	0.1	NTU	**966**	**183**	**572**	**80.2**	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**222**	**224**	**170**	**217**	----
Total Alkalinity as CaCO3	----	1	mg/L	**222**	**224**	**170**	**217**	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**80**	**82**	**35**	**81**	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**259**	**241**	**182**	**282**	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**44**	**59**	**59**	**56**	----
Magnesium	7439-95-4	1	mg/L	**27**	**28**	**29**	**32**	----
Sodium	7440-23-5	1	mg/L	**213**	**185**	**102**	**208**	----
Potassium	7440-09-7	1	mg/L	<1	<1	**2**	<1	----
EG020F: Dissolved Metals by ICP-MS								
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	----
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----
Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----
Manganese	7439-96-5	0.001	mg/L	**0.218**	**0.060**	**0.200**	**0.099**	----
Nickel	7440-02-0	0.001	mg/L	**0.002**	**0.001**	<0.001	**0.002**	----
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	----
Zinc	7440-66-6	0.005	mg/L	**0.005**	<0.005	<0.005	**0.007**	----
Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	**0.26**	**0.14**	----
EK026SF: Total CN by Segmented Flow Analyser								
Total Cyanide	57-12-5	0.004	mg/L	<0.004	<0.004	<0.004	<0.004	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	WMLP277	WMLP278	WMLP279	WMLP280	----
				Client sampling date / time	06-Aug-2019 09:25	06-Aug-2019 10:35	06-Aug-2019 11:20	06-Aug-2019 08:40	----
Compound	CAS Number	LOR	Unit		ES1925150-006	ES1925150-007	ES1925150-008	ES1925150-009	--------
					Result	Result	Result	Result	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		0.21	0.49	0.10	0.23	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		0.21	0.49	0.10	0.23	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		0.8	0.9	0.7	0.5	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ Total Nitrogen as N	----	0.1	mg/L		1.0	1.4	0.8	0.7	----
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		1.24	0.90	2.17	0.42	----
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		13.4	13.0	9.26	14.0	----
ø Total Cations	----	0.01	meq/L		13.7	13.3	9.82	14.5	----
ø Ionic Balance	----	0.01	%		1.02	1.20	2.93	1.75	----

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES1925151**	Page	: 1 of 6
Client	: **AUSTRALASIAN GROUNDWATER AND ENVIRONMENTAL CONSULTANTS PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: COSTANTE CONTE	Contact	: Customer Services ES
Address	: 4 HUDSON STREET HAMILTON NSW 2303	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: G1922H ASHTON ANNUAL SAMPLING	Date Samples Received	: 08-Aug-2019 16:47
Order number	: ----	Date Analysis Commenced	: 08-Aug-2019
C-O-C number	: ----	Issue Date	: 15-Aug-2019 15:11
Sampler	: WALTER ROWLANDS		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 10		
No. of samples analysed	: 10		

ilac-MRA NATA
Accreditation No. 825
Accredited for compliance with ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW

General Comments

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Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	GM1	WML 120A	WML 120B	WML 183	WMLP239
			Client sampling date / time	01-Aug-2019 08:55	07-Aug-2019 12:25	07-Aug-2019 12:50	07-Aug-2019 13:25	01-Aug-2019 13:50
Compound	CAS Number	LOR	Unit	ES1925151-001	ES1925151-002	ES1925151-003	ES1925151-004	ES1925151-005
				Result	Result	Result	Result	Result
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**7.48**	**7.53**	**7.26**	**7.63**	**7.48**
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**2250**	**923**	**553**	**5140**	**806**
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Total Dissolved Solids @180°C	----	10	mg/L	**1030**	**473**	**266**	**2440**	**408**
EA045: Turbidity								
Turbidity	----	0.1	NTU	**71.8**	**10.3**	**5.8**	**183**	**14.6**
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**261**	**189**	**124**	**772**	**155**
Total Alkalinity as CaCO3	----	1	mg/L	**261**	**189**	**124**	**772**	**155**
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**170**	**11**	**14**	**364**	**13**
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**399**	**133**	**60**	**860**	**117**
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**71**	**35**	**20**	**125**	**46**
Magnesium	7439-95-4	1	mg/L	**49**	**28**	**14**	**188**	**19**
Sodium	7440-23-5	1	mg/L	**294**	**93**	**57**	**713**	**74**
Potassium	7440-09-7	1	mg/L	**3**	**2**	<1	**9**	**1**
EG020F: Dissolved Metals by ICP-MS								
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	**0.002**
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Manganese	7439-96-5	0.001	mg/L	**0.454**	**0.117**	**0.004**	**0.108**	**0.015**
Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	<0.001	**0.002**	<0.001
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	7440-66-6	0.005	mg/L	**0.035**	<0.005	<0.005	**0.017**	**0.010**
Iron	7439-89-6	0.05	mg/L	**0.47**	**0.66**	<0.05	**0.06**	**0.08**
EK026SF: Total CN by Segmented Flow Analyser								
Total Cyanide	57-12-5	0.004	mg/L	<0.004	<0.004	<0.004	<0.004	<0.004

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	GM1	WML 120A	WML 120B	WML 183	WMLP239
				Client sampling date / time	01-Aug-2019 08:55	07-Aug-2019 12:25	07-Aug-2019 12:50	07-Aug-2019 13:25	01-Aug-2019 13:50
Compound	CAS Number	LOR	Unit		ES1925151-001	ES1925151-002	ES1925151-003	ES1925151-004	ES1925151-005
					Result	Result	Result	Result	Result
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		**0.01**	<0.01	**0.03**	<0.01	<0.01
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		**0.01**	<0.01	**0.03**	<0.01	<0.01
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		**0.3**	**0.1**	<0.1	**1.5**	<0.1
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ Total Nitrogen as N	----	0.1	mg/L		**0.3**	**0.1**	<0.1	**1.5**	<0.1
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		**0.34**	**0.05**	**0.05**	**0.16**	**0.04**
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		**20.0**	**7.76**	**4.46**	**47.3**	**6.67**
ø Total Cations	----	0.01	meq/L		**20.4**	**8.15**	**4.63**	**53.0**	**7.10**
ø Ionic Balance	----	0.01	%		**1.07**	**2.45**	**1.85**	**5.68**	**3.16**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	WMLP261	WMLP302	WMLP308	WMLP358	YAP016
			Client sampling date / time	07-Aug-2019 11:20	07-Aug-2019 11:55	02-Aug-2019 13:55	01-Aug-2019 13:10	01-Aug-2019 09:40
Compound	CAS Number	LOR	Unit	ES1925151-006	ES1925151-007	ES1925151-008	ES1925151-009	ES1925151-010
				Result	Result	Result	Result	Result
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	7.42	7.09	7.43	7.11	7.60
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	1450	1180	1730	439	1410
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Total Dissolved Solids @180°C	----	10	mg/L	720	532	844	222	664
EA045: Turbidity								
Turbidity	----	0.1	NTU	9.5	2.4	70.0	59.2	1.3
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	251	205	179	85	208
Total Alkalinity as CaCO3	----	1	mg/L	251	205	179	85	208
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	33	22	175	3	108
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	261	199	294	58	202
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	36	28	78	28	26
Magnesium	7439-95-4	1	mg/L	35	31	36	13	19
Sodium	7440-23-5	1	mg/L	191	154	200	26	218
Potassium	7440-09-7	1	mg/L	2	2	3	<1	2
EG020F: Dissolved Metals by ICP-MS								
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Lead	7439-92-1	0.001	mg/L	0.001	<0.001	<0.001	<0.001	<0.001
Manganese	7439-96-5	0.001	mg/L	0.036	0.025	0.118	0.013	0.003
Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.002	0.001	<0.001
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	7440-66-6	0.005	mg/L	<0.005	0.005	0.010	0.019	<0.005
Iron	7439-89-6	0.05	mg/L	0.98	1.44	0.59	<0.05	<0.05
EK026SF: Total CN by Segmented Flow Analyser								
Total Cyanide	57-12-5	0.004	mg/L	<0.004	<0.004	<0.004	<0.004	<0.004

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	WMLP261	WMLP302	WMLP308	WMLP358	YAP016
				Client sampling date / time	07-Aug-2019 11:20	07-Aug-2019 11:55	02-Aug-2019 13:55	01-Aug-2019 13:10	01-Aug-2019 09:40
Compound	CAS Number	LOR	Unit		ES1925151-006	ES1925151-007	ES1925151-008	ES1925151-009	ES1925151-010
					Result	Result	Result	Result	Result
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		<0.01	**0.01**	**0.14**	**0.06**	**0.08**
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		<0.01	**0.01**	**0.14**	**0.06**	**0.08**
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		**0.2**	**0.4**	**0.4**	<0.1	<0.1
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ Total Nitrogen as N	----	0.1	mg/L		**0.2**	**0.4**	**0.5**	<0.1	<0.1
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		**0.04**	**0.05**	**0.15**	**0.20**	**0.02**
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		**13.1**	**10.2**	**15.5**	**3.40**	**12.1**
ø Total Cations	----	0.01	meq/L		**13.0**	**10.7**	**15.6**	**3.60**	**12.4**
ø Ionic Balance	----	0.01	%		**0.11**	**2.54**	**0.38**	**2.88**	**1.19**

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES1925152**	Page	: 1 of 7
Client	: **AUSTRALASIAN GROUNDWATER AND ENVIRONMENTAL CONSULTANTS PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: COSTANTE CONTE	Contact	: Customer Services ES
Address	: 4 HUDSON STREET HAMILTON NSW 2303	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: G1922H ASHTON ANNUAL SAMPLING	Date Samples Received	: 08-Aug-2019 16:49
Order number	:	Date Analysis Commenced	: 08-Aug-2019
C-O-C number	: ----	Issue Date	: 14-Aug-2019 17:09
Sampler	: WALTER ROWLANDS		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 14		
No. of samples analysed	: 14		

Accreditation No. 825
Accredited for compliance with ISO/IEC 17025 - Testing

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- Analytical Results

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Signatories

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Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW

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- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)			Client sample ID	**GM3B**	**PB1**	**RA18**	**RM10**	**WML115B**
			Client sampling date / time	01-Aug-2019 11:45	07-Aug-2019 09:45	07-Aug-2019 08:50	07-Aug-2019 10:00	01-Aug-2019 10:40
Compound	*CAS Number*	*LOR*	*Unit*	**ES1925152-001**	**ES1925152-002**	**ES1925152-003**	**ES1925152-004**	**ES1925152-005**
				Result	Result	Result	Result	Result
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**8.11**	**7.97**	**7.92**	**7.94**	**7.79**
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**7960**	**1620**	**1250**	**1380**	**3450**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	WMLP320	WMLP326	WMLP327	T4-A	T4-P
			Client sampling date / time	07-Aug-2019 10:25	05-Aug-2019 12:30	05-Aug-2019 12:55	05-Aug-2019 13:55	05-Aug-2019 14:35
Compound	CAS Number	LOR	Unit	ES1925152-006	ES1925152-007	ES1925152-008	ES1925152-009	ES1925152-010
				Result	Result	Result	Result	Result
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	7.86	8.06	7.98	7.93	8.02
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	1360	1590	2100	1610	1990
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Total Dissolved Solids @180°C	----	10	mg/L	----	----	----	828	965
EA045: Turbidity								
Turbidity	----	0.1	NTU	----	----	----	22.2	6.8
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	----	----	----	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	----	----	----	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	----	----	----	205	344
Total Alkalinity as CaCO3	----	1	mg/L	----	----	----	205	344
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	----	----	----	88	94
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	----	----	----	290	321
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	----	----	----	56	58
Magnesium	7439-95-4	1	mg/L	----	----	----	30	39
Sodium	7440-23-5	1	mg/L	----	----	----	205	287
Potassium	7440-09-7	1	mg/L	----	----	----	1	3
EG020F: Dissolved Metals by ICP-MS								
Arsenic	7440-38-2	0.001	mg/L	----	----	----	<0.001	<0.001
Cadmium	7440-43-9	0.0001	mg/L	----	----	----	<0.0001	<0.0001
Chromium	7440-47-3	0.001	mg/L	----	----	----	<0.001	<0.001
Copper	7440-50-8	0.001	mg/L	----	----	----	<0.001	<0.001
Lead	7439-92-1	0.001	mg/L	----	----	----	<0.001	<0.001
Manganese	7439-96-5	0.001	mg/L	----	----	----	0.098	0.035
Nickel	7440-02-0	0.001	mg/L	----	----	----	<0.001	<0.001
Selenium	7782-49-2	0.01	mg/L	----	----	----	<0.01	<0.01
Zinc	7440-66-6	0.005	mg/L	----	----	----	0.007	0.007
Iron	7439-89-6	0.05	mg/L	----	----	----	<0.05	0.27
EK026SF: Total CN by Segmented Flow Analyser								
Total Cyanide	57-12-5	0.004	mg/L	----	----	----	<0.004	<0.004

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	WMLP320	WMLP326	WMLP327	T4-A	T4-P
				Client sampling date / time	07-Aug-2019 10:25	05-Aug-2019 12:30	05-Aug-2019 12:55	05-Aug-2019 13:55	05-Aug-2019 14:35
Compound	CAS Number	LOR	Unit		ES1925152-006	ES1925152-007	ES1925152-008	ES1925152-009	ES1925152-010
					Result	Result	Result	Result	Result
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		----	----	----	<0.01	<0.01
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		----	----	----	**0.72**	<0.01
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		----	----	----	**0.72**	<0.01
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		----	----	----	**1.1**	**0.3**
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ **Total Nitrogen as N**	----	0.1	mg/L		----	----	----	**1.8**	**0.3**
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		----	----	----	**0.96**	**0.02**
EN055: Ionic Balance									
ø **Total Anions**	----	0.01	meq/L		----	----	----	**14.1**	**17.9**
ø **Total Cations**	----	0.01	meq/L		----	----	----	**14.2**	**18.7**
ø **Ionic Balance**	----	0.01	%		----	----	----	**0.34**	**2.13**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	WMLP311	WMLP323	WMLP324	WMLP325	----
			Client sampling date / time	05-Aug-2019 09:45	05-Aug-2019 08:15	05-Aug-2019 08:50	05-Aug-2019 10:30	----
Compound	CAS Number	LOR	Unit	ES1925152-011	ES1925152-012	ES1925152-013	ES1925152-014	--------
				Result	Result	Result	Result	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**7.21**	**7.29**	**7.72**	**7.97**	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**1510**	**1510**	**1570**	**2330**	----
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Total Dissolved Solids @180°C	----	10	mg/L	**728**	**696**	**786**	**1140**	----
EA045: Turbidity								
Turbidity	----	0.1	NTU	**239**	**620**	**3560**	**76.0**	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**188**	**212**	**238**	**331**	----
Total Alkalinity as CaCO3	----	1	mg/L	**188**	**212**	**238**	**331**	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**119**	**130**	**187**	**89**	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**239**	**215**	**220**	**464**	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**65**	**85**	**82**	**80**	----
Magnesium	7439-95-4	1	mg/L	**37**	**34**	**43**	**46**	----
Sodium	7440-23-5	1	mg/L	**175**	**137**	**164**	**316**	----
Potassium	7440-09-7	1	mg/L	**3**	**2**	**3**	**3**	----
EG020F: Dissolved Metals by ICP-MS								
Arsenic	7440-38-2	0.001	mg/L	<0.001	**0.003**	<0.001	<0.001	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	----
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	**0.010**	----
Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----
Manganese	7439-96-5	0.001	mg/L	**0.081**	**0.305**	**0.318**	**0.314**	----
Nickel	7440-02-0	0.001	mg/L	**0.433**	**0.002**	**0.005**	**0.001**	----
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	----
Zinc	7440-66-6	0.005	mg/L	**0.013**	**0.010**	**0.009**	<0.005	----
Iron	7439-89-6	0.05	mg/L	**0.17**	<0.05	**0.12**	**0.71**	----
EK026SF: Total CN by Segmented Flow Analyser								
Total Cyanide	57-12-5	0.004	mg/L	<0.004	<0.004	<0.004	<0.004	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	WMLP311	WMLP323	WMLP324	WMLP325	----
				Client sampling date / time	05-Aug-2019 09:45	05-Aug-2019 08:15	05-Aug-2019 08:50	05-Aug-2019 10:30	----
Compound	CAS Number	LOR	Unit		ES1925152-011	ES1925152-012	ES1925152-013	ES1925152-014	--------
					Result	Result	Result	Result	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		**0.25**	**0.32**	**0.09**	**0.02**	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		**0.25**	**0.32**	**0.09**	**0.02**	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		**0.5**	**1.0**	**0.7**	**0.6**	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ Total Nitrogen as N	----	0.1	mg/L		**0.8**	**1.3**	**0.8**	**0.6**	----
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		**0.16**	**0.25**	**0.36**	**0.15**	----
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		**13.0**	**13.0**	**14.8**	**21.6**	----
ø Total Cations	----	0.01	meq/L		**14.0**	**13.0**	**14.8**	**21.6**	----
ø Ionic Balance	----	0.01	%		**3.72**	**0.16**	**0.04**	**0.10**	----

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES1925155**	Page	: 1 of 6
Client	: **AUSTRALASIAN GROUNDWATER AND ENVIRONMENTAL CONSULTANTS PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: COSTANTE CONTE	Contact	: Customer Services ES
Address	: 4 HUDSON STREET HAMILTON NSW 2303	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: G1922H ASHTON ANNUAL SAMPLING	Date Samples Received	: 08-Aug-2019 16:50
Order number	:	Date Analysis Commenced	: 08-Aug-2019
C-O-C number	: ----	Issue Date	: 15-Aug-2019 13:18
Sampler	: WALTER ROWLANDS		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 8		
No. of samples analysed	: 8		

Accreditation No. 825
Accredited for compliance with ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Neil Martin	Team Leader - Chemistry	Chemistry, Newcastle West, NSW

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	WML119	WML129	WML181	WML262	WMLP301
			Client sampling date / time	08-Aug-2019 12:10	08-Aug-2019 10:15	08-Aug-2019 12:40	08-Aug-2019 13:20	08-Aug-2019 11:15
Compound	CAS Number	LOR	Unit	ES1925155-001	ES1925155-002	ES1925155-003	ES1925155-004	ES1925155-005
				Result	Result	Result	Result	Result
EA005: pH								
pH Value	----	0.01	pH Unit	7.07	7.20	7.35	8.14	8.18
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	1460	373	2540	3210	3140
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Total Dissolved Solids @180°C	----	10	mg/L	739	198	1310	1690	1620
EA045: Turbidity								
Turbidity	----	0.1	NTU	23.2	174	19.8	129	260
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	36	39
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	334	90	467	767	773
Total Alkalinity as CaCO3	----	1	mg/L	334	90	467	890	805
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	8	7	<1	<1	<1
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	231	39	478	444	459
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	23	15	11	10	5
Magnesium	7439-95-4	1	mg/L	22	8	10	10	4
Sodium	7440-23-5	1	mg/L	223	40	476	640	665
Potassium	7440-09-7	1	mg/L	4	2	2	3	3
EG020F: Dissolved Metals by ICP-MS								
Arsenic	7440-38-2	0.001	mg/L	<0.001	0.002	<0.001	<0.001	<0.001
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	7440-47-3	0.001	mg/L	0.012	<0.001	0.001	<0.001	<0.001
Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Manganese	7439-96-5	0.001	mg/L	0.101	0.170	0.023	0.040	0.015
Nickel	7440-02-0	0.001	mg/L	0.010	0.001	<0.001	0.001	<0.001
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	7440-66-6	0.005	mg/L	0.011	0.014	<0.005	0.007	0.005
Iron	7439-89-6	0.05	mg/L	1.10	0.44	0.44	0.15	0.06
EK026SF: Total CN by Segmented Flow Analyser								
Total Cyanide	57-12-5	0.004	mg/L	<0.004	<0.004	<0.004	<0.004	<0.004

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	WML119	WML129	WML181	WML262	WMLP301
				Client sampling date / time	08-Aug-2019 12:10	08-Aug-2019 10:15	08-Aug-2019 12:40	08-Aug-2019 13:20	08-Aug-2019 11:15
Compound	CAS Number	LOR	Unit		ES1925155-001	ES1925155-002	ES1925155-003	ES1925155-004	ES1925155-005
					Result	Result	Result	Result	Result
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		<0.01	**0.02**	<0.01	<0.01	<0.01
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		<0.01	**0.02**	<0.01	<0.01	<0.01
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		**1.6**	**0.4**	**0.8**	**6.9**	**2.4**
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ Total Nitrogen as N	----	0.1	mg/L		**1.6**	**0.4**	**0.8**	**6.9**	**2.4**
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		**0.15**	**0.56**	**0.05**	**2.30**	**0.51**
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		**13.4**	**3.04**	**22.8**	**30.3**	**29.0**
ø Total Cations	----	0.01	meq/L		**12.8**	**3.20**	**22.1**	**29.2**	**29.6**
ø Ionic Balance	----	0.01	%		**2.28**	**2.46**	**1.53**	**1.80**	**0.94**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	WMLP336	WMLP337	WMLP338	----	----
			Client sampling date / time	08-Aug-2019 09:35	08-Aug-2019 08:25	08-Aug-2019 09:10	----	----
Compound	CAS Number	LOR	Unit	ES1925155-006	ES1925155-007	ES1925155-008	--------	--------
				Result	Result	Result	----	----
EA005: pH								
pH Value	----	0.01	pH Unit	**6.60**	**7.24**	**6.76**	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**732**	**3260**	**2000**	----	----
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Total Dissolved Solids @180°C	----	10	mg/L	**370**	**1880**	**1120**	----	----
EA045: Turbidity								
Turbidity	----	0.1	NTU	**5.9**	**3990**	**4240**	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**143**	**422**	**268**	----	----
Total Alkalinity as CaCO3	----	1	mg/L	**143**	**422**	**268**	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**23**	**125**	**80**	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**102**	**694**	**416**	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**36**	**103**	**82**	----	----
Magnesium	7439-95-4	1	mg/L	**18**	**123**	**58**	----	----
Sodium	7440-23-5	1	mg/L	**64**	**346**	**213**	----	----
Potassium	7440-09-7	1	mg/L	**1**	**5**	**7**	----	----
EG020F: Dissolved Metals by ICP-MS								
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	**0.001**	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	----	----
Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	<0.001	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	----	----
Manganese	7439-96-5	0.001	mg/L	**0.057**	**0.183**	**0.659**	----	----
Nickel	7440-02-0	0.001	mg/L	**0.003**	**0.004**	**0.006**	----	----
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	----	----
Zinc	7440-66-6	0.005	mg/L	**0.029**	**0.023**	**0.102**	----	----
Iron	7439-89-6	0.05	mg/L	**0.20**	<0.05	**0.90**	----	----
EK026SF: Total CN by Segmented Flow Analyser								
Total Cyanide	57-12-5	0.004	mg/L	<0.004	<0.004	<0.004	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	WMLP336	WMLP337	WMLP338	----	----
				Client sampling date / time	08-Aug-2019 09:35	08-Aug-2019 08:25	08-Aug-2019 09:10	----	----
Compound	CAS Number	LOR	Unit		ES1925155-006	ES1925155-007	ES1925155-008	--------	--------
					Result	Result	Result	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	<0.01	**0.03**	----	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		**0.78**	**0.12**	**0.55**	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		**0.78**	**0.12**	**0.58**	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		<0.1	**1.2**	**11.4**	----	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ Total Nitrogen as N	----	0.1	mg/L		**0.8**	**1.3**	**12.0**	----	----
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		**0.07**	**1.48**	**3.04**	----	----
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		**6.21**	**30.6**	**18.8**	----	----
ø Total Cations	----	0.01	meq/L		**6.09**	**30.4**	**18.3**	----	----
ø Ionic Balance	----	0.01	%		**1.02**	**0.28**	**1.20**	----	----

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES1925154**	Page	: 1 of 4
Client	: **AUSTRALASIAN GROUNDWATER AND ENVIRONMENTAL CONSULTANTS PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: COSTANTE CONTE	Contact	: Customer Services ES
Address	: 4 HUDSON STREET HAMILTON NSW 2303	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: G1922H ASHTON ANNUAL SAMPLING	Date Samples Received	: 08-Aug-2019 16:50
Order number	: ----	Date Analysis Commenced	: 08-Aug-2019
C-O-C number	: ----	Issue Date	: 15-Aug-2019 15:12
Sampler	: WALTER ROWLANDS		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 3		
No. of samples analysed	: 3		

Accreditation No. 825
Accredited for compliance with ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	WMLP343	WMLP346	WMLP349	----	----
			Client sampling date / time	02-Aug-2019 10:30	02-Aug-2019 09:35	02-Aug-2019 08:30	----	----
Compound	CAS Number	LOR	Unit	ES1925154-001	ES1925154-002	ES1925154-003	--------	--------
				Result	Result	Result	----	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**7.60**	**7.43**	**7.18**	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**866**	**579**	**984**	----	----
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Total Dissolved Solids @180°C	----	10	mg/L	**401**	**277**	**480**	----	----
EA045: Turbidity								
Turbidity	----	0.1	NTU	**354**	**0.8**	**7.2**	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**182**	**145**	**151**	----	----
Total Alkalinity as CaCO3	----	1	mg/L	**182**	**145**	**151**	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**7**	<1	**18**	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**121**	**63**	**178**	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**51**	**26**	**33**	----	----
Magnesium	7439-95-4	1	mg/L	**23**	**15**	**20**	----	----
Sodium	7440-23-5	1	mg/L	**75**	**56**	**119**	----	----
Potassium	7440-09-7	1	mg/L	<1	<1	<1	----	----
EG020F: Dissolved Metals by ICP-MS								
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	<0.001	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	**0.001**	<0.001	----	----
Copper	7440-50-8	0.001	mg/L	**0.002**	**0.002**	<0.001	----	----
Lead	7439-92-1	0.001	mg/L	**0.002**	<0.001	<0.001	----	----
Manganese	7439-96-5	0.001	mg/L	**0.017**	**0.070**	**0.142**	----	----
Nickel	7440-02-0	0.001	mg/L	**0.002**	**0.002**	**0.001**	----	----
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	----	----
Zinc	7440-66-6	0.005	mg/L	**0.053**	**0.007**	**0.008**	----	----
Iron	7439-89-6	0.05	mg/L	<0.05	**0.63**	**0.72**	----	----
EK026SF: Total CN by Segmented Flow Analyser								
Total Cyanide	57-12-5	0.004	mg/L	<0.004	**0.010**	<0.004	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	WMLP343	WMLP346	WMLP349	----	----
				Client sampling date / time	02-Aug-2019 10:30	02-Aug-2019 09:35	02-Aug-2019 08:30	----	----
Compound	CAS Number	LOR	Unit		ES1925154-001	ES1925154-002	ES1925154-003	--------	--------
					Result	Result	Result	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	<0.01	<0.01	----	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		**0.66**	<0.01	<0.01	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		**0.66**	<0.01	<0.01	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		**0.8**	<0.1	<0.1	----	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ **Total Nitrogen as N**	----	0.1	mg/L		**1.5**	<0.1	<0.1	----	----
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		**0.26**	**0.05**	**0.04**	----	----
EN055: Ionic Balance									
ø **Total Anions**	----	0.01	meq/L		**7.20**	**4.67**	**8.41**	----	----
ø **Total Cations**	----	0.01	meq/L		**7.70**	**4.97**	**8.47**	----	----
ø **Ionic Balance**	----	0.01	%		**3.39**	**3.04**	**0.33**	----	----

CHAIN OF CUSTODY

ALS Laboratory: please tick →

ADELAIDE 21 Burma Road Pooraka SA 5095 Ph: 08 8359 0890 E: adelaide@alsglobal.com
BRISBANE 32 Shand Street Stafford QLD 4053 Ph: 07 3243 7222 E: samples.brisbane@alsglobal.com
GLADSTONE 46 Callemondah Drive Clinton QLD 4680 Ph: 07 7471 5600 E: gladstone@alsglobal.com
MACKAY 78 Harbour Road Mackay QLD 4740 Ph: 07 4944 0177 E: mackay@alsglobal.com
MELBOURNE 4 Westall Road Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsglobal.com
MUDGEE 27 Sydney Road Mudgee NSW 2850 Ph: 02 6372 6735 E: mudgee mail@alsglobal.com
NEWCASTLE 5 Rose Gum Road Warabrook NSW 2304 Ph: 02 4968 9433 E: samples.newcastle@alsglobal.com
NOWRA 4/13 Geary Place North Nowra NSW 2541 Ph: 024423 2063 E: nowra@alsglobal.com
PERTH 10 Hod Way Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsglobal.com
SYDNEY 27 [illegible] Ph: 02 8784 [illegible]
TOWNSVILLE [illegible] Ph: 07 4796 [illegible]
WOLLONGONG [illegible] Ph: 02 4225 [illegible]

CLIENT: AGE Consultants	TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)	☐ Standard TAT (List due date):
OFFICE: Newcastle		☐ Non Standard or urgent TAT (List due date):
PROJECT: Ashton Annual Sampling	ALS QUOTE NO.: EN/222/18	
PROJECT ID: G1922H		
PROJECT MANAGER: Costante Conte	CONTACT PH: 0439 738 877	
SAMPLER: Walter Rowlands	SAMPLER MOBILE: 0423 037 572	
COC Emailed to ALS? YES	EDD FORMAT (or default): XTAB, ENMRG, ESDAT, PDF	
Email Reports to: Walter@ageconsultants.com.au, Costante.Conte@ageconsultants.com.au		
Email Invoice to: As above + accounts@ageconsultants.com.au		
COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:		

COC SEQUENCE NUMBER (Circle)

COC: 1 2 3 4 5 6
OF: 1 2 3 4 5 6

RELINQUISHED BY:	RECEIVED BY:		
DATE/TIME: 8/8/19 4:46	DATE/TIME: 8/8/19 16:46	DATE/TIME:	DATE/TIME:

ALS USE	SAMPLE DETAILS MATRIX: SOLID (S) WATER (W)			CONTAINER INFORMATION	ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).											Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	pH & EC	NT-1 & NT-2	W-1 (7 metals)	EG020 - Fe, Mn, Se	EA015H - TDS	EA045 - turbidity	NT-11 - Total P, Total N	EK058G - NO3	EK055 - [illegible]	EK026SF		Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
1	RA27	6/8/19, 7:45	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	X	
2	T2-P	6/8/19, 13:05	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	X	
3	T3-A	6/8/19, 13:20	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	X	
4	T3-P	6/8/19, 14:00	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	X	
5	WML113C	6/8/19, 12:30	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	X	
6	WMLP277	6/8/19, 9:25	W	P, N, S, SP	5	X	X	X	X	X	X	X	X		X	X	
7	WMLP278	6/8/19, 10:35	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	X	
8	WMLP279	6/8/19, 11:20	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	X	
9	WMLP280	6/8/19, 8:40	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	X	
					45												

V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved, AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulfate Soils; B = Unpreserved Bag. [illegible] Plastic; AG = Amber Glass Unpreserved; AP = Airfreight Unpreserved Plastic

Environmental Division Sydney
Work Order Reference
ES1925150

Telephone : [illegible]

ALS Environmental

CHAIN OF CUSTODY

ALS Laboratory: please tick →

CLIENT: AGE Consultants

OFFICE: Newcastle

PROJECT: Ashton Annual Sampling

PROJECT ID: G1922H

PROJECT MANAGER: Costante Conte — CONTACT PH: 0439 738 877

SAMPLER: Walter Rowlands — SAMPLER MOBILE: 0423 037 572

COC Emailed to ALS? YES — EDD FORMAT (or default): XTAB, ENMRG, ESDAT, PDF

Email Reports to: Walter@ageconsultants.com.au, Costante.Conte@ageconsultants.com.au

Email Invoice to: As above + accounts@ageconsultants.com.au

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g.. Ultra Trace Organics)

☐ Standard TAT (List due date):

☐ Non Standard or urgent TAT (List due date):

ALS QUOTE NO.: EN/222/18

COC SEQUENCE NUMBER (Circle)

COC: (1) 2 3 4 5 6

OF: (1) 2 3 4 5 6

FOR LABORATORY USE ONLY (Circle)

RELINQUISHED BY: [signature]

DATE/TIME: 8/8/19 4:46

RECEIVED BY: [signature]

DATE/TIME: 8/8/19 16:46

RELINQUISHED BY:

DATE/TIME:

RECEIVED BY:

DATE/TIME:

ALS USE	SAMPLE DETAILS MATRIX: SOLID (S) WATER (W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).											Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	pH & EC	NT-1 & NT-2	W-1 (7 metals)	EG020 - Fe, Mn, Se	EA015H - TDS	EA045 - turbidity	NT-11 - Total P, Total N	EK058G - NO3	ED0?? - HCO3	EK026SF		Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
1	GM1	1/8/19, 8:55	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	X	
2	WML120A	7/8/19, 12:25	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	X	
3	WML120B	7/8/19, 12:50	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	X	
4	WML183	7/8/19, 13:25	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	X	
5	WMLP239	1/8/19, 13:50	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	X	
6	WMLP261	7/8/19, 11:20	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	X	
7	WMLP302	7/8/19, 11:55	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	X	
8	WMLP308	2/8/19, 13:55	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	X	
9	WMLP358	1/8/19, 13:10	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	X	
10	YAP016	1/8/19, 9:40	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	X	
					50												

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP = Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial; SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag

Environmental Division
Sydney
Work Order Reference
ES1926?51

CHAIN OF CUSTODY

ALS Laboratory: please tick →

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WOLLONGONG 99 Kenny Street Wollongong NSW 2500 Ph: 02 4225 3125 E: portkembla@alsglobal.com

CLIENT:	AGE Consultants	TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)	☐ Standard TAT (List due date):
OFFICE:	Newcastle		☐ Non Standard or urgent TAT (List due date):
PROJECT:	Ashton Annual Sampling	ALS QUOTE NO.: EN/222/18	
PROJECT ID:	G1922H		
PROJECT MANAGER:	Costante Conte	CONTACT PH: 0439 738 877	
SAMPLER:	Walter Rowlands	SAMPLER MOBILE: 0423 037 572	
COC Emailed to ALS?	YES	EDD FORMAT (or default): XTAB, ENMRG, ESDAT, PDF	

COC SEQUENCE NUMBER (Circle)

COC: 1 2 3 4 5 6

OF: 1 2 3 4 5 6

FOR LABORATORY USE ONLY (Circle)

Email Reports to: Walter@ageconsultants.com.au, Costante.Conte@ageconsultants.com.au

Email Invoice to: As above + accounts@ageconsultants.com.au

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:
DATE/TIME: 8/8/19 4:47	DATE/TIME: 8/8/19 16:47	DATE/TIME:

ALS USE | SAMPLE DETAILS MATRIX: SOLID (S) WATER (W) | CONTAINER INFORMATION | ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).

LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	pH & EC	NT-1 & NT-2	W-1 (7 metals)	EG020 - Fe, Mn, Se	EA015H - TDS	EA045 - turbidity	NT-11 - Total P, Total N	EK058G - NO3	EK062G - NO2	EK055G	
1	GM3B	1/8/19, 11:45	W	P	1	X										
2	PB1	7/8/19, 9:45	W	P	1	X										
3	RA18	7/8/19, 8:50	W	P	1	X										
4	RM10	7/8/19, 10:00	W	P	1	X										
5	WML115B	1/8/19, 10:40	W	P	1	X										
6	WMLP320	7/8/19, 10:25	W	P	1	X										
7	WMLP326	5/8/19, 12:30	W	P	1	X										
8	WMLP327	5/8/19, 12:55	W	P	1	X										
9	T4-A	5/8/19, 13:55	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	X
10	T4-P	5/8/19, 14:35	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	X
11	WMLP311	5/8/19, 9:45	W	P, N, S, SP	4	X	X	X	X	X	X	X	X	X	X	X
12	WMLP323	5/8/19, 8:15	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	X
					27											

Environment Division Sydney

Work Order Reference ES1922152

Telephone : +61-2-8784 8555

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CHAIN OF CUSTODY

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☐MACKAY 78 Harbour Road Mackay QLD 4740 Ph: 07 4944 0177 E: mackay@alsglobal.com

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☐NEWCASTLE 5 Rose Gum Road Warabrook NSW 2304 Ph: 02 4968 9433 E: samples.newcastle@alsglobal.com

☐NOWRA 4/13 Geary Place North Nowra NSW 2541 Ph: 024423 2063 E: nowra@alsglobal.com

☐PERTH 10 Hod Way Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsglobal.com

☐SYDNEY 277-289 Woodpark Road Smithfield NSW 2164 Ph: 02 8784 8555 E: samples.sydney@alsglobal.com

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☐WOLLONGONG 99 Kenny Street Wollongong NSW 2500 Ph: 02 4225 3125 E: portkembla@alsglobal.com

CLIENT: AGE Consultants

OFFICE: Newcastle

PROJECT: Ashton Annual Sampling

PROJECT ID: G1922H

PROJECT MANAGER: Costante Conte

CONTACT PH: 0439 738 877

SAMPLER: Walter Rowlands

SAMPLER MOBILE: 0423 037 572

COC Emailed to ALS? YES

EDD FORMAT (or default): XTAB, ENMRG, ESDAT, PDF

Email Reports to: Walter@ageconsultants.com.au, Costante.Conte@ageconsultants.com.au

Email Invoice to: As above + accounts@ageconsultants.com.au

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

TURNAROUND REQUIREMENTS : ☐ Standard TAT (List due date):

(Standard TAT may be longer for some tests e.g. Ultra Trace Organics) ☐ Non Standard or urgent TAT (List due date):

ALS QUOTE NO.: EN/222/18

COC SEQUENCE NUMBER (Circle)

COC: 1 2 3 4 5 6 7

OF: 1 2 3 4 5 6 7

FOR LABORATORY USE ONLY (Circle)

Yes N/A

Bricks present upon Yes N/A

Temperature on Receipt 6.3

RELINQUISHED BY:

DATE/TIME: 8/8/19, 16:47

RECEIVED BY:

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ALS USE	SAMPLE DETAILS MATRIX: SOLID (S) WATER (W)			CONTAINER INFORMATION	ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).											Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	pH & EC	NT-1 & NT-2	M-1 (7 metals)	EG020 - Fe, Mn, Se	EA015H - TDS	EA045 - turbidity	NT-11 - Total P, Total N	EK058G - NO3	ED093 - [illegible]	EK026SF		Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
13	WMLP324	5/8/19, 3:50	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	X	
14	WMLP325	5/8/19, 10:30	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	X	
					10												

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP = Airfreight Unpreserved Plastic

V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;

Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottle; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulfate Soils; B = Unpreserved Bag

CHAIN OF CUSTODY

ALS Laboratory: please tick →

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BRISBANE 32 Shand Street Stafford QLD 4053 Ph: 07 3243 7222 E: samples.brisbane@alsglobal.com
GLADSTONE 46 Callemondah Drive Clinton QLD 4680 Ph: 07 7471 5600 E: gladstone@alsglobal.com
MACKAY 78 Harbour Road Mackay QLD 4740 Ph: 07 4944 0177 E: mackay@alsglobal.com
MELBOURNE 2 Westall Road Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsglobal.com
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NOWRA 4/13 Geary Place North Nowra NSW 2541 Ph: 024423 2063 E: nowra@alsglobal.com
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SYDNEY 2 [illegible] Ph: 02 8784 [illegible]
TOWNSVILLE [illegible] Ph: 07 4796 [illegible]
WOLLONGONG [illegible] Ph: 02 4225 [illegible]

CLIENT: AGE Consultants
OFFICE: Newcastle
PROJECT: Ashton Annual Sampling
PROJECT ID: G1922H
PROJECT MANAGER: Costante Conte
SAMPLER: Walter Rowlands
COC Emailed to ALS? YES
Email Reports to: Walter@ageconsultants.com.au, Costante.Conte@ageconsultants.com.au
Email Invoice to: As above + accounts@ageconsultants.com.au
COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

TURNAROUND REQUIREMENTS : ☐ Standard TAT (List due date):
(Standard TAT may be longer for some tests e.g. Ultra Trace Organics) ☐ Non Standard or urgent TAT (List due date):
ALS QUOTE NO.: EN/222/18
CONTACT PH: 0439 738 877
SAMPLER MOBILE: 0423 037 572
EDD FORMAT (or default): XTAB, ENMRG, ESDAT, PDF

COC SEQUENCE NUMBER (Circle)
COC: 1 2 3 4 5 6
DF: 1 2 3 4 5 6

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ALS USE	SAMPLE DETAILS MATRIX: SOLID (S) WATER (W)			CONTAINER INFORMATION	ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).										Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	pH & EC	NT-1 & NT-2	W-1 (7 metals)	EG020 - Fe, Mn, Se	EA015H - TDS	EA045 - turbidity	NT-11 - Total P, Total N	EK058G - NO3	[illegible]	EK062SF	
1	WML119	8/8/19, 12:10	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	A
2	WML129	8/8/19, 10:15	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	B
3	WML181	8/8/19, 12:40	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	C
4	WML262	8/8/19, 13:20	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	D
5	WMLP301	8/8/19, 11:15	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	E
6	WMLP336	8/8/19, 9:35	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	F
7	WMLP337	8/8/19, 3:25	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	X
8	WMLP338	8/8/19, 9:10	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	X
					40											

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V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = [illegible] ulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formate [illegible] Preserved
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Ba [illegible] for Acid Sulphate Soils; B = Unpreserved Ba [illegible]

Environmental Division
Sydney
Work Order Reference
ES1925[illegible]55

Telephone : + 6[illegible]

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☐GLADSTONE 46 Callemondah Drive Clinton QLD 4680 Ph: 07 7471 5600 E: gladstone@alsglobal.com
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☐MELBOURNE 2- Westall Road Springvale VIC 3171 Ph: 03 8549 960[illegible] E: samples.melbourne@alsglobal.com
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☐NEWCASTLE 5 Rose Gum Road Warabrook NSW 2304 Ph: 02 4968 9433 E: samples.newcastle@alsglobal.com
☐NOWRA 4/13 Geary Place North Nowra NSW 2541 Ph: 024423 2063 E: nowra@alsglobal.com
☐PERTH 10 Hod Way Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsglobal.com
☐SYDNEY 277-289 Woodpark Road Smithfield NSW [illegible] Ph: 02 8784 8555 E: samples.sydney@alsglobal.com
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☐WOLLONGONG 99 Kenny Street Wollongong NSW [illegible] Ph: 02 4225 3125 E: portkembla@alsglobal.com

CLIENT: AGE Consultants

OFFICE: Newcastle

PROJECT: Ashton Annual Sampling

PROJECT ID: G1922H

PROJECT MANAGER: Costante Conte — CONTACT PH: 0439 738 877

SAMPLER: Walter Rowlands — SAMPLER MOBILE: 0423 037 572

COC Emailed to ALS? YES — EDD FORMAT (or default): XTAB. ENMRG, ESDAT, PDF

Email Reports to: Walter@ageconsultants.com.au, Costante.Conte@ageconsultants.com.au

Email Invoice to: As above + accounts@ageconsultants.com.au

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)

☐ Standard TAT (List due date):

☐ Non Standard or urgent TAT (List due date):

ALS QUOTE NO.: EN/222/18

COC SEQUENCE NUMBER (Circle)

COC: 1 2 3 4 5 6

OF: 1 2 3 4 5 6

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ALS USE	SAMPLE DETAILS MATRIX: SOLID (S) WATER (W)			CONTAINER INFORMATION	ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).											
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	pH & EC	NT-1 & NT-2	W-1 (7 metals)	EG020 - Fe, Mn, Se	EA015H - TDS	EA045 - turbidity	NT-11 - Total P, Total N	EK058G - NO3	[illegible]	EK026SF	
1	WMLP343	2/8/19, 10:30	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	
2	WMLP346	2/8/19, 9:35	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	
3	WMLP349	2/8/19, 8:30	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	X
					15											

Comments or samples [illegible]

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP = Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = [illegible] Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preser
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag

Environmental Division Sydney
Work Order Reference
ES1925154

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Appendix G T2A Monitoring Bore Investigation

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TKD/BDM/DWI:kc
G1922I_T2A Monitoring bore investigation
23 September 2019

Attention: Lachlan Crawford

Company Name
Ashton Coal Operations Pty Ltd
PO Box 2216
GREENHILLS NSW 2323

via email

Dear Lachlan,

RE: Ashton Coal Mine – T2A Monitoring Bore Investigation

1 Introduction

The Ashton Coal Mine (Ashton) routinely monitors groundwater levels and quality in the groundwater systems overlying the underground mining area. The monitoring network targets the Quaternary alluvium and Permian interburden/coal units with open monitoring bores and vibrating wire piezometers (VWP). Monitoring campaigns are conducted on a monthly basis to collect water level and quality data from the monitoring network. The data collected from key monitoring is reviewed on a monthly basis, whilst the remainder of bores are reviewed annually in accordance with the Water Management Plan (WMP[1]).

A review of data from monitoring bores located on Bowmans Creek Alluvium (BCA) was undertaken as part of the June 2019 monthly monitoring campaign. The June 2019 review indicated that groundwater levels within monitoring bore T2A (BCA monitoring bore) bore had dropped below the trigger level of 54.17 mAHD for the previous three consecutive rounds. This has triggered the response protocol relating to exceedance of groundwater trigger values in the WMP. Additionally, monitoring bore T2A had run dry as of 13 June 2019. Ashton engaged Australasian Groundwater and Environmental Consultants Pty Ltd (AGE) to investigate and report on this issue. This letter summarises the results of the investigation.

[1] Water Management Plan (WMP) – reviewed and updated by Gilbert & Associates Pty Ltd and Australasian Groundwater and Environmental (AGE) on behalf of Ashton and approved by the NSW Department of Planning & Environment (DPE) on 27 October 2015. The groundwater monitoring program was changed and came into force the 1st November 2015. Further amendments to the WMP following DPE comments saw the latest iteration issued on 11 May 2016.

2 Groundwater levels

Manual and electronic groundwater level measurements are recorded monthly at monitoring bore T2A. Figure 2.1 shows the groundwater level trend measured in bore T2A compared to daily rainfall and the Cumulative Rainfall Departure ((CRD) Bredenkamp, et al.1995). The CRD is a summation of the monthly departure of rainfall from the long-term average monthly rainfall and is based on Ashton meteorological site data.

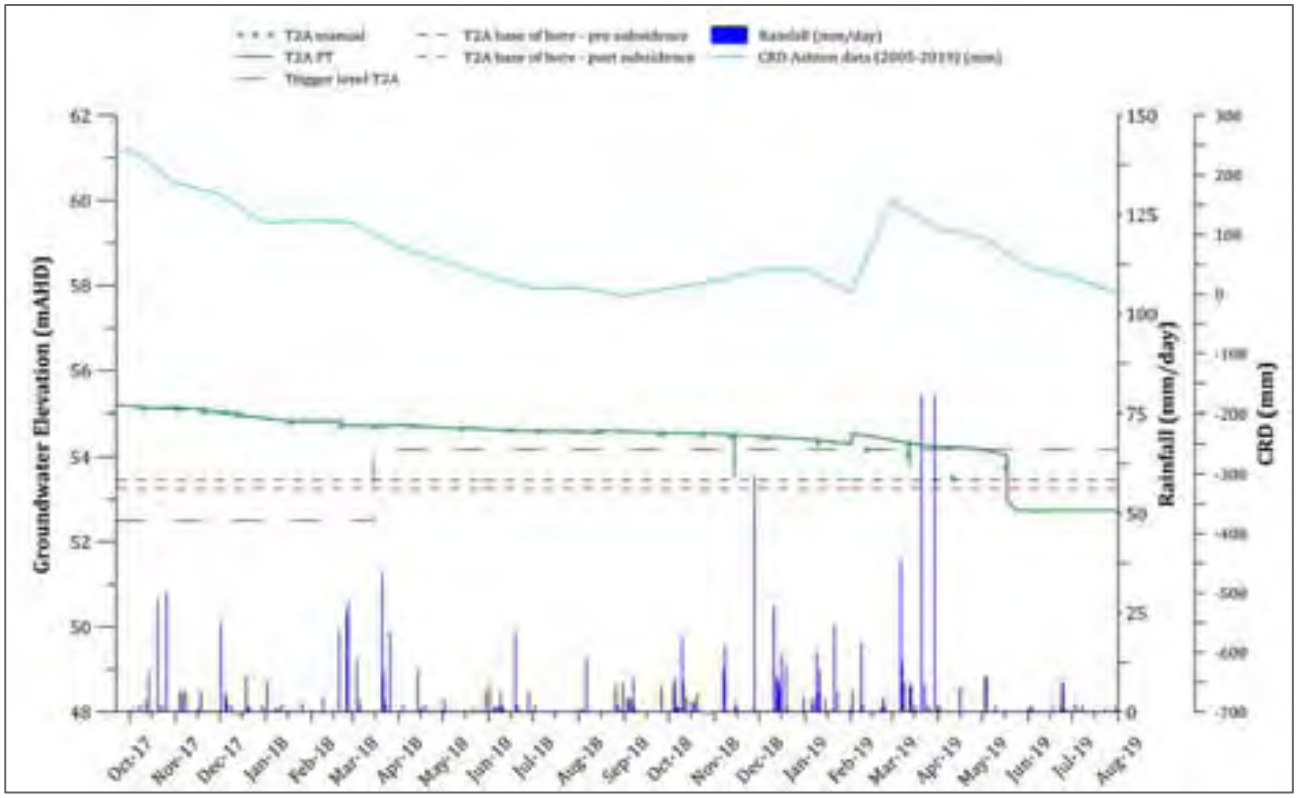


Figure 2.1 T2A hydrograph

Figure 2.1 shows that the groundwater levels at bore T2A has been gradually decreasing commensurate with a declining CRD, indicative of the below average rainfall in the area over an extended period. Groundwater levels within T2A have declined below the trigger value of 54.17 mAHD since 12 March 2019. The last recorded manual groundwater level measurement at T2A was 53.73m AHD (17 May 2019), with subsequent measurements in June, July and August 2019 showing the bore to be dry.

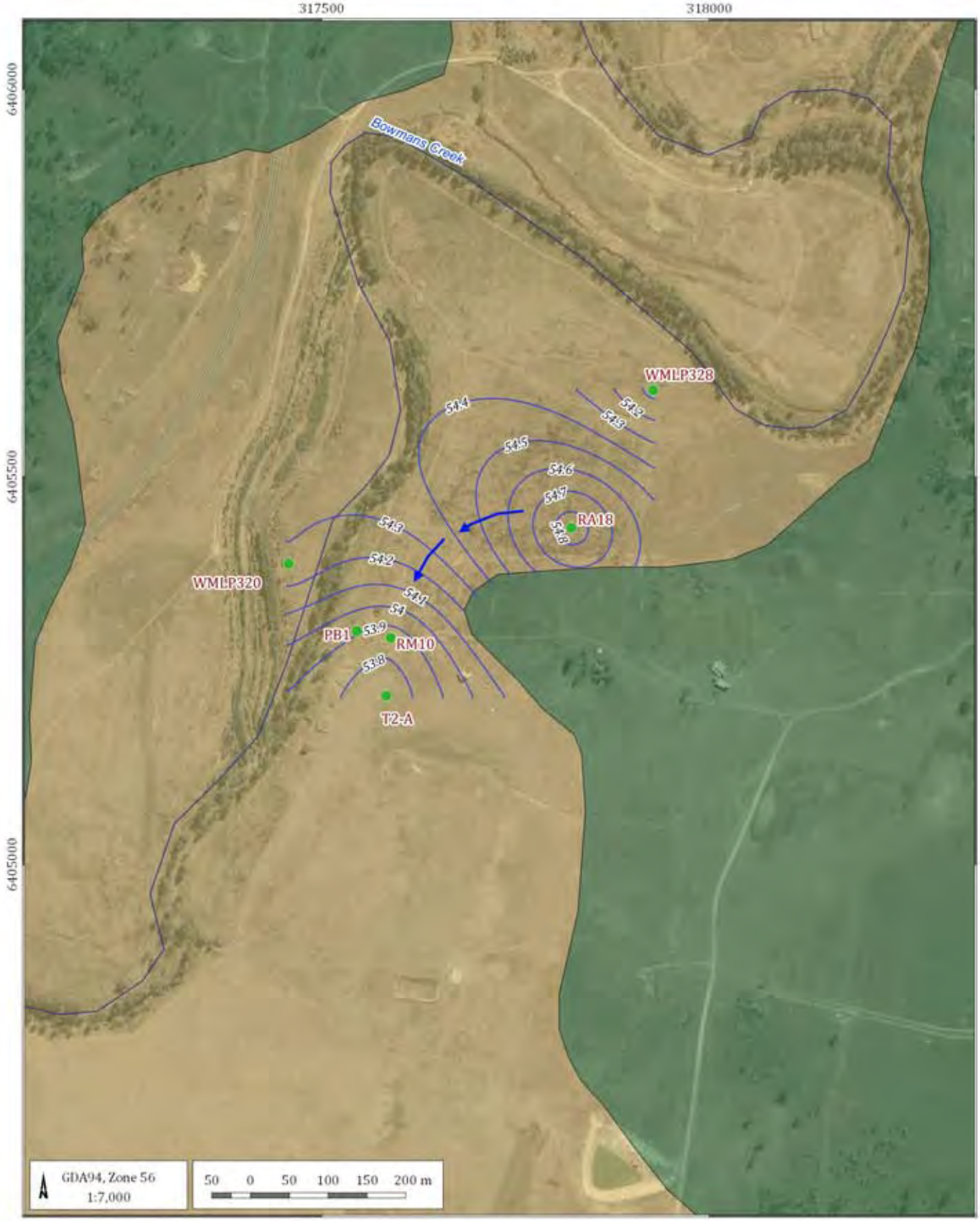
Field notes from the May sampling round indicate the bore contained very little water and there was difficulty in obtaining a sample, with only a small amount of brown coloured groundwater recovered. The Ontoto brand pressure transducer (PT) deployed in T2A appears to have been exposed to the atmosphere during this sampling event and has remained dry thereafter, displaying a false reading below the base of the bore (as measured post subsidence at this location, and discussed in the next section (refer Figure 2.1).

2.1 BCA alluvium potentiometric contours

Groundwater elevations within T2A and surrounding bores were contoured using the latest available concurrent water levels (17 May 2019) for the BCA bores nearby to T2A, and are shown on Figure 2.2. The location, survey data and groundwater levels relating to bores surrounding T2A is summarised in Table 2.1.

As would be expected, Figure 2.2 shows alluvial groundwater flows under a gentle gradient from north to south in the vicinity of Bowmans Creek, roughly mirroring the morphology of the creek. Monitoring bores RA18, RM10 and T2A are located closest to the edge of the mapped alluvial boundary. However, T2A is 'shielded' from the alluvial groundwater flow by a spur of less permeable Permian aged strata that extends into the eastern portion of the alluvial sediments (refer Figure 2.2).

Table 2.1 shows the last recorded groundwater level in T2A was 0.48 m above the base of the bore in May 2019. The elevation of the top of casing and the base of the relevant BCA bores shows these bores have been affected by between 0.06 and 0.68 m of subsidence. As a result, the water level is now below the base of T2A following the May sampling round. The condition of the slotted casing within T2A is unknown. It is also not known whether the slotted casing extends to the base of the borehole at T2A, or if the bore is fitted with a sump.



LEGEND

- Bowmens creek alluvium bore
- Drainage
- Groundwater level contour (m)
- Flow direction
- Quaternary alluvium
- Permian

Ashton T2A investigation (G1922I)

Groundwater elevation contour map

AGE

DATE 20/09/2019

FIGURE No: **2.2**

©2019 Australasian Groundwater and Environmental Consultants Pty Ltd (AGE) - www.ageconsultants.com.au
Source: 1 second SRTM Derived DEM-S - © Commonwealth of Australia (Geoscience Australia) 2011., GEODATA TOPO 250K Series 3 - © Commonwealth of Australia (Geoscience Australia) 2006.;
N:\Groundwater Jobs\G1922I Ashton T2A investigation\3_GIS\02.02_G1922I_Groundwater elevation contour map.qgs

Table 2.1 Survey and groundwater data - T2A and surrounding bores

Bore ID	Easting*	Northing*	Casing elevation – Pre subsidence (mAHD)	Casing elevation – Post subsidence (mAHD)	Base of bore elevation - Pre subsidence (mAHD)	Base of bore elevation - Post subsidence[1] (mAHD)	Groundwater elevation (mAHD) May 2019
T2A	317583	6405217	61.85	61.64	53.46	53.25	53.73
PB1	317545	6405301	-	60.46	-	52.81	54.59
RM10	317589	6405292	61.55	61.49	51.22	51.16	53.83
RA18	317821	6405434	63.16	62.48	54.94	54.26	54.88
WMLP320	317457	6405388	61.96	61.92	53.06	53.02	54.29
WMLP328	317927	6405611	62.76	-	50.69	-	54.06

Notes: * *Coordinates: GDA94 Zone 56.*

[1] *Measured May 2017.*

2.2 Water levels vs base of bore depth

Groundwater levels relative to the base elevations of each monitoring bore located near to T2A and screened in the BCA are shown in Figure 2.3. This shows groundwater levels have declined in all bores adjacent to T2A and within the BCA from December 2017 to June 2019. Whilst T2A is the only bore to have run dry in the area, a number of other BCA bores also have very little water remaining in the bore casing; most notably RA18, which is also situated on the edge of the alluvial boundary.

The data also shows water levels in all the BCA have bores have been declining at a generally similar rate since December 2018. This is in line with the below average rainfall that has been experienced in this region over the same time period.

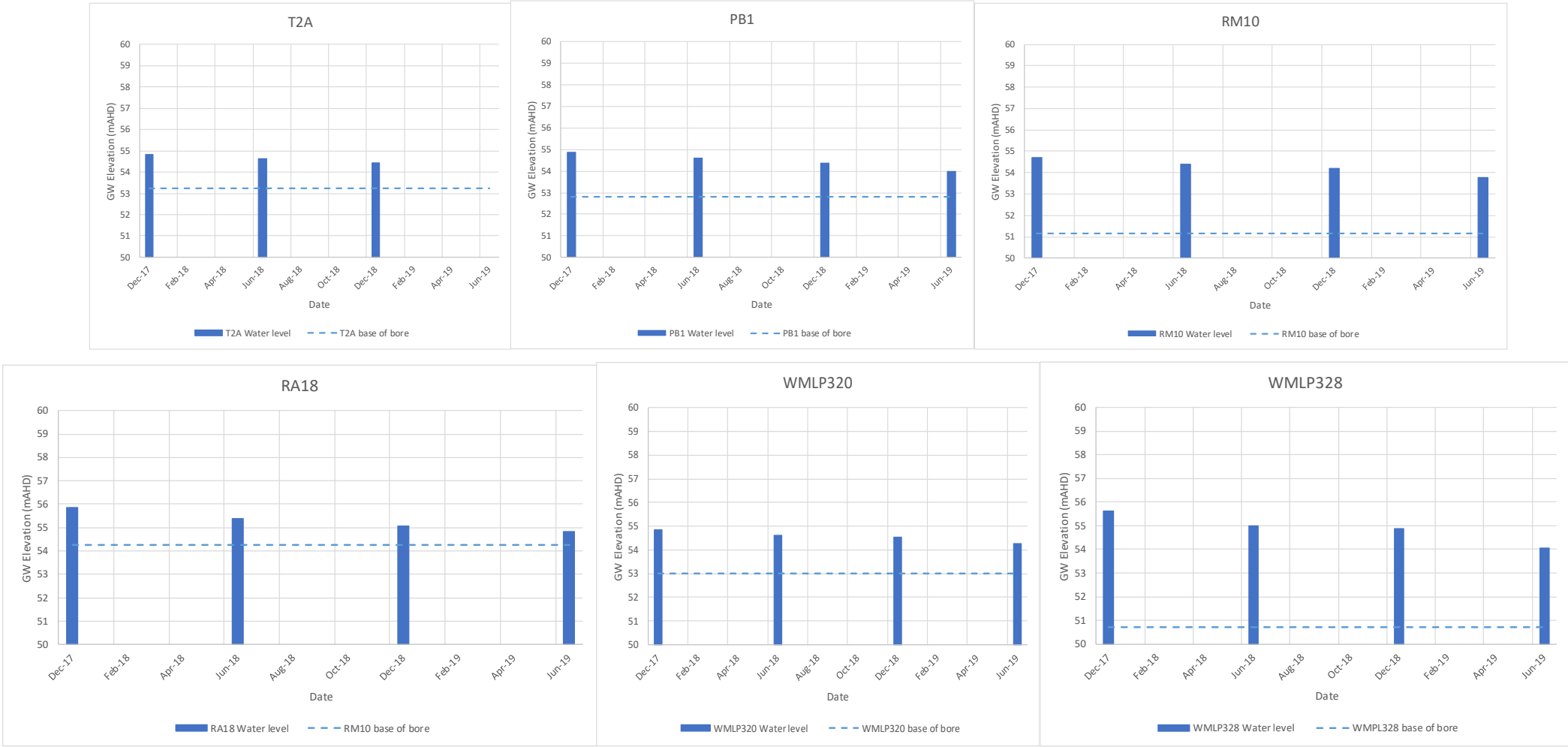


Figure 2.3 T2A and surrounding bores – groundwater levels and base of bores

3 Conclusion

Groundwater level data recorded for the BCA monitoring bores shows water levels have been declining at a similar rate in recent times (since December 2018), most likely as a result of below average rainfall. Monitoring bore T2A (and RA18, RM10) are situated nearby to the edge of the alluvium. Notably, both bores are assessed to have the least amount of groundwater above the base of the bore when compared to other BCA monitoring bores. With the continuing groundwater level decline within the alluvium, the alluvial fringes appear to have been the first monitoring bores to become dry, as observed in monitoring bore T2A. Monitoring bore RA18 is nearly dry, with only 0.62 m of water remaining within the base of the bore.

The May sampling round appears to have removed the last remaining water within T2A and the bore did not recharge. The reasons for this are unclear. It may be that the last remaining water within T2A was stored within a sump and this water was removed during sampling.

Another possibility is the screen is blocked and/or damaged due to mine subsidence, thereby hindering groundwater flow into the bore. However, the rate of groundwater level decline seen within T2A and that of neighbouring bores would suggest that groundwater levels are generally declining within the BCA alluvium, having now fallen below the elevation necessary to saturate the fringes of the alluvium.

If you have any queries, please do not hesitate to call.

Yours faithfully,

Kaan Duz
Project Hydrogeologist
Australasian Groundwater and Environmental Consultants Pty Ltd

Appendix H July Monitoring Exceedance Review – Investigation of Monitoring bore WMLP311

Australasian Groundwater
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BM (G1922E.Yancoal Ashton WMLP311 EC exceedance)
31 July 2018

Yancoal Australia
Ashton Coal Mine
Camberwell NSW
via email

Attention: Lachlan Crawford
cc: Phillip Brown

Dear Lachlan,

RE: Ashton Coal Mine – July Monitoring Exceedance Review – Investigation of Monitoring Bore WMLP311

1 Introduction

The Ashton Coal Mine (Ashton) routinely monitors groundwater levels and quality in the groundwater systems overlying the underground mining area. The monitoring network targets the Quaternary alluvium and Permian interburden / coal units with open monitoring bores and vibrating wire piezometers (VWP). Monitoring campaigns are conducted on a monthly basis to collect water level and quality data from the monitoring network. The data collected from key monitoring is reviewed on a monthly basis, whilst the remainder of bores are reviewed annually in accordance with the Water Management Plan (WMP[1]).

The monitoring bore WMLP311 is screened in the Bowmans Creek Alluvium (BCA). In July 2018, the bore was found to have exceeded the site WMP electrical conductivity (EC) trigger for three consecutive monitoring rounds.

The WMP requires three consecutive exceedances of the EC trigger be investigated. Ashton engaged Australasian Groundwater and Environmental Consultants Pty Ltd (AGE) to investigate and report on this issue. This letter summarises the results of the investigation.

[1] Water Management Plan (WMP) - reviewed and updated by Gilbert & Associates Pty Ltd and Australasian Groundwater and Environmental (AGE) on behalf of Ashton and approved by the NSW Department of Planning & Environment (DPE) on 27 October 2015. The groundwater monitoring program was changed and came into force the 1st November 2015. Further amendments to the WMP following DPE comments saw the latest iteration issued on 1 March 2018.

In addition to the WMLP311 EC exceedance, two adjacent monitoring bores have water level measurements close to their respective triggers. Whilst three consecutive groundwater level exceedances have not been recorded as of the July 2018 monitoring round, it should be noted that WMLP328 (screened in BCA), recorded groundwater level exceedances in the last two monitoring rounds, and WMLP323 (screened in BCA) recorded a general decline in groundwater levels and an increase in EC values. This general trend of decreasing groundwater levels and increasing EC is observed throughout the northern area of the BCA.

This letter, however, specifically addresses the three recorded exceedances in WMLP311.

Figure 1.1 below shows the locations of WMLP311, WMLP 323 and WMLP328. The figure also shows the extent of mapped Quaternary alluvium, the inferred extent of saturated alluvium (after Aquaterra 2009[2]) and the location of mined longwall panels.

[2] Aquaterra (2009), Ashton Underground Mine Extension of Development Consent Area - Groundwater Impact Assessment

LEGEND

- Alluvium
- Saturated BCA (Aquaterra 2009)
- Longwall panels (ULD)
- Mined longwall panel (ULD)

Location

- Monitoring bore

Yancoal Ashton - WMLP311 EC Exceedance (G1922E)

Location of WMLP311, WMLP323, WMLP328

AGE

DATE 31/07/2018

FIGURE No **1.1**

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N:/Groundwater Jobs/G1922E Yancoal Ashton WMLP311 EC Trigger Investigation/3_GIS/Workspaces/001_Deliverable1/G1922E Figure1_WMLP311_323_328.qgs
Aquaterra (2009), Ashton Underground Mine Extension of Development Consent Area - Groundwater Impact Assessment

2 Investigation and results

2.1 Monitoring bore – WMLP311

Monitoring bore WMLP311 was drilled by Hunter Drilling and installed under the supervision of Aquaterra on 24 January 2011 at the request of Ashton. The purpose of this bore was to assess how the BCA and the weathered profile of the underlying coal measures overburden interact. This bore overlies the unmined section of longwall panel LW5 (refer Figure 1.1).

WMLP311 was installed to a depth of 7.6 metres below ground level (mbgl) and is screened within alluvial sand and gravel between 3.6 mbgl and 6.6 mbgl. WMLP323 and WMLP328 are both screened in similar material and at similar depths to WMLP311.

The Ashton WMP outlines the groundwater monitoring program and lists trigger criteria (groundwater level and quality) to be used to assess the potential for mining to impact the alluvial groundwater system. The WMP includes bore specific groundwater level triggers for the BCA and water quality impact assessment criteria for each of the three alluvial aquifers on site – BCA, Glennies Creek Alluvium (GCA) and the Hunter River Alluvium (HRA).

As described within the WMP, the groundwater trigger values account for natural variation using data collected between 2011 to 2015 as well as approved impacts[3] indicated by predicted drawdown[4]. The result is a practical trigger level that accounts for both approved mining impacts and natural variability.

In a similar fashion to groundwater levels, groundwater quality exhibits a degree of natural variation. Water quality triggers are based on groundwater quality records and use the calculated 5th and 95th percentile of the historical data for pH and EC. These percentiles are more conservative than those outlined in the procedure recommended by ANZECC/ARMCANZ (2000). The trigger criteria and latest recorded measurements for groundwater levels and EC within WMLP311, WMLP323 and WMLP328 are shown in Table 2.1. Exceedances are shown in orange.

Table 2.1 WMLP311, WMLP323 andWMLP328 groundwater levels, EC trigger criteria, EC monitoring results and exceedances

Bore ID	Groundwater level trigger (mAHD)	Groundwater EC trigger (µS/cm) (95th percentile)	June 2018 groundwater level (mAHD)	July 2018 groundwater level (mAHD)	May 2018 EC (µS/cm)	June 2018 EC (µS/cm)	July 2018 EC (µS/cm)
WMLP311	57.5	1289	58.37	58.28	1293	1332	1354
WMLP323	59.2	1241	59.76	59.7	1207	1217	1240
WMLP328	55.15	1175	54.99	54.84	1172	1150	1172

[3] Aquaterra (2009). "*Bowmans Creek Diversion: Groundwater Impact Assessment Report*". Reference No. S55G/011g, dated 21 October 2009.

[4] RPS (2014). "*Ashton coal groundwater model*". Reference No. S55N/022b, dated 09 May 2014.

Figure 2.1 shows the long term trend of the WMLP311 groundwater level and EC compared to the cumulative rainfall departure (CRD). The CRD is an analysis of the monthly rainfall compared with the long-term average for the same month. A rising trend in the CRD plot indicates months of above average rainfall, whilst a falling slope indicates periods when rainfall is below the monthly average. A sharp decline in the CRD can be clearly seen from the beginning of 2017 to the present day. This decline is a reflection of the below average rainfall the region is currently experiencing. Longwall panel start or finish dates are indicated by a vertical dashed line.

Figure 2.2 shows the EC results for WMLP311, WMLP323 and WMLP328 compared to the CRD within this dry period. Figure 2.3 shows the groundwater levels for WMLP311, WMLP323 and WMLP328 compared to the CRD over the same time period.

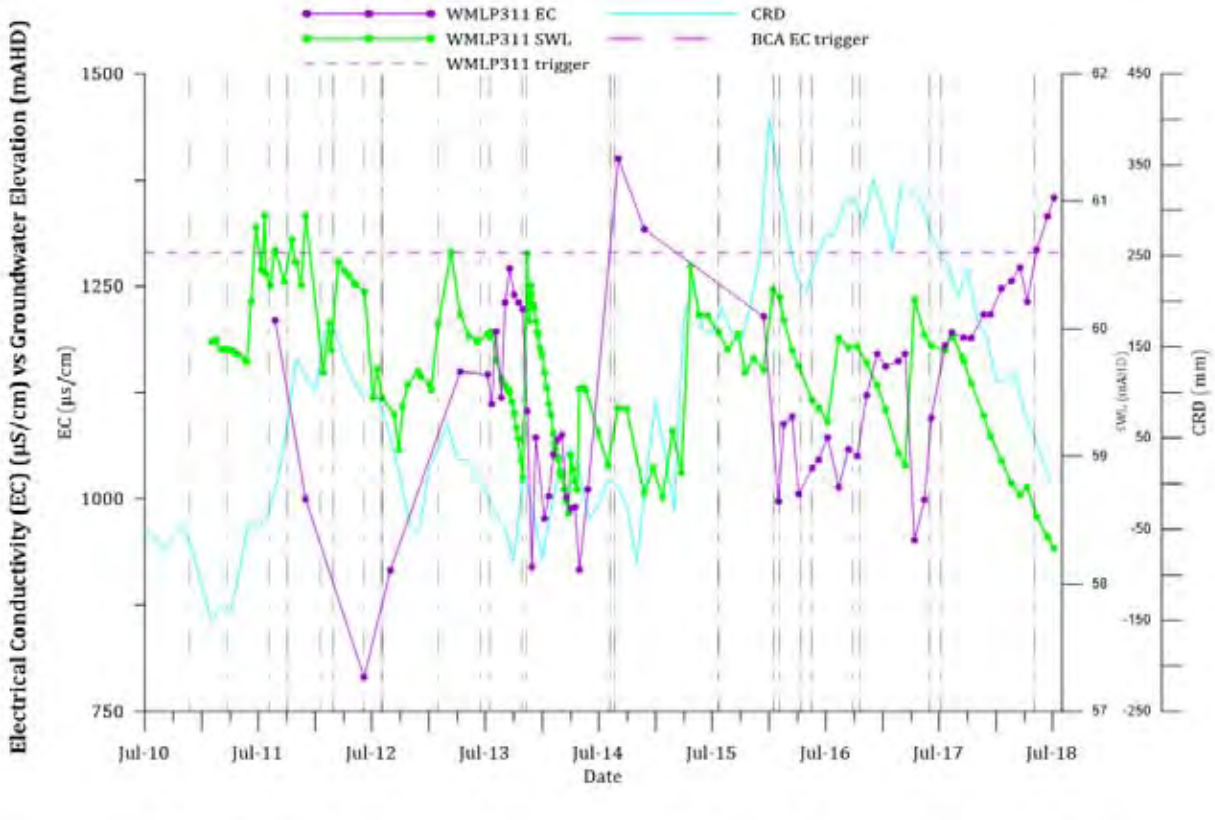


Figure 2.1 WMLP311 groundwater level and EC results vs CRD

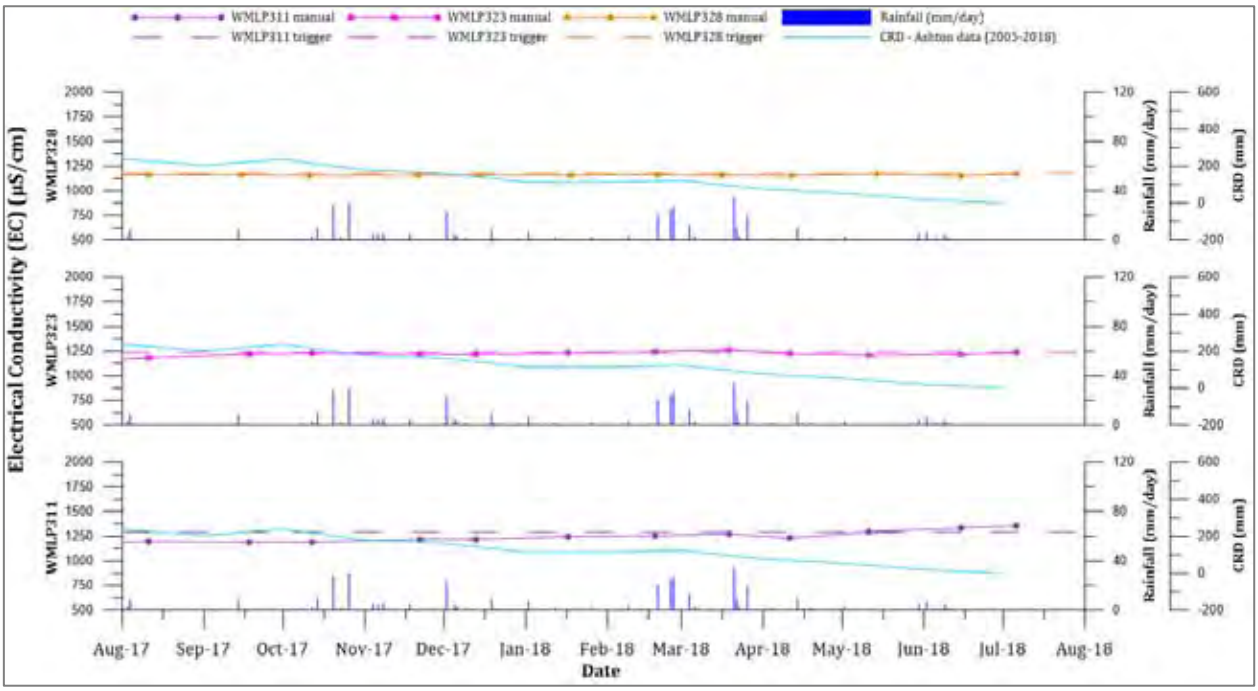


Figure 2.2 WMLP311, WMLP323 and WMLP328 EC results vs CRD

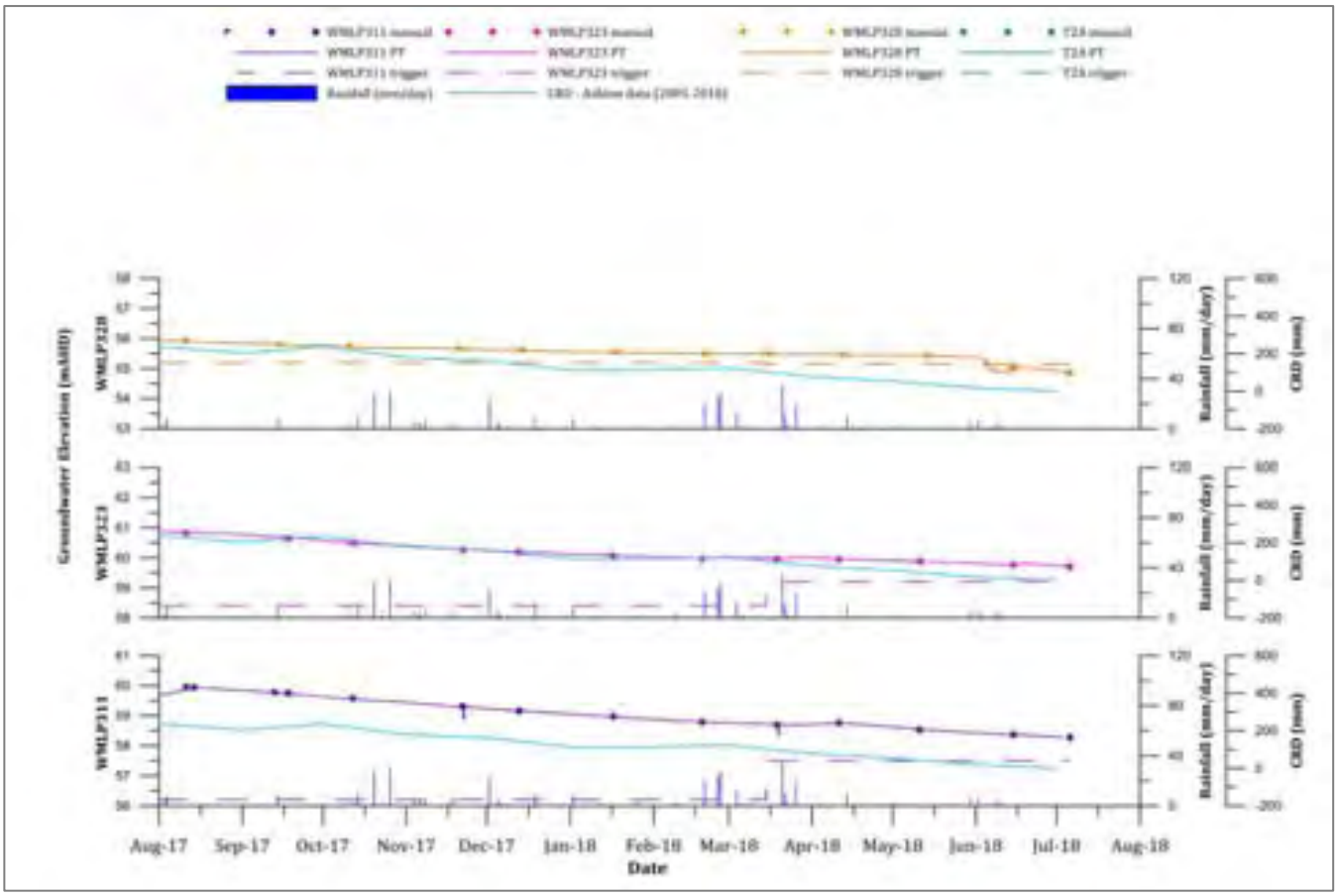


Figure 2.3 WMLP311, WMLP323 and WMLP328 groundwater level results vs CRD

With respect to monitoring bore WMLP311, it can be seen that notable increases in groundwater level coincide with periods of increasing CRD, indicating that the BCA is recharged by rainfall/runoff recharge and from Bowmans Creek itself, whether directly from the surface or via through flow within the alluvial aquifer. The historically low present day groundwater levels seen within WMLP311 also correspond to a period of no flow and historically low surface water levels within Bowmans Creek (refer Figure 2.4). Figure 2.4 shows that Bowmans Creek has had low or no flow for the past 12 months.

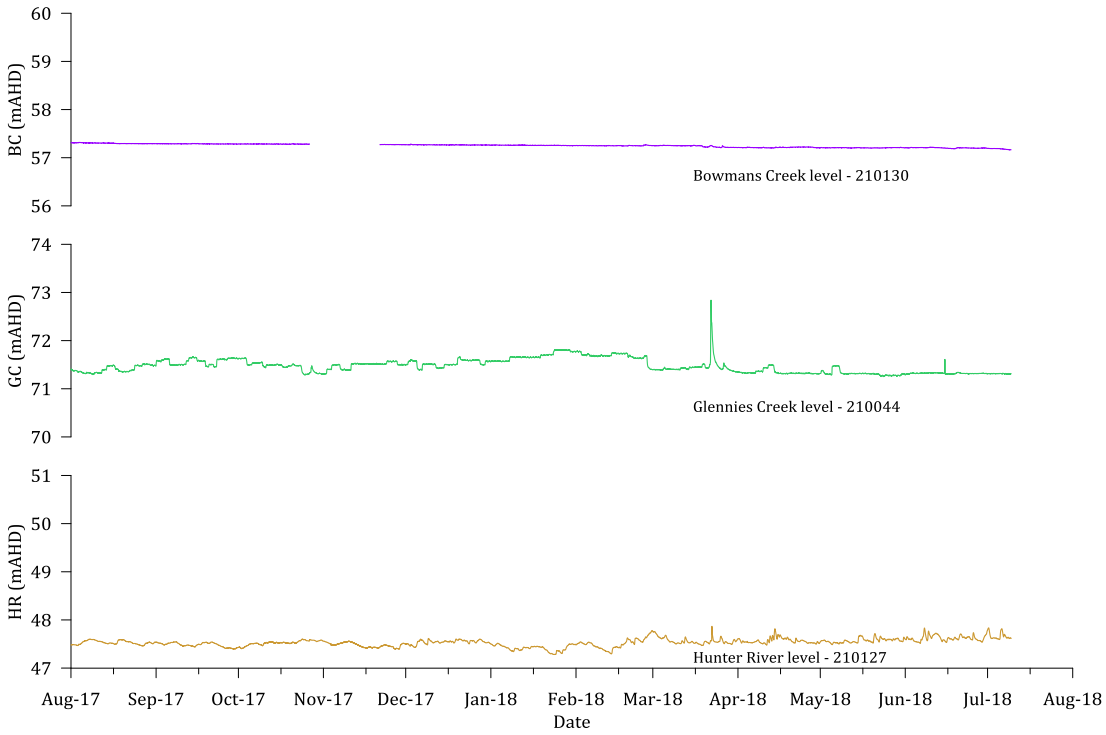


Figure 2.4 Surface water level trends

Figure 2.1, Figure 2.2 and Figure 2.3 also show that:

- An inverse relationship exists between groundwater levels and EC values. This relationship is most clearly defined over the latest period of below average rainfall (2017/2018);
- Bores screened within the BCA all showed a decline in groundwater level and an increase in EC over this dry period, and;
- Whilst WMLP311 has not been undermined, the commencement or termination of longwall panels appears to have no bearing on either groundwater level or EC in WMLP311.

The trend in EC measurements appears to be relatively steady over the history of monitoring at the site. Of the 61 historic WMLP311 EC measurements, five are above the EC trigger of 1,289 µS/cm. Periods of low and or declining EC coincide with periods of increasing CRD, such as mid-2012 and early-2016. The reverse of this can also be seen in mid-2014 and the present day, with elevated EC records coinciding with periods of declining CRD, indicating EC within this bore is influenced by climatic conditions. With the exception of the above mentioned time periods, the trend in groundwater EC in WMLP311 appears to generally oscillate between 1,000 and 1,250 µS/cm.

The trend in pH measurements also appear to loosely correlate to CRD and also suggest the observed variability is due to climatic conditions. A general increase in pH was noted in 2017/2018, which coincided with a period of decreasing CRD, and hence reduced average rainfall (Figure 2.5).

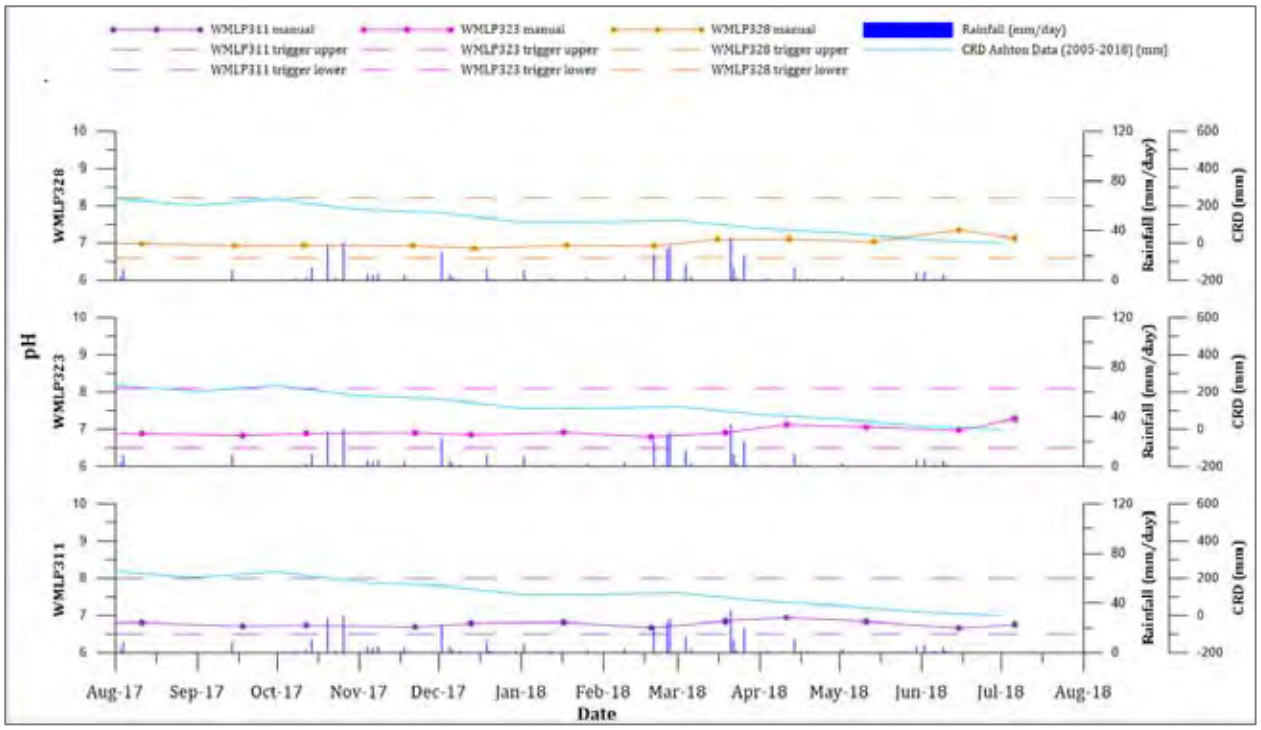


Figure 2.5 WMLP311, WMLP323 and WMLP328 pH results vs CRD

Table 2.1 summarises statistics for the WMLP311 monitoring data. This data shows that the EC for this bore is often close to the trigger value of 1,289 µS/cm. As discussed, extended periods of below average rainfall result in higher EC readings in WMLP311.

Table 2.2 Summary of WMLP311 quality statistics

Parameter	Value (µS/cm)	pH
Range	790 – 1,400	6.31 – 8.20
Average	1,121	7.01
Median	1,119	6.90
95th percentile	1,317	7.76
5th percentile	920	6.52

A copy of the bore construction log for WMLP311 is included as Attachment 1. The bore construction logs show bore WMLP311 is screened within sands and gravels of the BCA. The log also shows that a siltstone unit associated with the Permian Coal Measures subcrops directly beneath the alluvium. Other nearby bores (T3A) are known to have subcropping coal seams less than 5 m beneath the base of the alluvium. Whilst WMLP311 only intersected approximately 1 m of Permian strata, it is likely that coal would have been intersected had the borehole continued much deeper. Given the likely proximity of coal seams to the base of the alluvium there is the potential for groundwater exchange between the alluvium and the more saline groundwater associated with the fractured rock. The possibility of this groundwater exchange is even more likely given the reduced hydraulic head associated with the historically low groundwater levels in alluvial monitoring bore WMLP311 and surface water in Bowmans Creek.

3 Summary

In summary:

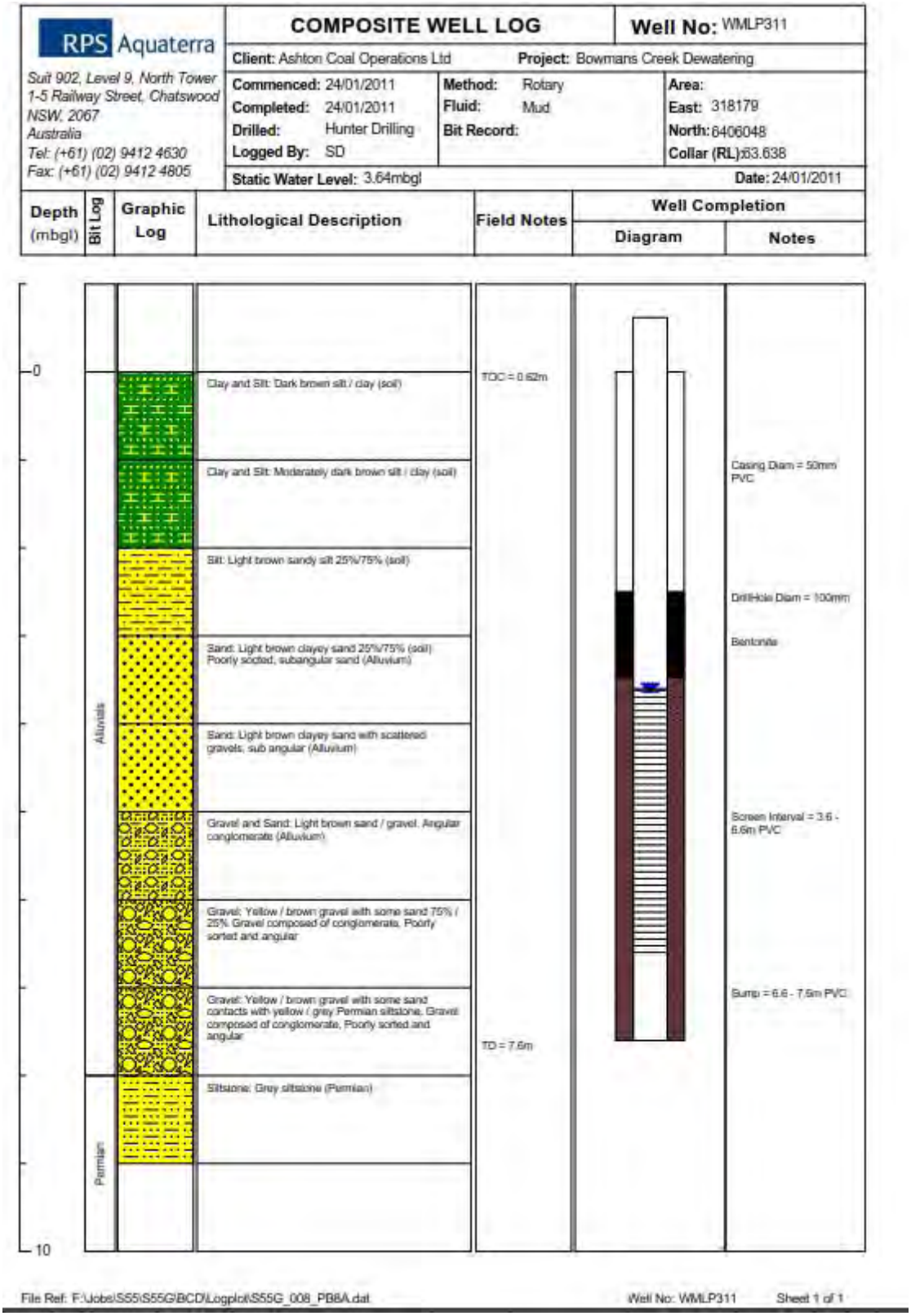
- An inverse relationship exists between groundwater levels and EC values in WMLP311, and also in WMLP323 and WMLP328 although no exceedance protocol has been required. This relationship is most clearly defined over the latest period of below average rainfall (2017/2018) and is further supported by available pH data; and
- Groundwater levels in BCA bores are strongly influenced by rainfall. The current extended period of below average rainfall has seen a commensurate decline in groundwater levels within BCA bores; in particular WMLP328;
- Whilst WMLP311 has not been undermined, the commencement or termination of longwall panels appears to have no bearing on either groundwater levels or EC in WMLP311.

Given time, a return to average rainfall values, and in increased hydraulic head in Bowmans Creek and associated alluvium, it is likely that EC levels within WMLP311 will decline from the current level of 1,354 µS/cm and return to levels nearer the average of 1,121 µS/cm.

This is likely to be the case for the whole of the northern portion of the BCA on site and the motive for why WMLP323 and WMLP328 have presented low water levels and elevated EC values.

Although the impacts are not considered mining related, they are within the approved impacts.

Attachment 1 WMLP311 bore construction log


RPS Aquaterra
Suit 902, Level 9, North Tower
1-5 Railway Street, Chatswood
NSW, 2067
Australia
Tel: (+61) (02) 9412 4630
Fax: (+61) (02) 9412 4805
COMPOSITE WELL LOG
Well No: WMLP311
Client: Ashton Coal Operations Ltd
Project: Bowmans Creek Dewatering
Commenced: 24/01/2011
Completed: 24/01/2011
Drilled: Hunter Drilling
Logged By: SD
Method: Rotary
Fluid: Mud
Bit Record:
Area:
East: 318179
North: 6406048
Collar (RL): 83.638
Static Water Level: 3.64mbgl
Date: 24/01/2011
Depth (mbgl)
Bit Log
Graphic Log
Lithological Description
Field Notes
Well Completion
Diagram
Notes
0
10
Alluvials
Permian
Clay and Silt: Dark brown silt / clay (soil)
Clay and Silt: Moderately dark brown silt / clay (soil)
Silt: Light brown sandy silt 25%/75% (soil)
Sand: Light brown clayey sand 25%/75% (soil) Poorly sorted, subangular sand (Alluvium)
Sand: Light brown clayey sand with scattered gravels, sub angular (Alluvium)
Gravel and Sand: Light brown sand / gravel. Angular conglomerate (Alluvium)
Gravel: Yellow / brown gravel with some sand 75% / 25%. Gravel composed of conglomerate, Poorly sorted and angular
Gravel: Yellow / brown gravel with some sand contacts with yellow / grey Permian siltstone. Gravel composed of conglomerate, Poorly sorted and angular
Siltstone: Grey siltstone (Permian)
TOC = 0.62m
TD = 7.6m
Casing Diam = 50mm PVC
DrillHole Diam = 100mm
Bentonite
Screen Interval = 3.6 - 6.6m PVC
Sump = 6.6 - 7.6m PVC
File Ref: F:\Jobs\S55\S55G\BCD\Logplot\S55G_008_PB8A.dat
Well No: WMLP311
Sheet 1 of 1