Department of Planning and Environment

Phillip Brown
Environment and Community Relations Superintendent
Ashton Coal Operations Limited

By email only: Phillip.Brown@yancoal.com.au

13/05/2022

Ashton Coal Mine (DA309-11-2001-I)
Annual Review 2021

Dear Mr Brown

Reference is made to your post approval matter, DA309-11-2001-I-PA-17, Annual Review (AR) 2021 for the Ashton Coal Mine, submitted as required by Schedule 5, Condition 10 of DA309-11-2001-I as modified (the consent) to the Department of Planning and Environment (the department) on 31 March 2022.

The department has reviewed AR 2021 and considers it to generally satisfy the reporting requirements of the consent and the department's *Annual Review Guideline* (October 2015). Please make publicly available a copy of AR 2021 on the company website.

Please note that the department's acceptance of AR 2021 is not an endorsement of the compliance status of the project. The department notes that the non-compliances identified in AR 2021 have previously been assessed by the department.

Should you wish to discuss the matter further, please contact Joel Curran, Senior Compliance Officer, on 02 4904 2702 or compliance@planning.nsw.gov.au

Yours sincerely

Heidi Watters
Team Leader Northern
Compliance

As nominee of the Planning Secretary

Ashton Coal
PART OF THE YANCOAL AUSTRALIA GROUP

YANCOAL
兖煤澳大利亚有限公司

Annual Review

Ashton Coal Project

1 January 2021 – 31 December 2021

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ASHTON COAL

PTY LTD

ABN: 22 078 556 500

Annual Review

for the

Ashton Coal Project

1 January 2021 – 31 December 2021

Compiled for:

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March 2022

AshtonCoal
PART OF THE YANCOAL AUSTRALIA GROUP

TITLE BLOCK

Name of Operation	Ashton Coal Project
Name of Operator	Ashton Coal Operations Pty Limited
Development consent / project approval #	309-11-2001-i
Name of holder of development consent / project approval	Ashton Coal Operations Pty Limited
Mining Lease #	ML 1529, ML 1533 and ML 1623
Name of holder of mining lease	White Mining (NSW) Pty Limited
Water licence #	Multiple - see Section 3
Name of holder of water licence	Ashton Coal Mines Limited
MOP/RMP start date	01/07/2018
MOP/RMP end date	26/02/2024
Annual Review start date	01/01/2021
Annual Review end date	31/12/2021

I, Aaron McGuigan, certify that, to the best of my knowledge, this report is a true and accurate record of the compliance status of the Ashton Coal Project for the period 1 January 2021 to 31 December 2021 and that I am authorised to make this statement of behalf of Ashton Coal Operations Pty Limited.

Note.

a) The Annual Review is an 'environmental audit' for the purposes of section 122B(2) of the Environmental Planning and Assessment Act 1979. Section 122E provides that a person must not include false or misleading information (or provide information for inclusion in) an audit report produced to the Minister in connection with an environmental audit if the person knows that the information is false or misleading in a material respect. The maximum penalty is, in the case of a corporation, $1 million and for an individual, $250,000.

b) The Crimes Act 1900 contains other offences relating to false and misleading information: Section 192G (Intention to defraud by false or misleading statement – maximum penalty 5 years imprisonment); Section 307A, 307B and 307C (false or misleading application/information/documents – maximum penalty 2 years imprisonment or $22,000, or both).

Name of authorised reporting officer	Aaron McGuigan
Title of authorised reporting officer	Operations Manager
Signature of authorised reporting officer	
Date	31 March 2022

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1. STATEMENT OF COMPLIANCE

The compliance status of relevant approvals was reviewed for the reporting period and is summarised in **Table 1.1**. It was determined that there was one non-compliance during the reporting period with Development Consent 309-11-2001-i. Non-compliances with the conditions of EPL 11879 are reported separately as part of the EPL Annual Return.

Table 1.1
Statement of Compliance

Were all conditions of the relevant approval(s) complied with?	Yes / No
Development Consent 309-11-2001-i	No
Mining Lease 1529	Yes
Mining Lease 1533	Yes
Mining Lease 1623	Yes
Water Access Licences 1358, 15583, 8404, 997, 1120, 1121, 6346, 23912, 984, 19510, 36702, 36703, 29566, 41501, 41552, 41553	Yes

Table 1.2
Non-compliances

Relevant Approval	Cond #	Condition Description (summary)	Compliance Status	Comment	Where Addressed in Annual Review
DA 309-11-2001-i	3/12	Ensure that all reasonable and feasible avoidance measures are employed so that the Ashton Mine Complex does not cause or contribute to the exceedance of the air quality criteria.	*Non-compliant*	The 24 hour PM_{10} criteria was exceeded at Site 10 on three occasions. Incident reports were submitted and it was determined in each case that Ashton was not a significant contributor.	Section 6.5

Compliance Status Key

Risk level	*Colour code*	*Description*
High	*Non-compliant*	*Non-compliance with potential for significant environmental consequences, regardless of the likelihood of occurrence.*
Medium	*Non-compliant*	*Non-compliance with:* • *potential for serious environmental consequences, but is unlikely to occur; or* • *potential for moderate environmental consequences, but is likely to occur.*
Low	*Non-compliant*	*Non-compliance with:* • *potential for moderate environmental consequences, but is unlikely to occur; or* • *potential for low environmental consequences, but is likely to occur.*
Administrative non-compliance	*Non-compliant*	*Only to be applied where the non-compliance does not result in any risk of environmental harm (e.g. submitting a report to government later than required under approval conditions).*

2. INTRODUCTION

2.1 OVERVIEW OF OPERATIONS

The Ashton Coal Project (ACP) is located approximately 14km northwest of Singleton, New South Wales (see **Figure 2.1**). The ACP includes the decommissioned North-east Open Cut (NEOC), an underground coal mine, a Coal Handling and Preparation Plant (CHPP) and a rail siding. The ACP was granted Development Consent DA 309-11-2001-i in October 2002 by the (then) Minister for Planning. DA 309-11-2001-i has been modified a total of ten times, with the most recent modification (MOD5) being granted on 20 June 2016.

Ashton Coal Operations Pty Limited also holds Project Approval (PA) 08_0182, issued on 17 April 2015, for open cut mining within the South East Open Cut (SEOC) (see **Figure 2.1**). The granting of MOD5 permitted the integration of the existing ACP and the SEOC project, with the combined development referred to as the Ashton Mine Complex. As operations at the SEOC project have not commenced, this Annual Review reports only upon the operations associated with the ACP.

A brief summary of the operations at the ACP are provided as follows.

North-east Open Cut

The NEOC was mined between January 2004 and September 2011 at which point coal extraction ceased and, with approval, placement of coarse reject within the NEOC void commenced. The NEOC will continue to provide for coarse reject storage prior to the ultimate final landform rehabilitation, and may be used for coal fines emplacement, if needed.

Ashton Underground Coal Mine

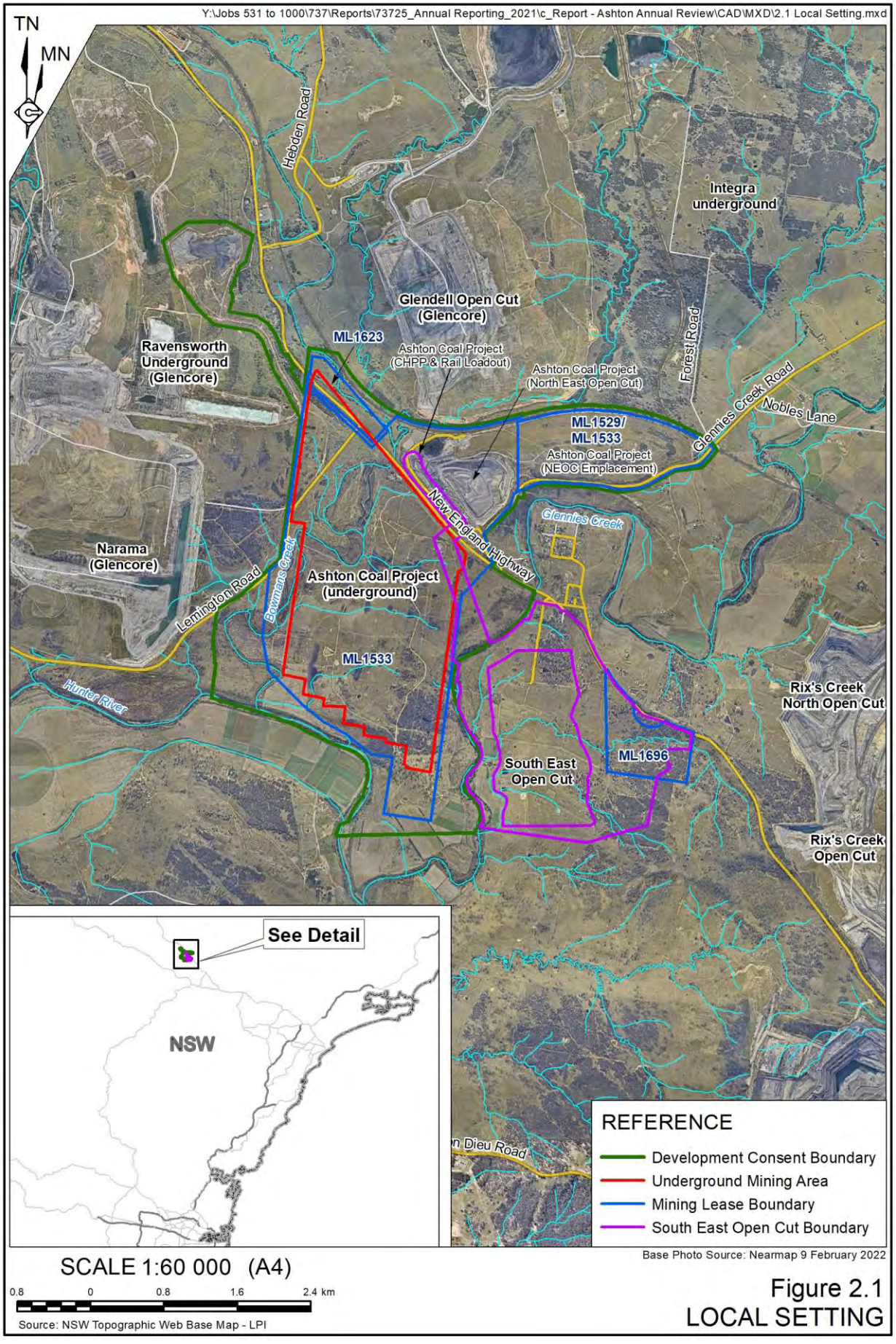
The Ashton underground operations commenced in December 2005 with the first longwall coal extracted within the Pikes Gully Seam in March 2007. Construction of the Bowmans Creek Diversion was completed in November 2012 allowing extraction of coal from beneath those excised sections of Bowmans Creek. Coal extraction operations within the underground operations remain ongoing with an approved maximum production of 5.45Mtpa.

Coal Handling and Preparation Plant

The CHPP was commissioned in April 2004 and expanded during 2006/2007, increasing its capacity from 400t/hr to 1 000t/hr. The CHPP continues to process coal from the Ashton underground operations for export through the Port of Newcastle, NSW.

2.2 SCOPE AND FORMAT

This Annual Review for the Ashton Coal Project has been compiled by R.W. Corkery & Co. Pty Limited on behalf of Ashton Coal Operations Pty Limited (ACOL). ACOL became part of Yancoal Australia Limited in July 2009.


Y:\Jobs 531 to 1000\737\Reports\73725_Annual Reporting_2021\c_Report - Ashton Annual Review\CAD\MXD\2.1 Local Setting.mxd
TN
MN
Hebden Road
Integra underground
Glendell Open Cut (Glencore)
ML1623
Ravensworth Underground (Glencore)
Ashton Coal Project (CHPP & Rail Loadout)
Ashton Coal Project (North East Open Cut)
Forest Road
Glennies Creek Road
Nobles Lane
ML1529/ ML1533
Ashton Coal Project (NEOC Emplacement)
New England Highway
Glennies Creek
Narama (Glencore)
Bowmans Creek
Ashton Coal Project (underground)
Lemington Road
ML1533
Hunter River
Rix's Creek North Open Cut
ML1696
South East Open Cut
Rix's Creek Open Cut
See Detail
NSW
REFERENCE
Development Consent Boundary
Underground Mining Area
Mining Lease Boundary
South East Open Cut Boundary
Base Photo Source: Nearmap 9 February 2022
SCALE 1:60 000 (A4)
0.8 0 0.8 1.6 2.4 km
Source: NSW Topographic Web Base Map - LPI
Figure 2.1
LOCAL SETTING

This is the seventh Annual Review submitted for the ACP, following eleven Annual Environmental Management Reports, and is applicable for the period 1 January to 31 December 2021 ("the reporting period"). The information presented within this Annual Review has been compiled based on information and advice provided by ACOL.

This Annual Review has been prepared in accordance with the requirements of *Schedule 5 Condition 10* of DA No. 309-11-2001-I (MOD5), the annual reporting requirements of Mining Leases 1529, 1533 and 1623, and the commitments outlined in the Mining Operations Plan (MOP). This Annual Review generally follows the format and content requirements identified in the Department of Planning and Environment's (DPE) *Annual Review Guideline* dated October 2015.

2.3 KEY PERSONNEL CONTACT DETAILS

The Operations Manager, Mr Aaron McGuigan is the primary mine contact (Tel: 02 6570 9104) and is responsible for the environmental management of the mine and ensuring compliance with all relevant legislative obligations. Mr Phillip Brown (Tel: 0439 909 952) is the nominated Environment & Community Relations Superintendent and is also responsible for the environmental management of the mine. The contact details for the mine office are as follows.

Postal Address:	Ashton Coal Operations Pty Limited PO Box 699 SINGLETON NSW 2330	Tel: 02 6576 1111 Fax: 02 6576 1122
Email:	Ashton.environment&community@yancoal.com.au	
Physical Address:	Ashton Coal Operations Glennies Creek Road CAMBERWELL NSW 2330	

A 24-hour Environmental Hotline (Tel: 1800 657 639) is maintained by ACOL. Details of calls taken on this number are forwarded to the Environment & Community Relations Superintendent for further actioning, if required.

3. APPROVALS

ACOL has operated the ACP under the key approvals listed in **Table 3.1**.

Table 3.1
Ashton Coal Project – Consents, Leases and Licences

Consent/Lease/Licence	Issue Date	Expiry Date	Details / Comments
Development Approvals			
Development Consent DA 309-11-2001-i	11 October 2002	26 February 2024[1]	Granted by the (then) Minister for Planning and last modified on 20 June 2016 (MOD5).
Mining Authorities[2]			
Mining Lease ML 1529	10 September 2003	11 November 2021	Granted by the (then) Minister for Mineral Resources. Incorporates 128.7ha of surface area. Renewal pending following lodgement of renewal application on 19 May 2020.
Mining Lease ML 1533	26 February 2003	25 February 2024	Granted by the (then) Minister for Mineral Resources. Incorporates 883.4ha of surface area.
Mining Lease ML 1623	30 October 2008	30 October 2029	Granted by (then) Minister for Mineral Resources. Incorporates 26.17ha of surface area.
Other Licences			
Environment Protection Licence No. 11879	2 September 2003	Not applicable	Issued by the (then) Department of Environment and Climate Change (EPA). Current licence version dated 3 February 2020.
Water Access Licence (WAL) 1358	Continuing		Hunter Regulated River Water Source. Supplementary water. Share component: 4ML.
WAL 15583	Continuing		Hunter Regulated River Water Source. General security. Share component: 354ML.
WAL 8404	Continuing		Hunter Regulated River Water Source. High security. Share component: 80ML.
WAL 997	Continuing		Hunter Regulated River Water Source. High security. Share component: 11ML.
WAL 1120	Continuing		Hunter Regulated River Water Source. High security. Share component: 3ML.
WAL 1121	Continuing		Hunter Regulated River Water Source. General security. Share component: 335ML.
WAL 6346	Continuing		Hunter Regulated River Water Source. Supplementary water. Share component: 15.5ML.
WAL 23912	Continuing		Jerrys Water Source. Share component: 14ML.
WAL 984	Continuing		Hunter Regulated River Water Source. General security. Share component: 9ML.
WAL 19510	Continuing		Hunter Regulated River Water Source. High security. Share component: 130ML.
WAL 36702	Continuing		Jerrys Water Source. Share component: 116ML.
WAL 36703	Continuing		Jerrys Water Source. Share component: 150ML.

Table 3.1 (Cont'd)
Ashton Coal Project – Consents, Leases and Licences

Consent/Lease/Licence	Issue Date	Expiry Date	Details / Comments
Other Licences (Cont'd)			
WAL 29566	Continuing		Jerrys Water Source Aquifer Share component: 358ML.
WAL 41501	Continuing		Sydney Basin-North Coast Groundwater Source. Share component: 100ML.
WAL 41552	Continuing		Sydney Basin-North Coast Groundwater Source. Share component: 511ML.
WAL 41553	Continuing		Sydney Basin-North Coast Groundwater Source. Share component: 81ML.
Note 1: Mining operations approved until 26 February 2024 or for a period of 12 years following recommencement of open cut mining operations (including overburden removal) at the Ashton Mine Complex, whichever is longer.			
Note 2: See **Figure 2.1**.			

This Annual Review has been prepared to fulfil the annual reporting requirements of DA 309-11-2001-i, ML 1529, ML 1533, ML1623 and the various Water Access Licences listed in **Table 3.1**. A separate Annual Return has continued to be submitted to the NSW EPA in accordance with the requirements of Environment Protection Licence 11879. Reporting requirements under the approved Extraction Plan for LW201-204 and 2009 Conservation Agreement (for Southern Woodlands Conservation Area) are also included in the scope of this report.

It is noted that the SEOC Project Approval PA 08_0182, issued on 17 April 2015, will lapse on 17 April 2022 (following a 2 year extension) as Ashton has been unable to purchase or lease Property 129, as required by Schedule 2 Condition 10A of that approval.

During the reporting period, a modification application was lodged with DPIE for modification DA309-11-2001-i to provide for access to and mining of existing approved, but unmined, coal from the adjoining Ravensworth Mine Complex via connection with the existing Ashton underground workings. As part of the modification, an extension to the period for mining operations has also been sought to approximately December 2035. The application is expected to be determined during the next reporting period.

ACOL also holds a range of additional licences, approvals and permits which are reported upon separately. This includes Exploration Licence 4918, granted on 18 December 1995 with a current expiry date of 18 December 2021 (renewal pending), and Exploration Licence 5860, granted on 22 May 2001 with a current expiry date of 22 May 2026.

4. OPERATIONS SUMMARY

4.1 MINING OPERATIONS

Open cut coal mining activities ceased in September 2011 and open cut rehabilitation works were completed between 2011 and 2012 with the exception of the Open Cut Void which is used as a reject emplacement.

Approval for underground mining operations includes the extraction of coal from the Pikes Gully (PG), Upper Liddell (ULD), Upper Lower Liddell (ULLD and Lower Barrett (LB) coal seams. Underground mining relies upon the longwall extraction method following continuous miner development of main headings and twin heading gate-roads.

During the reporting period coal was mined from Longwall (LW) 204 and LW205 within the ULLD seam with road development principally between Panels LW206 and LW207 (A and B) and the 200 Mains (see **Figure 4.1**). **Table 4.1** presents a summary of the production statistics for the previous, current and next reporting periods.

In summary, a total of 2 600 721t of Run of Mine (ROM) coal was mined from underground operations during the reporting period and a total of approximately 1 184 981t of product coal was transported to the Port of Newcastle by rail.

Table 4.1
Production Summary

Material	Approved limit (specify source)	Previous reporting period (actual)	This reporting period (actual)	Next reporting period (forecast)
Topsoil Stripped	None specified	0	0	0
Waste Rock / Overburden (m^3)	None specified	0	0	0
ROM Coal / Ore (t)[2]	5 450 000[1]	3 383 255	2 600 721	2 661 707
Coarse Reject (t)	None specified	1 459 538	1 096 474	1 181 922
Fine Reject (Tailings) (t)	None specified	398 036	315 718	340 322
Saleable Product (t)	None specified	1 597 769	1 184 981	1 139 463

Note 1: For underground operations as specified by DA 309-11-2001-i, Schedule 2, Condition 6(a). A maximum of 3 600 000t from open cut mining operations is also provided by MP 08_0182, however, this approval has not yet been enacted.

Note 2: ROM coal does not equate to the sum of rejects and saleable product due to slight variance in the timing between extraction, stockpiling, processing and transport of coal off site.

Based on current resource estimates and extraction rates, it is anticipated that the remaining underground mine life is approximately 6 years (i.e. until 2027).

4.2 GAS MANAGEMENT

Construction of three gas drainage borehole wells, located above LW205 (two) and LW206A (one), commenced during the reporting period. The gas drainage plant functioned throughout the reporting period, although flaring[1] was sporadically unable to be undertaken due to low methane concentrations. Greenhouse gas emissions continued to be reported as required by the National Greenhouse Gas and Energy Reporting (NGER) requirements (see Section 6).

[1] Flaring is a process of combusting, principally methane, to produce gases with a lower global warming potential.

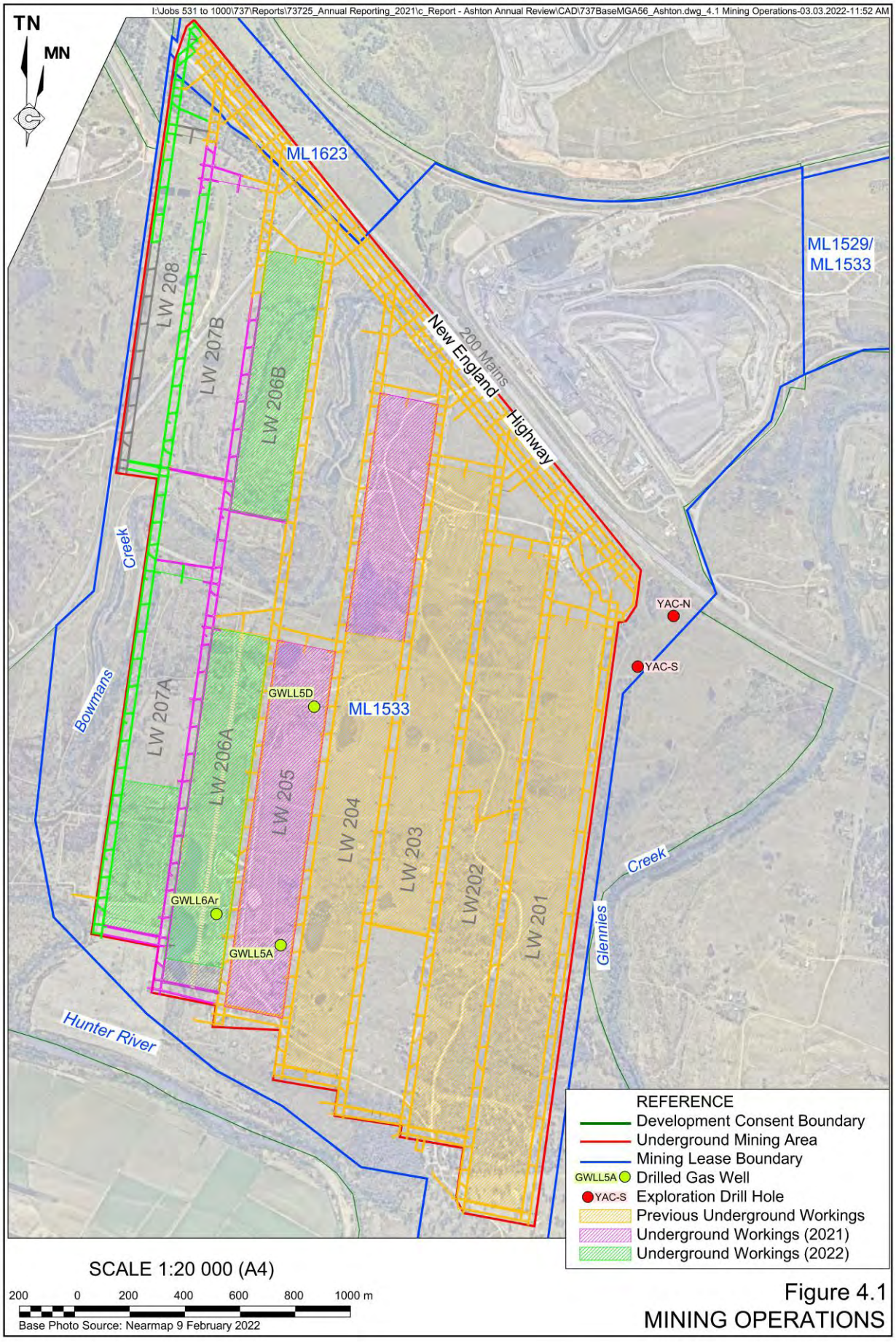


Figure 4.1
MINING OPERATIONS

4.3 OTHER OPERATIONS DURING THE REPORTING PERIOD

A total of 16 internal Ground Disturbance Permits (GDPs) were applicable during the reporting period (see **Table 4.2**).

Table 4.2
Ground Disturbance Permits - 2021

Ground Disturbance Permit No.	Purpose	Rehabilitation Status
172	Two geophysics holes YACN and YACS2 (YAC031, 032)	Rehabilitation complete / permit closed.
173	Drainage works on CHPP Access Road	Rehabilitation complete / permit closed.
174	Excavate around septic tank to remove and relocate to property in Camberwell.	Rehabilitation complete / permit closed.
175	Pipeline excavation for GW4LLD to GW3C	Rehabilitation ongoing.
176	Geotech investigations of Tailings Dam Wall (TSF Void 4 East Embankment)	Rehabilitation ongoing.
177	Arc works for 11 KV powerline	Rehabilitation ongoing.
178	CCTV Camera Relocation	Rehabilitation complete / permit closed.
179	Drill pad construction (GWLL5A)	Rehabilitation ongoing.
180	Conduct salvage work on Alt Route	Rehabilitation ongoing.
181	Drill pad construction (GWLL6A)	Rehabilitation complete / permit closed.
182	11KV Powerline Relocation	Rehabilitation ongoing.
183	Property 130 - Power supply trenching to monitoring station.	Rehabilitation complete / permit closed.
185	Clearing of roadway drains - Property 129 - W Bowman	Rehabilitation complete / permit closed.
186	Installation of emergency muster sign	Rehabilitation complete / permit closed.
187	Dam embankment /surface roadway re-profile to design height	Rehabilitation ongoing.
189	Test pit for archaeology survey	Rehabilitation complete / permit closed.

Two exploration holes (GDP #172) were also drilled during the reporting period for geotechnical information relating to the drift from the Upper Lower Liddell to the Lower Barrett Seam (see **Figure 4.1**).

Environmental monitoring activities continued throughout the reporting period including air quality, surface water, groundwater, flora and fauna and subsidence monitoring. Results of this monitoring is summarised in Sections 6 and 7.

4.4 NEXT REPORTING PERIOD

The activities proposed for 2022 will principally involve a continuation of activities undertaken during the previous twelve months. The following provides a summary of the planned activities.

Exploration

It is not anticipated that further exploration will be undertaken during the next reporting period.

Mining

During the next reporting period, mining will focus upon continued longwall mining within Panels LW206A, LW206B and LW207A (see **Figure 4.1**). It is estimated that in the order of 2 661 707t of ROM coal will be extracted during the next reporting period.

Rehabilitation

Rehabilitation activities planned for the 2022 reporting period include the rehabilitation of any subsidence impacts and completion of rehabilitation for remaining ground disturbances outlined in **Table 4.2** where able. Ongoing remedial treatment of previously repaired subsidence surface cracking and maintenance of existing disturbance, principally erosion and sediment control, will also be undertaken as necessary.

Monitoring

Environmental, meteorological and subsidence monitoring will continue to be undertaken during the next reporting period in accordance with the approved management plans.

Community Consultation and Liaison

The Community Consultative Committee will continue to be convened during the next reporting period. It is expected that meetings will be held once every four months unless otherwise agreed with the committee. The 24hr environmental hotline will be maintained and a register retained of any complaints received.

Mining Operations Plan / Rehabilitation Management Plan

A Rehabilitation Management Plan (RMP) and Forward Program will be prepared during the next reporting period in accordance with the Operational Rehabilitation Reforms and amendments to the *Mining Regulation 2016*. The RMP will replace the existing MOP which was prepared for the period ending 26 February 2024.

As part of the preparation of the RMP it is planned to reflect updated rehabilitation / biodiversity completion and performance criteria as developed through the ecological monitoring undertaken to date and planned changes to rehabilitation of the NEOC emplacement. The RMP will also address matters raised by the Resources Regulator in their letter 27 August 2021, including completion of a revised risk assessment, review of available material to achieve final landform and rehabilitation outcomes, and monitoring of erosion.

Environmental Management Plans

Whilst the majority of management plans were reviewed and revised during the 2020 reporting period to reflect improved monitoring programs and recommendations arising from the 2019 Independent Environmental Audit, a further review and update will be undertaken following the determination of the modification application submitted for DA 309-11-2001-i (see Section 3).

5. ACTIONS REQUIRED FROM PREVIOUS ANNUAL REVIEW

The 2020 Annual Review was submitted to the Resources Regulator and the (then) Department of Planning, Industry and Environment (DPIE) compliance unit on 31 March 2021. A notice of receipt was received from the Resources Regulator, however, no feedback or actions were raised. A Request for Information was received by DPIE on 29 July 2021 seeking clarification of the methodology used in reporting air monitoring results as reported in the 2020 Annual Review. Following receipt of DPIE feedback, a review and revision of the presentation of data **Table 6.6** of Section 6.5 was undertaken, and amended versions of the Annual Review were submitted on 26 August 2021 and 17 September 2021. Further correspondence was received from DPIE on 21 September 2021 confirming that the amended Annual Review was considered to generally satisfy the conditions of the approval with no further actions raised.

Separately to the Annual Review Process, the Resources Regulator also undertook a site inspection on 16 June 2021 as part of a targeted assessment program for mines across NSW. The assessment focused upon how the final landform is being established to achieved sustainable rehabilitation outcomes. Five recommendations were subsequently made by letter dated 27 August 2021. As discussed in Section 4.4, these recommendations will be addressed as part of the preparation of the RMP during the next reporting period.

6. ENVIRONMENTAL PERFORMANCE

6.1 SUMMARY OF ENVIRONMENTAL PERFORMANCE

A summary of environmental performance for the principal environmental aspects is provided in **Table 6.1**. Further detail regarding specific environmental aspects is also provided in the following subsections.

Table 6.1
Environmental Performance

Aspect	Approval criteria / EIS prediction	Performance during the reporting period	Trend/key management implications	Implemented/proposed management actions
Noise	No exceedance of applicable noise criteria.	No exceedances. Two community noise complaints were received for the mine during the reporting period, however, ACP activities were determined not to be contributing.	Monitoring implies management measures are currently adequate.	No additional management action required. Continue proactive management approach.
Blasting	No exceedance of applicable blast criteria.	No blasting during reporting period.	Not applicable – no blasting	As no blasting planned for the next reporting period, no specific actions are required.
Air Quality	No exceedances of the applicable air quality criteria.	Three exceedances of the 24 hour PM_{10} criteria recorded. Incident investigation confirmed that ACP was not a significant contributor.	Implies management measures are currently adequate.	No additional management action required.
Biodiversity	No significant impacts upon flora, fauna species, populations, communities or habitat.	No adverse impacts upon flora, fauna species, populations, communities or habitat attributable to the ACP were recorded. Notwithstanding, actions to improve biodiversity management have been recommended.	Current mining design and safeguards are currently adequate. However, further proactive land management actions can be taken to improve biodiversity outcomes.	Within Bowmans Creek Riparian Area, proposed habitat enhancement and controlled grazing to be investigated. Ongoing pest and weed control.
Heritage	Management in accordance with approved Aboriginal Heritage Management Plan, including salvage.	Archaeological investigations and salvages undertaken in accordance with management plan, Aboriginal Heritage Impact Permits, and in consultation with Aboriginal Community. No complaints or issues raised.	Implies management actions are currently adequate.	No additional management action currently required.
Subsidence	Subsidence management in accordance with approved Subsidence Management Plan / Extraction Plan.	Subsidence impacts generally within predicted levels in accordance with the Extraction Plan. Minor rehabilitation and maintenance works completed to address impacts.	Implies management measures and action responses are currently adequate and predictions sufficiently accurate.	Continued monitoring and review of results. Continue remediation as required in accordance with approved Extraction Plans.

6.2 METEOROLOGICAL MONITORING

Meteorological data is used by ACOL to interpret environmental impacts and to understand air quality and noise management outcomes. The ACP has two meteorological monitoring stations, namely Monitoring Site 1 (M1 - predominantly used to monitor for noise and air quality impacts in adverse weather conditions and determine temperature inversion stability class) and the Repeater Station (the main monitoring site) (see **Figure 6.1**).

A summary of rainfall data since the commencement of operations is presented in **Table 6.2** whilst monthly wind roses for the reporting period are presented in **Figures 6.2** and **6.3**.

Table 6.2
Monthly Rainfall Records

	Average Monthly Rainfall (mm)												
Period	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Total**
2004	81.2	145.6	47.8	23.0	22.6	2.1	1.5	7.0	36.2	61.8	42.8	81.6	546.2
2005	56.6	116.8	79.2	8.5	43.4	87.0	12.0	7.0	41.4	107.6	86.0	15.2	660.7
2006	57.2	47.3	37.6	25.4	1.8	30.8	37.4	13.4	116.8	2.8	62.0	39.0	471.5
2007	30.0	32.6	83.0	27.8	30.4	270.5	14.8	73.7	9.0	15.4	124.2	58.2	769.6
2008	52.6	134.6	44.4	103.2	1.6	72.6	19.4	63.2	73.8	60.0	51.6	50.0	727.0
2009	3.6	161.6	84.8	47.6	42.8	27.4	20.9	0.4e	27.6	47.0	28.4	67.6	559.7
2010	51.0	66.6	69.8	24.8	70.2	40.2	64.8	24.5	24.6	58.6	92.2	33.6	620.9
2011	25.0	35.6	90.2	54.0	78.6	132.4	17.4	43.8	79.4	101.6	155.2	43.4	856.6
2012	45.8	142.6	76.6	28.8	12.2	55.8	35.2	7.2	4.8	3.2	27.4	53.4	493.0
2013	131.6	100.0	100.4	21.2	33.6	57.8	10.8	5.0	27.4	4.8	175.2	22.6	690.4
2014	6.8	136.6	119.2	76.4	10.6	21.0	42.6	58.2	33.8	21.2	16.2	157.4	700.0
2015	142.8	17.4	15.6	269.6	73.2	27.0	18.4	59.6	15.0	31.0	119.4	113.0	902.0
2016	218.2	9.6	13.6	11.0	20.2	113.6	47.2	35.2	75.8	46.4	50.2	112.6	753.6
2017	27.8	31.2	176.8	52.4	28.0	40.4	1.6	9.4	9.0	76.0	20.8	45.0	518.4
2018	13.8	76.6	83.2	16.0	10.0	45.6	2.8	30.4	25.6	57.8	91.8	81.0	534.6
2019	66.4	31.6	153.2	9.4	19.4	20.6	9.0	29.8	40.2	1.6	22.0	0.0	403.2
2020	62.0	169	108.2	71.2	30.0	43.8	121.4	39.2	53.6	126.2	29.6	142.2	996.4
2021	**78.4**	**149.8**	**272.4**	**27.6**	**25.4**	**66.0**	**24.6**	**34.0**	**38.0**	**79.0**	**296.0**	**114.6**	**1205.8**
Average	*63.9*	*89.2*	*92.0*	*49.9*	*30.8*	*64.1*	*27.9*	*31.8*	*40.7*	*50.1*	*82.8*	*68.4*	*689.4*

Note: Results relevant to this reporting period are in **bold**.

Total rainfall during the 2021 calendar year was 1205.8mm, significantly above the average rainfall of 689.4mm.

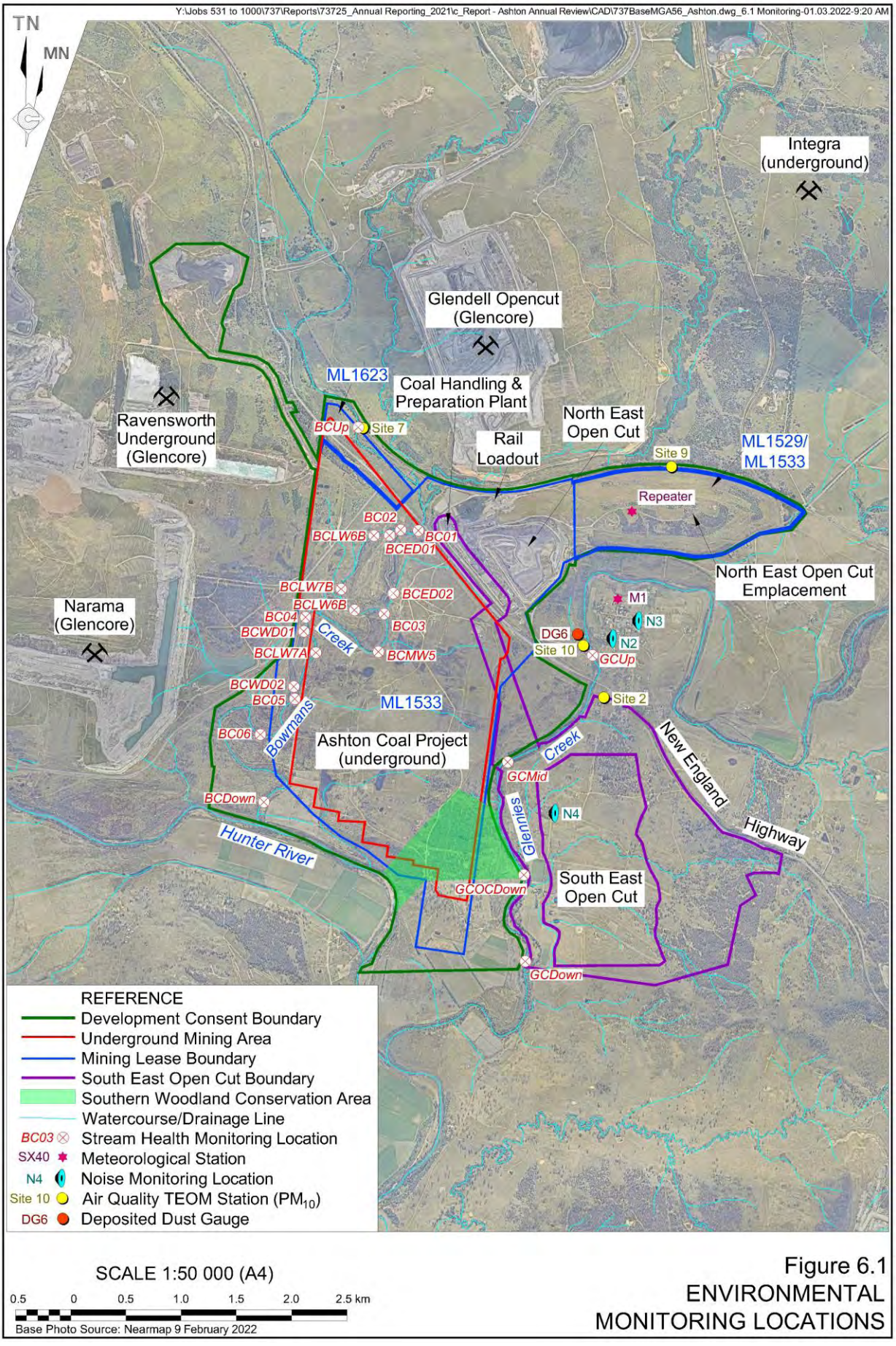


Figure 6.1
ENVIRONMENTAL MONITORING LOCATIONS

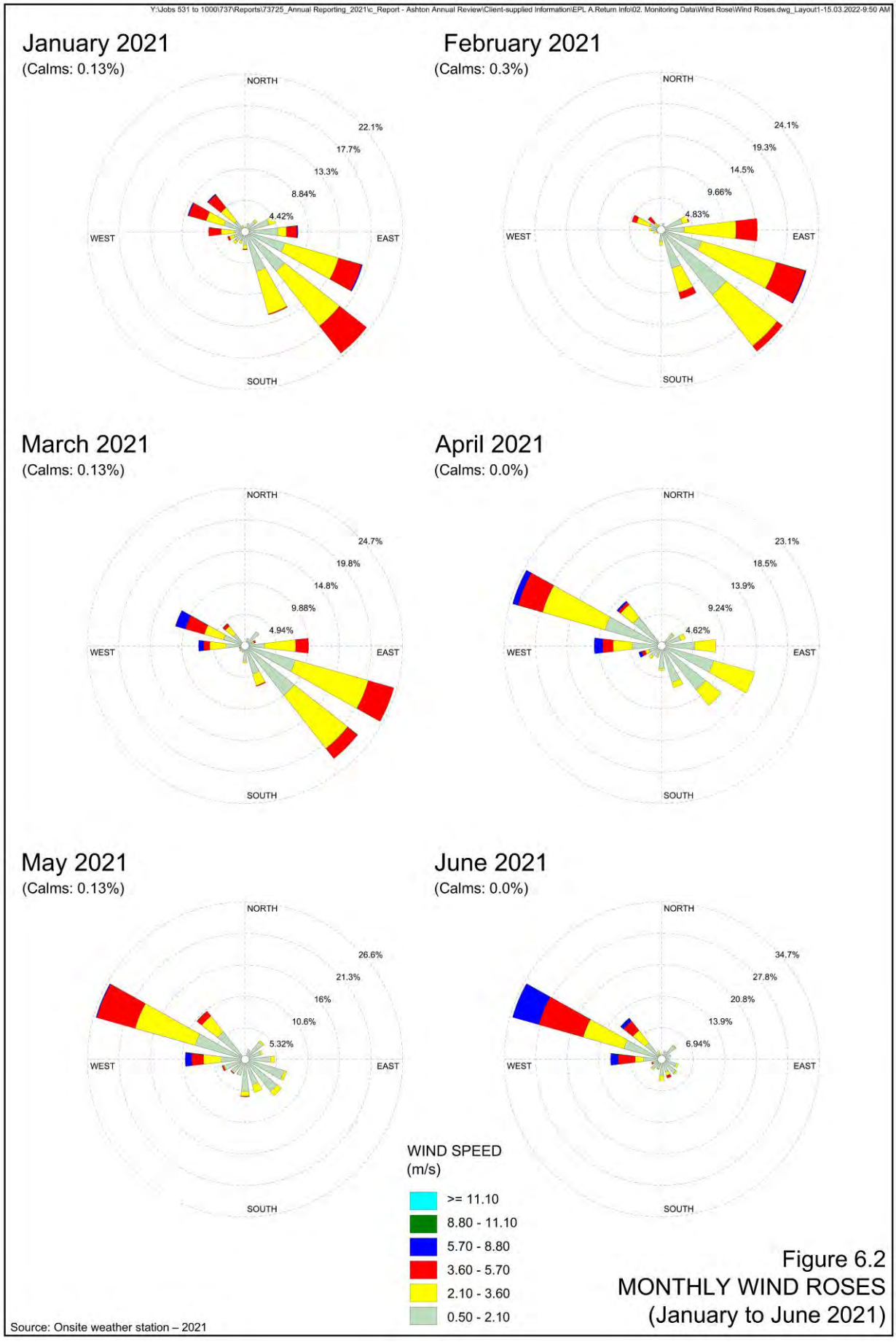


Figure 6.2
MONTHLY WIND ROSES
(January to June 2021)

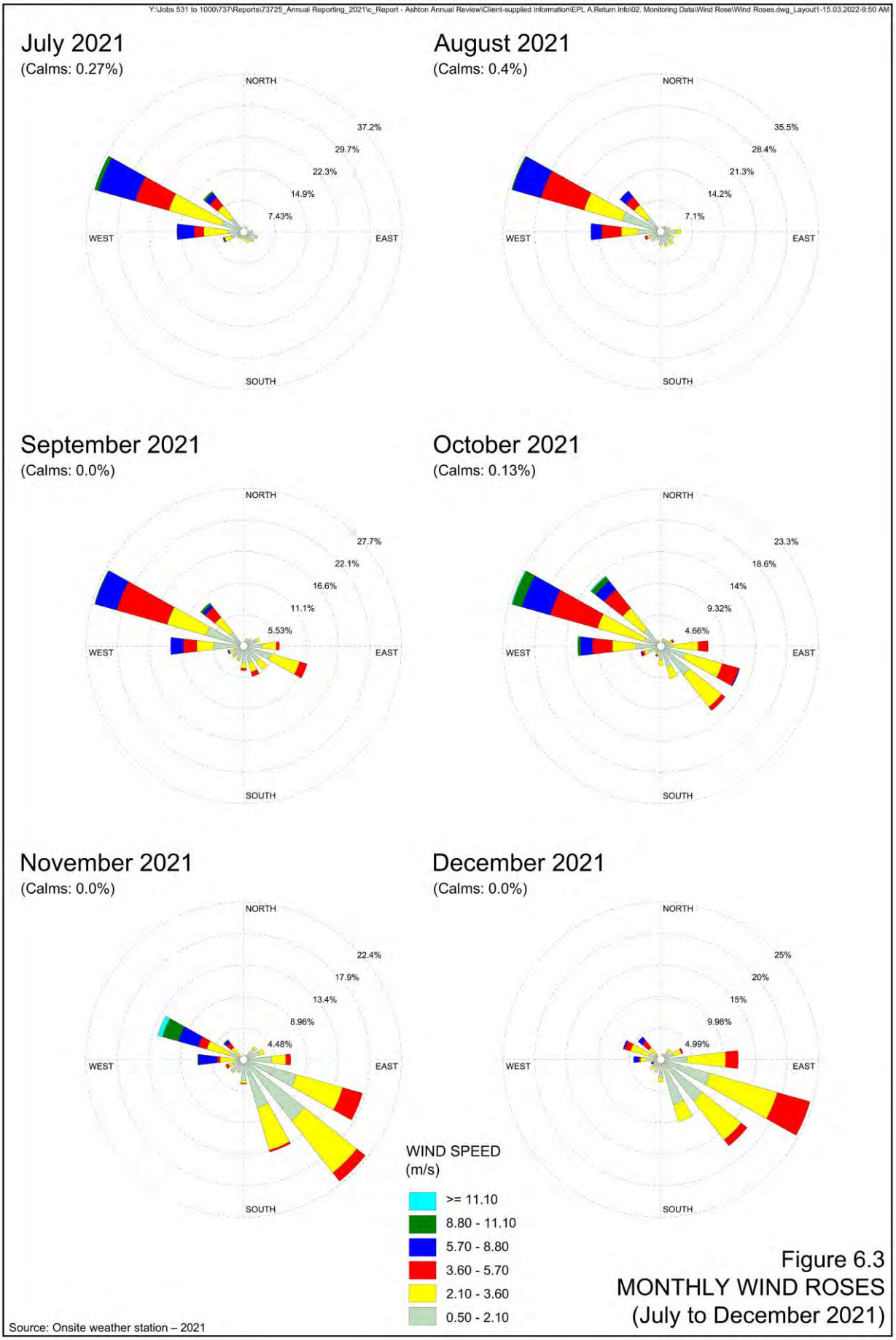


Figure 6.3
MONTHLY WIND ROSES
(July to December 2021)

6.3 NOISE

Environmental Management

Relevant noise impact assessment criteria, noise emission controls and compliance procedures are detailed in the Noise Management Plan for the ACP. The principal noise controls implemented at the ACP site during the reporting period included the maintenance of mobile plant, CHPP and ventilation fans, limiting hours of mobile noise generation (e.g. drilling), permanent noise mitigation controls at the CHPP, and pit top facilities located below the natural surface level.

Environmental Performance

Noise monitoring for the ACP consists of the following.

- Continuous noise monitoring – one continuous real time monitoring station located within Camberwell Village (see **Figure 6.1**) which informs proactive management of noise generating activities at the site. Monitoring results are not used for regulatory purposes.
- Unannounced[2] attended noise monitoring – monthly night-time monitoring conducted at three attended noise monitoring locations (see **Figure 6.1**).
- Secondary attended noise monitoring – undertaken within 75 minutes of an attended noise monitoring measurement if results indicate that ACP-related noise exceeds the relevant noise criteria under standard weather conditions (i.e. wind speeds up to 3m/s at 10m above ground level and/or a temperature inversion of up to 3°C).

Monthly noise monitoring results for each of the three attended noise monitoring locations are presented in **Table 6.3** and a copy of the attended noise monitoring compliance report prepared by EMM is presented as **Appendix 1**.

The results of attended noise monitoring during the reporting period indicate that ACP operations were inaudible at all three monitoring locations during the March, April, June and September monitoring. Operations were also inaudible at location N4 during the May, November and December monitoring. Noise during these monitoring events were attributable to non-ACP related road and rail traffic, wildlife, livestock and by other mines in the vicinity. During monitoring events in which operations at ACP were audible noise remained below the applicable criteria, including night-time sleep disturbance criteria ($L_{A(1\ min)}$), at all locations.

When audible, the ACP operations were also determined to be compliant with cumulative noise criteria. These results are consistent with noise monitoring results for previous years, with ACP operations remaining largely inaudible at the designated noise monitoring locations.

Two noise complaints were received during the reporting period. Follow up investigations indicated that noise from ACP was not the cause.

[2] ACOL are not informed of the monitoring until it is completed.

Table 6.3
Summary of Attended Noise Monitoring Results – 2021

Month	Criteria (dB)				Location			Exceedance
	Period	Day	Evening	Night	N2 (dB)[1]	N3 (dB)[1]	N4 (dB)[1]	
January	LAeq (15 min)	38	38	36	33	32	33	No
	LA1 (1 min)	-	-	46	34	33	34	No
February[2]	LAeq (15 min)	38	38	36	34	34	32	No
	LA1 (1 min)	-	-	46	38	41	33	No
March	LAeq (15 min)	38	38	36	IA	IA	IA	No
	LA1 (1 min)	-	-	46	IA	IA	IA	No
April[2]	LAeq (15 min)	38	38	36	IA	IA	IA	No
	LA1 (1 min)	-	-	46	IA	IA	IA	No
May[2]	LAeq (15 min)	38	38	36	<32	<32	IA	No
	LA1 (1 min)	-	-	46	35	34	IA	No
June	LAeq (15 min)	38	38	36	IA	IA	IA	No
	LA1 (1 min)	-	-	46	IA	IA	IA	No
July[2]	LAeq (15 min)	38	38	36	34	34	32	No
	LA1 (1 min)	-	-	46	39	40	32	No
August[2]	LAeq (15 min)	38	38	36	34	33	<32	No
	LA1 (1 min)	-	-	46	39	39	<32	No
September	LAeq (15 min)	38	38	36	IA	IA	IA	No
	LA1 (1 min)	-	-	46	IA	IA	IA	No
October[2]	LAeq (15 min)	38	38	36	31	31	<28	No
	LA1 (1 min)	-	-	46	35	36	<28	No
November	LAeq (15 min)	38	38	36	31	32	IA	No
	LA1 (1 min)	-	-	46	35	35	IA	No
December	LAeq (15 min)	38	38	36	31	29	IA	No
	LA1 (1 min)	-	-	46	32	31	IA	No

IA = Inaudible.
Note 1: Estimated or measured noise attributed to ACP.
Note 2: Criteria not applicable due to non-standard weather conditions (i.e. wind speeds over 3m/s at 10m above ground level and/or a temperature inversion greater than 3°C.

Source: EMM Consulting – 2021.

Reportable Incidents

No reportable incidents were recorded during the reporting period.

Further Improvements

Other than ongoing plant maintenance, monthly attended noise monitoring, and proactive management using continuous noise monitoring data, no additional management measures are planned during the next reporting period.

6.4 BLASTING

No surface blasts were undertaken during the reporting period.

6.5 AIR QUALITY

Environmental Management

Relevant air quality impact assessment criteria, air quality management measures and compliance procedures are detailed in the Air Quality and Greenhouse Gas Management Plan (AQGGMP) for the ACP. The principal air quality management measures applicable to the reporting period included:

- large earth berms and tree screens between the operations and the village (previously constructed and trees established);
- clear delineation and maintenance of roads and use of water carts to keep trafficked areas in a damp condition;
- keeping stockpiles damp by the use of fixed or mobile water sprays under dry and windy conditions; and
- proper maintenance of all diesel equipment used on site and fitting equipment with appropriate pollution control devices.

Greenhouse gas management during the reporting period included the flaring of gas from gas drainage bores, where feasible, to reduce greenhouse gas emissions. Additionally, energy efficient equipment is specified for all new or upgraded fixed and mobile plant as required.

Environmental Performance

Air quality monitoring at the ACP site consists of the following.

- Depositional dust monitoring – one sample collected every 30 days (± 2 days) from one depositional dust gauge (see **Figure 6.1**).
- Particulate matter 10 micrometres or less (PM_{10}) – a real-time tapered element oscillating microbalance (TEOM), Site 10 located at Camberwell. Two additional TEOM samplers (Sites 7 and 9) are used for operational management purposes and are not reflective of impacts on sensitive receivers (see **Figure 6.1**).

The results of air quality monitoring are provided as follows.

Deposited Dust

Deposited dust monitoring results for Sampling Point D6 during the reporting period are presented in **Table 6.4** with long-term data presented in **Figure 6.4**.

The highest insoluble solids measurements recorded during the reporting period from a non-contaminated sample was 6.0g/m^2/month in May 2021. Samples in January, March, and September 2021 were contaminated (e.g. with bird droppings, insects, vegetation) and were not recorded in the rolling annual average.

The rolling annual average deposited dust levels recorded throughout the reporting period ranged from 2.34g/m^2/month to 3.14g/m^2/month, i.e. remaining below the criteria of 4g/m^2/month, and indicating good air quality with respect to dust deposition.

Long term deposited dust monitoring results indicate that the rolling annual average has remained below criteria since 2015 following two significant exceedances due to regional dust storms.

Table 6.4
Deposited Dust Monitoring Results – Sampling Point D6 – 2021

Month	Sampling Period		Dust Deposition Rate (g/m²/month)			Comments
	Start Date	End Date	Insoluble	Rolling Annual Average	Ash	
January	1/01/2021	31/01/2021	9.5*	3.14	5.80	Contaminated - bird droppings, turbid/grey
February	1/02/2021	28/02/2021	2.1	2.49	1.50	-
March	1/03/2021	31/03/2021	11.9*	2.60	4.10	Contaminated - bird droppings, turbid/brown.
April	1/04/2021	30/04/2021	1.2	2.40	1.00	-
May	1/05/2021	31/05/2021	6.0	2.85	4.00	-
June	1/06/2021	30/06/2021	2.1	2.68	1.30	-
July	1/07/2021	2/08/2021	1.8	2.35	1.40	-
August	2/08/2021	1/09/2021	4.0*	2.36	1.90	Contaminated - Bird droppings, insects, slightly turbid and brown.
September	1/09/2021	1/10/2021	8.1*	2.36	6.90	Contaminated - Insects, vegetation
October	1/10/2021	1/11/2021	2.4	2.53	1.80	-
November	1/11/2021	29/11/2021	1.8	2.49	1.40	-
December	29/11/2021	30/12/2021	1.3	2.34	0.90	-
Minimum			**1.20**	**2.34**	**0.9**	**-**
Maximum			**11.90***	**3.14**	**6.9**	**-**

* Contaminated sample determined by an independent monitoring contractor or a NATA accredited laboratory and not included in the rolling annual average.

Source: Ashton Coal Operations Pty Limited.

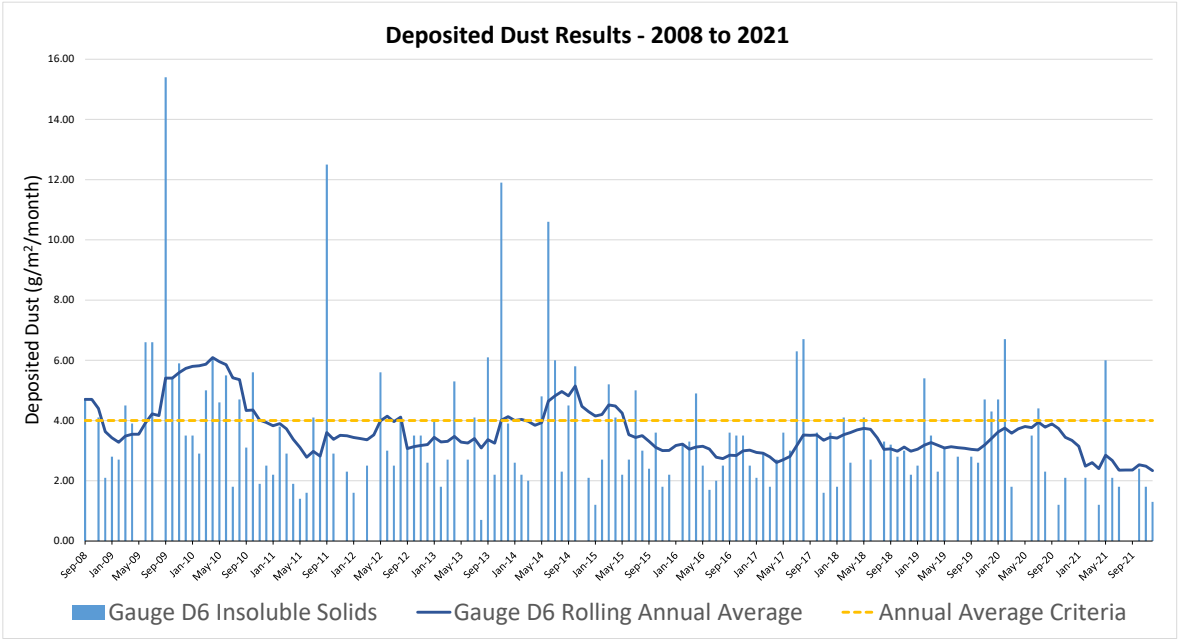


Figure 6.4
DEPOSITED MONITORING RESULTS

Suspended Particulates – PM_{10} and TSP

Table 6.5 provides a summary of the PM_{10} monitoring results for the reporting period and **Figures 6.5** to **6.7** present the PM_{10} data for the reporting period and the long-term monitoring data for each ACP TEOM. The highest recorded 24-hour average PM_{10} concentration during the reporting period ranged between 51.0µg/m^3 and 69.9µg/m^3, with the highest value measured on 29 October 2021 at monitoring Site 10. All monitoring locations recorded maximum suspended particulate concentrations above the 50µg/m^3 24-hour development consent criteria during the reporting period, particularly during September and October 2021. These elevated concentrations are generally consistent with similarly elevated PM_{10} levels recorded at the Upper Hunter Air Quality Monitoring Network (UHAQMN) station at Camberwell on these days.

Table 6.5
Summary of PM_{10} Monitoring Results – 2021

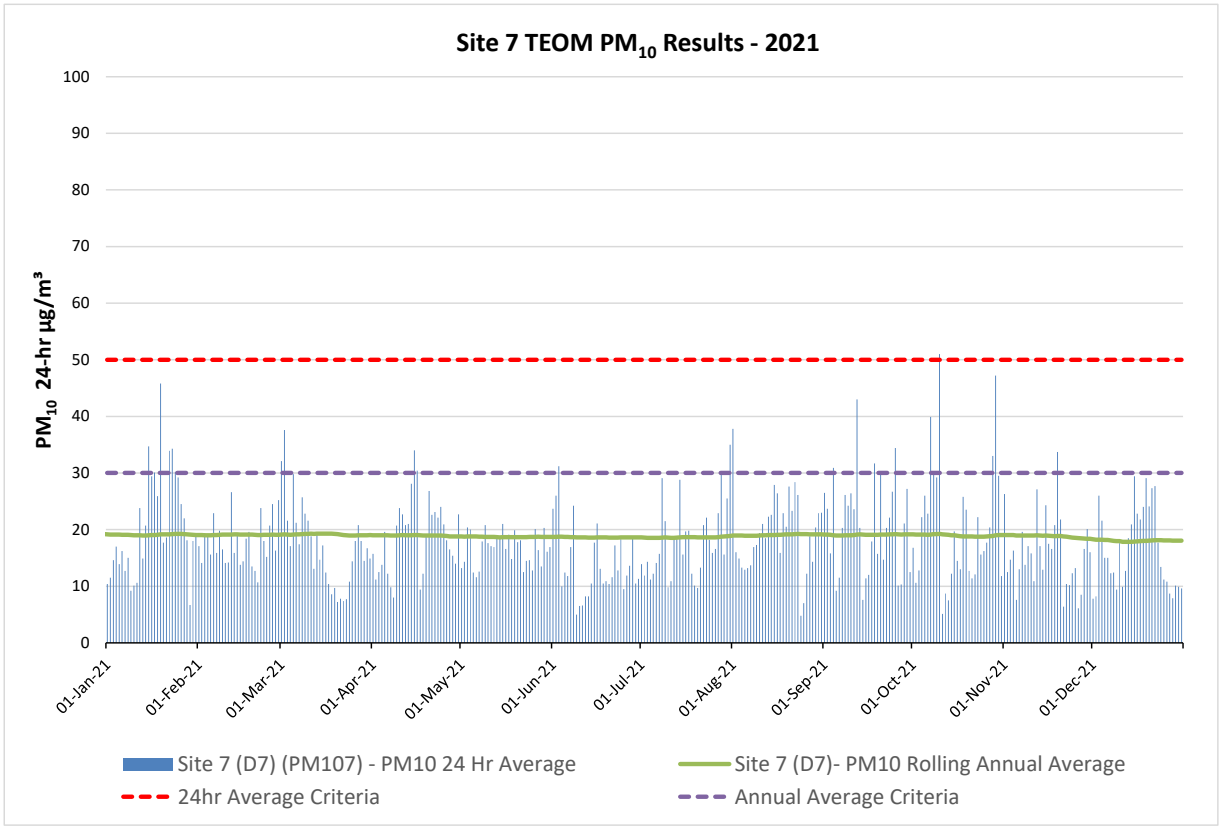
Monitoring Site	Minimum 24-hr µg/m^3	Maximum 24-hr µg/m^3	Short-Term Criteria µg/m^3	Annual Average 2021 µg/m^3	Annual Average Criteria µg/m^3
Site 7^	4.8	51.0	50	18.1	30
Site 9^	3.5	67.1		22.5	
Site 10^	2.0	69.9		19.7	
UHAQMN*	4.7	75.5		20.6	
* Provided as reference (includes all days) ^ Ashton results exclude extraordinary events as defined in DA 309-11-2001-i (note: there were no extraordinary events declared by DPIE during the reporting period)					
Source: Ashton Coal Operations Pty Limited.					

As Site 10 is representative of PM_{10} at sensitive receivers, all PM_{10} results above 50µg/m^3 at Site 10 are reported as an incident and investigated. The investigation includes a review of prevailing wind conditions, the activities occurring on site and the potential contribution from upwind sources to determine the likelihood of the ACP contributing to elevated levels above the criteria. The investigation also includes a detailed review of site operations to ensure that adequate dust controls were being implemented on site including use of water trucks, water sprays on the product stockpile gantries, rotary breaker and ROM coal stockpile discharge points.

During the reporting period, there were 3 days when the 24-hour PM_{10} results were above 50µg/m^3 at Site 10 (refer to **Table 6.6**). No Upper Hunter Declared Extraordinary days occurred during the reporting period. Investigations confirmed that, in each instance, ACP was not a substantial contributor to PM_{10} levels in Camberwell Village and that all reasonable and feasible avoidance measures are being employed. No further actions were required.

Table 6.6
24-hour PM_{10} Exceedance Investigation Outcomes – 2021

Date	Total PM_{10} (µg/m^3) (24hr average) at Site 10 (Camberwell Village)	Potential ACP PM_{10} (µg/m^3) (24hr average) Contribution at Site 10 (Camberwell Village)	Comments
12/09/2021	55.8	9.8	ACOL Not a substantial PM_{10} contributor (UHAQMN = 64.3ug/m^3)
7/10/2021	59.6	15.0	ACOL Not a substantial PM_{10} contributor (UHAQMN = 60.6ug/m^3)
29/10/2021	69.9	20.6	ACOL Not a substantial PM_{10} contributor (UHAQMN = 75.5ug/m^3)
Source: Ashton Coal Operations Pty Limited.			



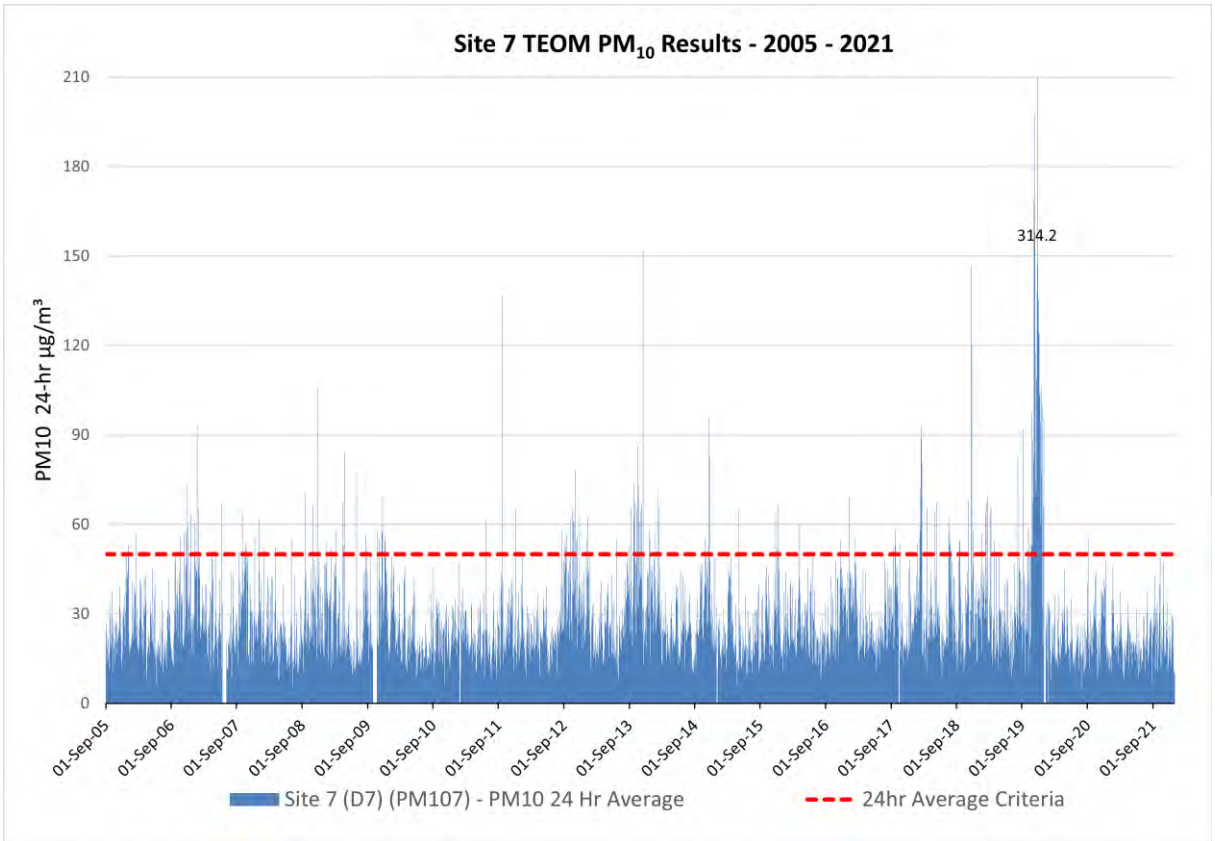
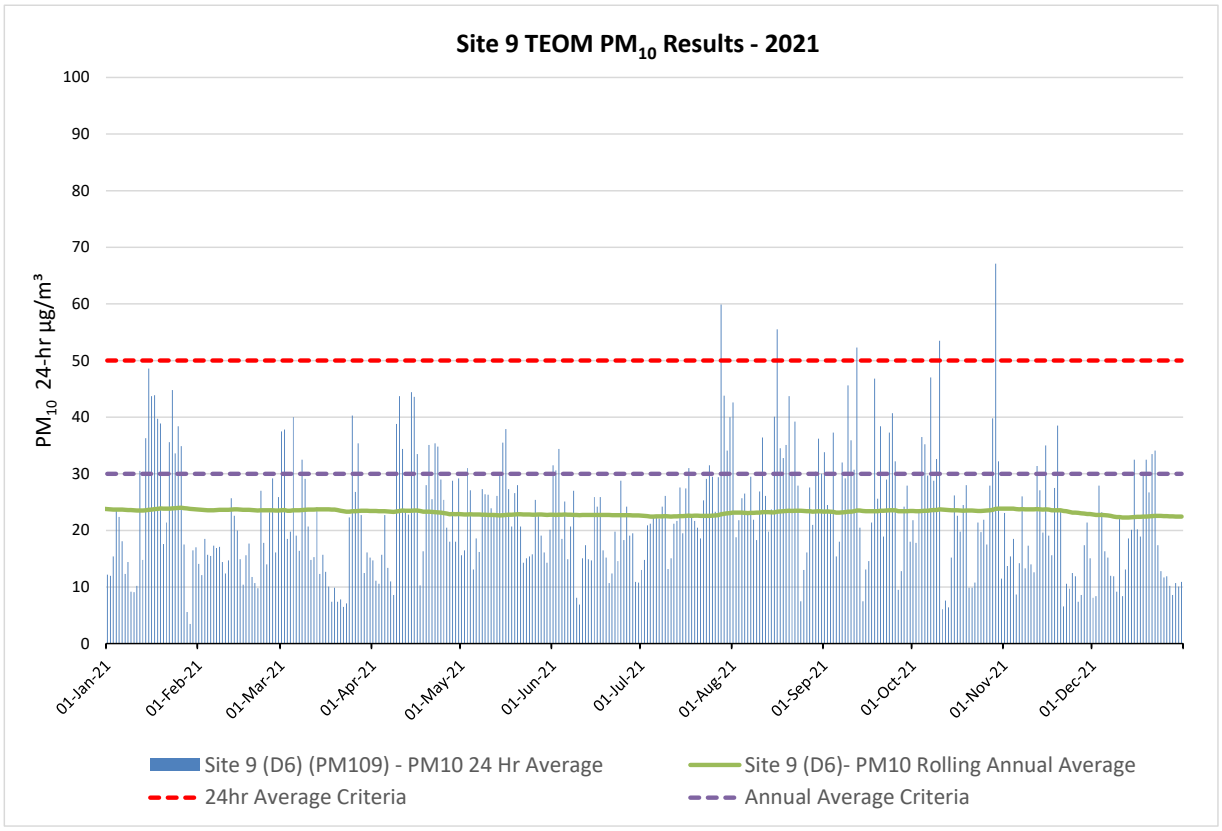


Figure 6.5
PM_{10} MONITORING RESULTS – SITE 7



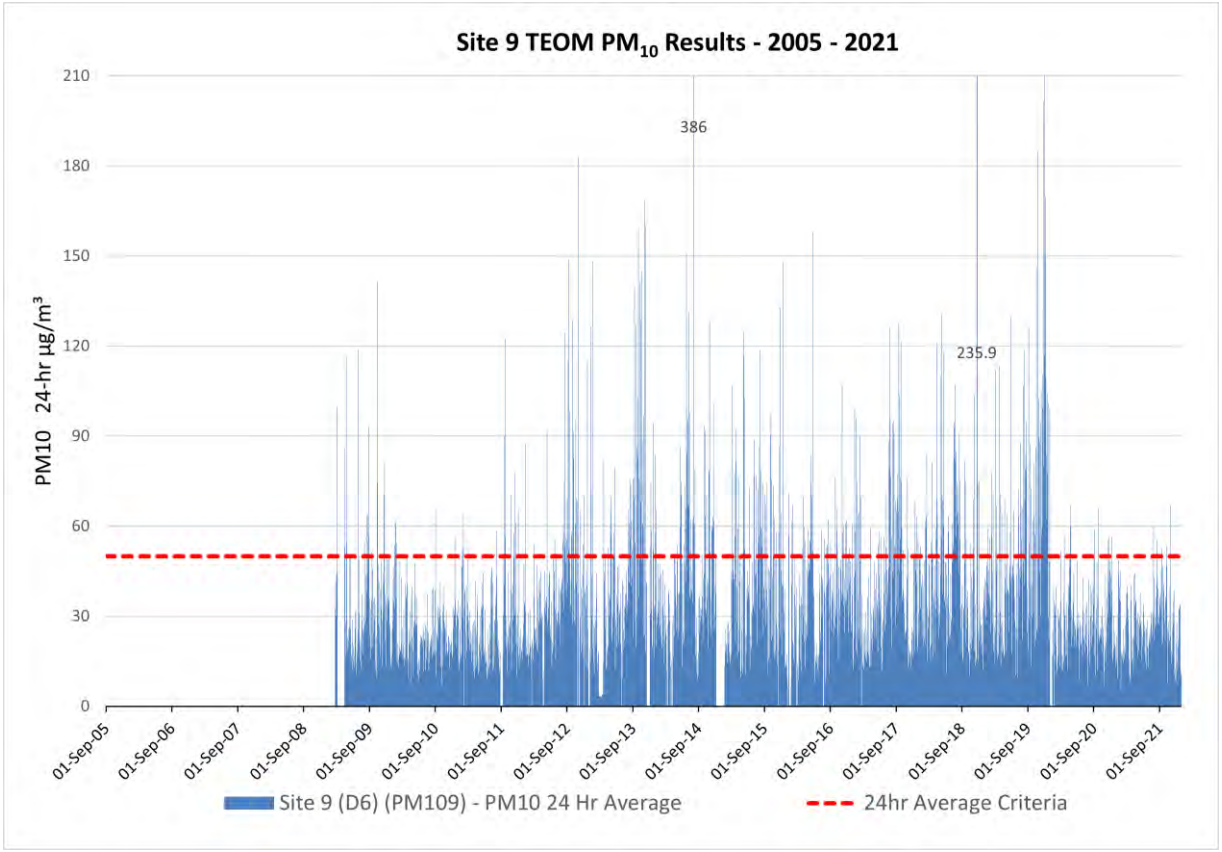
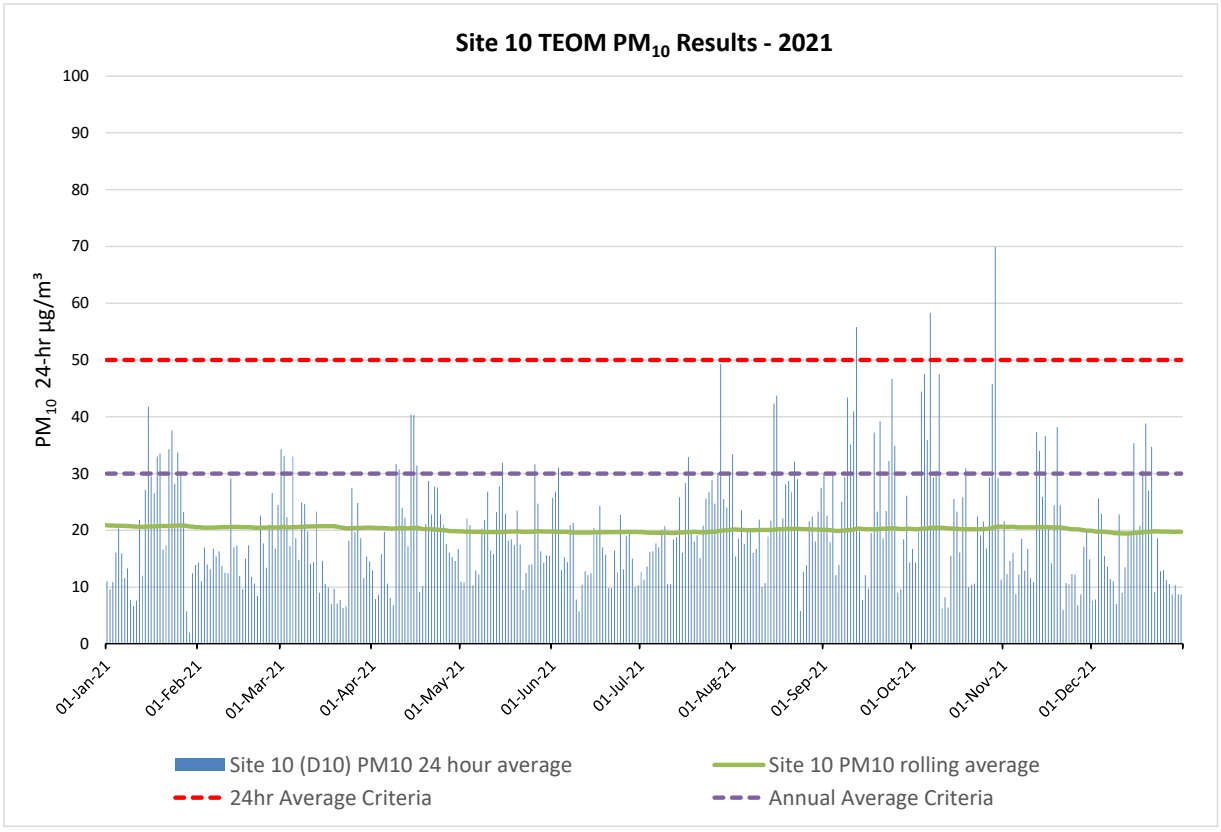


Figure 6.6
PM_{10} MONITORING RESULTS – SITE 9



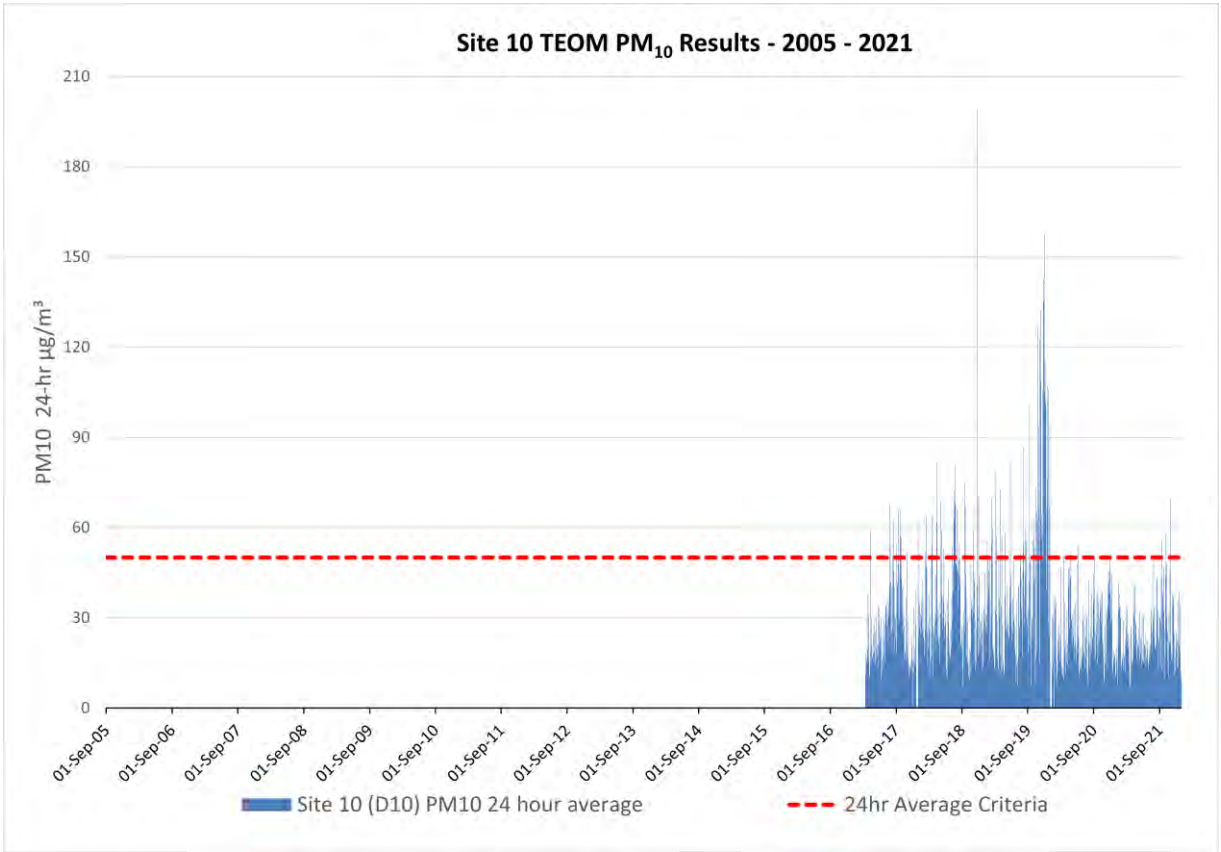


Figure 6.7
PM_{10} MONITORING RESULTS – SITE 10

The rolling annual average PM_{10} concentrations for each monitoring location ranged between 10.3µg/m^3 and 26.2µg/m^3 during the reporting period and was therefore below the annual average criteria value of 30µg/m^3. The annual average PM_{10} during the reporting period for all ACP monitoring sites was also generally consistent with or lower than that recorded at the DPIE-operated Upper Hunter Air Quality Monitoring Station at Camberwell, which recorded an annual average PM_{10} of 20.6µg/m^3.

As TSP is proportionally calculated from the annual average PM_{10} result at Site 10, the annual TSP remained below the annual average criteria of 90µg/m^3.

Greenhouse Gas

Greenhouse gas emissions associated with the ACP were reported on behalf of ACOL by Yancoal Australia Limited under the National Greenhouse and Energy Reporting Scheme (NGER) for the 2020-2021 reporting period. Scope 1 greenhouse gas emissions include both direct greenhouse gas production as a result of ACP operations as well as fugitive emissions associated with underground mine ventilation, gas drainage, gas flaring and post-mining gas. Scope 2 emissions include indirect greenhouse gas emissions primarily associated with emissions generated during the production of electricity used on site.

Table 6.7 presents an overview of ACP Scope 1 and Scope 2 greenhouse gas emissions for the reporting period and the previous five reporting periods. In summary, scope 1 emissions associated with the ACP totalled 411 570tCO_{2-e} (tonnes CO_2 equivalent) compared to 196 641tCO_{2-e} for the previous 2019-2020 reporting period. Scope 2 emissions associated with the ACP during the 2020-2021 reporting period totalled 39 761tCO_{2-e} compared to 32 982tCO_{2-e} during the previous 2019-2020 reporting period.

Table 6.7
ACP Greenhouse Gas Emissions – 2016/2017 to 2020/2021

Greenhouse Gas Emission Type	2016/2017	2017/2018	2018/2019	2019/2020	2020/2021
Scope 1 (tCO_{2-e})	339 443	259 148	216 181	196 641	411 570
Scope 2 (tCO_{2-e})	43 076	35 506	35 738	32 982	39 761
Total (tCO_{2-e})	382 519	294 654	251 919	229 623	451 331
Source: Yancoal Australia Limited – National Greenhouse and Energy Reporting Scheme Results 2020/2021.					

Significant variability in year to year ACP greenhouse gas emissions are primarily a reflection of changes in gas management methods as well as differences in gas levels between longwalls and seams mined during each reporting period. It is noted that, during the 2020/2021 reporting year the gas drainage was of insufficient purity (i.e. insufficient concentration of methane) to capture and safely flare resulting in a significantly lower volume of gas flared compared to the 2019/2020 reporting year.

Reportable Incidents

In accordance with reporting protocols, where the total 24-hour PM_{10} exceeded the 50µg/m^3 criteria (*Schedule 3, Condition 12* of Development Consent 309-11-2001-i) at Site 10, these were reported to DPIE and then investigated and a further report submitted to DPIE. As discussed above, each investigation confirmed that ACP was not a substantial contributor and that all reasonable and feasible avoidance measures were being employed. No further action was required for any of the exceedances.

Further Improvements

As the controls and management measures in place during the reporting period were considered effective, these will continue to be applied during the next reporting period.

6.6 BIODIVERSITY

Environmental Management

Biodiversity at the ACP site is managed under the Ashton Coal Flora and Fauna (Biodiversity) Management Plan (FFMP) and the Southern Woodland Conservation Area (SWCA). Management measures include: establishment of the SWCA, targeted rehabilitation to improve habitat linkages across the landscape, placement of nesting boxes, stock exclusion from selected areas, weed and feral pest control, and ongoing monitoring.

Environmental Performance

Multiple terrestrial and aquatic flora and fauna monitoring programs are completed each year to determine the condition of ecological communities and habitats, and compare these findings against relevant management plan performance indicators and closure objectives.

The monitoring programs include terrestrial and aquatic monitoring, weed and vertebrate pest monitoring and associated management measures where required. The monitoring program covers important biodiversity areas including the Bowmans Creek riparian corridor, the River Red Gum communities and the SWCA. This monitoring complements the rehabilitation monitoring of Bowmans Creek Diversion and North East Open Cut (NEOC), and the mining impacted "Farmland" above the underground mine, which is discussed further in Section 8. The following provides a summary of the key outcomes of the monitoring undertaken during the reporting period.

Where relevant, monitoring has been compared to completion / performance criteria developed for the ACP site. These updated completion / performance criteria are to be included in the RMP to be submitted during the next reporting period.

Flora and Fauna Monitoring

Bi-annual fauna monitoring was undertaken during the reporting period by Umwelt Environmental and Social Consultants in June 2021 and January 2022[3]. Fauna monitoring at the ACP site has been undertaken within the Southern Woodlands Conservation Area (SWCA) since 2005 and was expanded in 2010 to include the northern woodland and SEOC areas. The program was again expanded in 2018 to include monitoring of rehabilitated areas within the NEOC and Bowmans Creek Diversion. The survey areas for bi-annual fauna monitoring include ten survey transect sites, including four sites consisting of remnant vegetation ('control' sites), four sites located over previously undermined areas ('impact' sites) and two sites within rehabilitated areas.

A total of 144 fauna species were recorded as a result of the bi-annual fauna monitoring program, including 24 mammals, 96 birds, 9 amphibians and 14 reptiles. The following ten threatened species were recorded during the fauna monitoring surveys.

[3] Monitoring planned to be undertaken during November 2021 was postponed due to significant rainfall restricting access.

- Grey-crowned babbler (*Pomatostomus temporalis temporalis*).
- Speckled warbler (*Pyrrholaemus sagittatus*).
- White-throated needletail (*Hirundapus caudacutus*).
- Square-tailed kite (*Lophoictinia isura*).
- Black falcon (*Falco subniger*).
- Spotted harrier (*Circus assimilis*).
- Brush-tailed phascogale (*Phascogale tapoatafa*).
- Grey-headed flying-fox (*Pteropus poliocephalus*).
- Little bentwinged-bat (*Miniopterus australis*).
- Spotted-tailed quoll (*Dasyurus maculatus*)

Nine of the ten above species are listed as vulnerable and one species is listed as threatened (the white-throated needletail) under the NSW *Biodiversity Conservation Act 2016*. The grey-headed flying-fox and the spotted-tailed quoll are also listed respectively as vulnerable and endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

Three of the above threatened species have not previously been detected at the ACP site; the square-tailed kite, the black falcon, and the spotted-tailed quoll. A total of 30 threatened species have been recorded at the ACP site since monitoring commenced in 2006.

The following nine introduced species were recorded during the fauna monitoring surveys.

- European rabbit (*Oryctolagus cuniculus*).
- Brown hare (*Lepus capensis*).
- Red fox (*Vulpes vulpes*).
- Dog (*Canis lupis familiaris*).
- Pig (*Sus scrofa*).
- Black rat (*Rattus rattus*).
- House mouse (*Mus Musculus*).
- Spotted dove (*Streptopelia chinensis*).
- Common myna (*Sturnus tristis*).

Analysis of the fauna monitoring results indicated that species diversity was similar between the control (107 species) and impact (117 species) monitoring sites. Comparisons among species groups indicated an increase in species diversity for birds, reptiles and amphibians as well as a slight decrease in diversity for mammals compared to previous monitoring results (see **Figure 6.8**). These trends are generally consistent across both control and impact monitoring sites and are most likely explained by local environmental and ecological factors outside of the influence of mining activity. The increase in amphibian diversity between 2020 and 2021 compared to previous monitoring periods is likely a result of increased habitat availability following periods of increased rainfall.

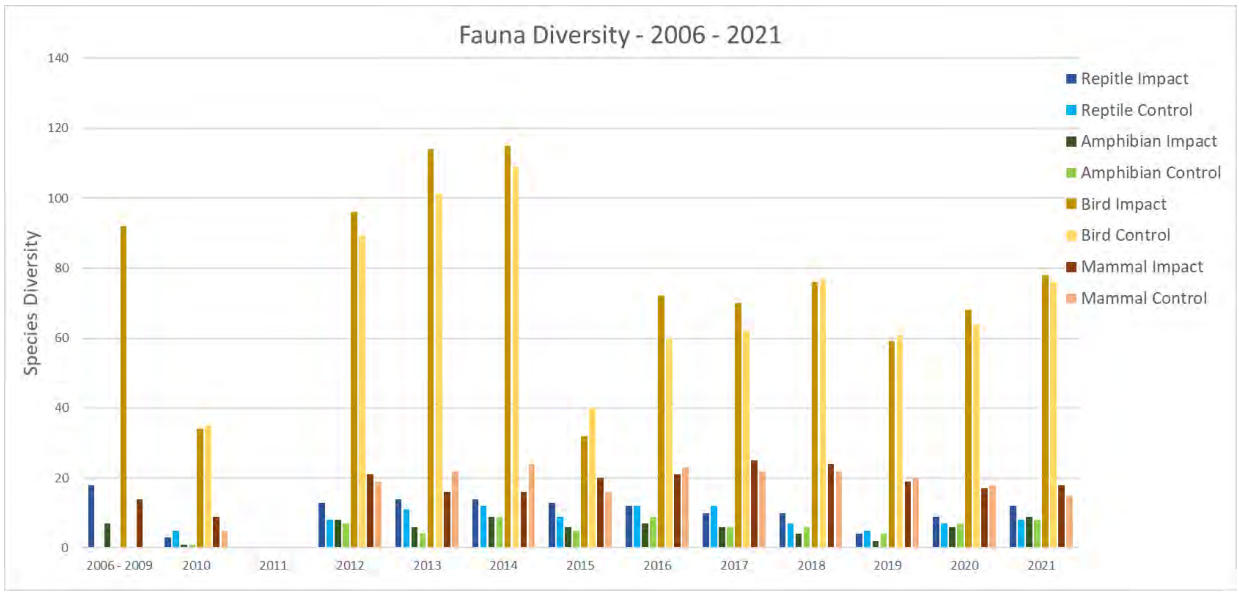


Figure 6.8
FAUNA DIVERSITY 2006 - 2021

Nest box inspections indicated that 36 of the 39 nest boxes installed in the SWCA remain in a condition sufficient to support roosting and nesting of arboreal species. Two species were observed to be using nest boxes during the fauna surveys; the common brushtail possum, with 17 possums found to be occupying eight boxes on two occasions, and the brush-tailed phascogale, with one individual observed on one occasion during January 2022.

The results of the bi-annual fauna monitoring program indicate that threatened fauna species and their habitats have not been adversely impacted by mining activities. Furthermore, the results of the fauna monitoring program indicate compliance with the relevant performance criteria outlined in the FFMP and no further actions are required to address FFMP compliance.

Aquatic Ecology – Bowmans Creek and Glennies Creek

Biannual monitoring of aquatic ecology was undertaken by Marine Pollution Research Pty Ltd in autumn (1 to 3 June 2021) and spring (5 to 6 October 2021).

Monitoring during this reporting period builds on both the results of initial surveys conducted in 2001 to support the original development application as well as the results of biannual monitoring undertaken since 2006. These results also include the ninth year of monitoring for the Bowmans Creek Diversion which was completed in 2012.

Monitoring locations currently include 18 sites within Bowmans Creek, one within each of the two Bowmans Creek Diversion channels and two within Glennies Creek. A further two monitoring sites will be added to the Bowmans Creek Diversion channels and Glennies Creek locations following the proposed increase in block bank height and the commencement of the SEOC construction respectively.

Habitat Condition

Aquatic habitat conditions during the 2021 sampling period were generally consistent with the previous reporting period, with instream and riparian vegetation showing an as-predicted proliferation in response to sustained water levels since mid-2020.

Aquatic habitat conditions for each monitoring site, measured using the Riparian Channel Environment habitat scoring system (RCE index), are presented in **Table 6.8**.

Table 6.8
Monitoring Site RCE Index Score – 2014 to 2021

Year	Period	Site RCE Index Score (% Condition)[1]												
		BCUp	BC1	BCLW6B[2]	BCED1[3]	BCED2[3]	BC3	BCMW5	BCLW7A[2]	BCWD2[3]	BC6	BCDown	GCUp	GCMid
2014	Autumn	78.8	77.9	72.1	74		78.8		72.1	76.9	76.9	76	73.1	73.1
	Spring	78.8	77.9	73.1	75		76.9		71.2	76.9	75	74	73.1	73.1
2015	Autumn	78.8	76.9	71.2	78.8		77.9		76	79.8	74	73.1	74	73.1
	Spring	77.9	75	69.2	75		77.9		73.1	76.9	74	71.2	74	74
2016	Autumn	77.9	75	69.2	75		77.9		73.1	76.9	74	71.2	74	74
	Spring	77.9	75	69.2	75		77.9		73.1	76.9	74	70.2	74	74
2017	Autumn	76.9	74	68.3	74		77.9		73.1	75	74	70.2	72.1	71.2
	Spring	74	74	69.2	74		77.9		73.1	75	72.1	70.2	73.1	73.1
2018	Autumn	76	76.9	71.2	Dry		77.9		75	Dry	72.1	70.2	73.1	73.1
	Spring	76	76.9	Dry	Dry		Dry		75	Dry	Dry	70.2	71.2	71.2
2019	Autumn	Dry	73.1	Dry	Dry		Dry		Dry	Dry	Dry	49	71.2	71.2
	Spring	Dry	76	Dry	Dry		Dry		Dry	Dry	Dry	52.9	71.2	71.2
2020	Autumn	76.9	74	74	77.9	78.8	76.9	74	74	Dry	76.9	52.9	73.1	73.1
	Spring	76.9	75	73.1	80.8	79.8	77.9	74	74	80.8	76	52.9	73.1	73.1
2021	Autumn	76.9	76	73.1	81.7	78.8	76	74	72.1	80.8	76	53.8	73.1	73.1
	Spring	75	76	73.1	79.8	78.8	76	74	72.1	80.8	74	53.8	73.1	73.1
Minimum		74	73.1	68.3	74	78.8	76	74	71.2	75	72.1	49	71.2	71.2
Maximum		78.8	77.9	74	81.7	79.8	78.8	74	76	80.8	76.9	76	74	74
Mean		77.1	75.6	71.2	76.8	79.1	77.5	74.0	73.4	77.9	74.5	64.5	72.9	72.8

Note 1: Monitoring sites are presented in order from upstream (left) to downstream (right). See **Figure 6.1**.
Note 2: Excised Creek monitoring sites.
Note 3: Diversion channel creek sites.

Source: Marine Pollution Research Pty Ltd (2022).

For those sites which were sampled, all sites were found to be in 'good' condition (i.e. >70%) with the exception of BCDown (53.8%). The riparian and aquatic habitat condition at BCDown was very poor and was below the long term mean for this site during both the autumn and spring survey rounds. This low score is largely the result of low scores of sediment composition, detritus and aquatic vegetation, with muddy sediments in the lower section of Bowmans Creek first noted during the autumn 2019 survey.

Relatively high scores recorded for sites BCED1, BCED2 and BCWD2 are largely reflective of factors including a more continuous and denser riparian corridor adjacent to these sites, minimal bank undercutting and minimal fine sediment accumulation. With the exception of site BCDown, habitat condition scores during both the autumn and spring sampling rounds were generally consistent with or higher than the long term mean for all monitoring sites.

Habitat condition scores recorded at Glennies Creek monitoring sites (GCUp and GCMid) are consistent with those recorded for the previous reporting period, showing a more-stabilised recovery from the lower scores recorded throughout spring 2018 to spring 2019. Habitat conditions at these sites are generally dependent upon water levels, with upstream dam water releases providing relatively stable flow rates during the reporting period.

Stream Health – Aquatic Fauna

Table 6.9 and **Table 6.10** present the long term macroinvertebrate diversity and SIGNAL Index scores respectively for monitoring locations within Bowmans Creek and Glennies Creek. In accordance with sampling triggers outlined in the FFMP, diversity values and SIGNAL scores are ranked as either 'Low', 'In' or 'High' if they fall below, within or above one standard deviation from the long term mean.

Macroinvertebrate diversities recorded for Bowmans Creek during the reporting period were low for three of the 11 sites sampled in autumn, with one site (BCLW7A) also rated as low during both autumn and spring. Low values likely reflect the delayed recovery of macroinvertebrate assemblages following prolonged dry conditions prior to the reporting period. Regional drought conditions during the 2018 and 2019 reporting periods resulted in reduced water quality (increased salinity and sediments) and habitat condition due to drought induced pool contraction and associated dieback of exposed plants. Notwithstanding, macroinvertebrate diversity levels during the autumn sampling round for all sites were either consistent with or higher than those reported during the previous reporting period. Higher diversity levels recorded during the spring sampling round display the recovery of macroinvertebrate assemblages during the reporting period in response to increased rainfall and water availability.

Site SIGNAL scores recorded for Bowmans Creek were either In or High at all sites sampled during both autumn and spring. For Glennies Creek, all macroinvertebrate diversities and SIGNAL scores were either within one standard deviation from the long term mean or higher during both seasonal sampling periods. The general consistency or improvement in SIGNAL scores compared to the previous reporting periods likely reflect a gradual recolonisation by more sensitive taxa due to sustained water levels, with complete recolonisation likely to take time due to the need for adult stages of these taxa to recolonise upstream areas by aerial means.

In summary, 'low' trigger values recorded for monitoring sites within Bowmans Creek during the reporting period are attributable to natural variation and natural environmental responses to prevailing climatic conditions. As such, no further action was required under the FFMP TARP.

In addition to aquatic macroinvertebrates, three native fish species, flathead gudgeons (*Phylipnodon grandiceps*), firetail gudgeons (*Hypseleotris galii*), Australian smelt (*Retropinna semmoni*), and three pest species, plague minnow (*Gambusia holbrooki*), goldfish (*Carassius auratus*), and carp (*Cyprinus carpio*), were also recorded at sites within both Bowmans Creek and Glennies Creek during the reporting period. Tadpoles were observed within Bowmans Creek during spring, and a large eastern long-necked turtle (*Chelodina longicollis*) was observed within Bowmans Creek during autumn.

Table 6.9
Stream Health Monitoring – Macroinvertebrate Diversity

Year	Period	Diversity (No. Taxa)																			
		Bowmans Creek Sites^											Summary		Glennies Creek Sites^					Summary	
		BC Up	BC1	BCLW6B	BCED1	BCED2	BC3	BC4.5	BCLW7A	BCWD2	BC6	BC Down	*Total*	*Mean Site*	GC Up	GCOC Up	GC Mid	GCOC Down	GC Down	*Total*	*Mean*
2007	Autumn	12	-	-	-	-	-	-	21	-	-	9	***25***	***14.0***	26	-	17	-	14	***34***	***19.0***
	Spring	21	-	-	-	-	-	-	17	-	-	17	***30***	***17.0***	22	26	22	23	20	***42***	***22.6***
2008	Autumn	20	-	-	-	-	-	-	21	-	-	16	***32***	***18.8***	26	24	24	24	23	***42***	***24.2***
	Spring	24	12	18	-	-	-	-	21	-	-	16	***37***	***18.8***	21	20	21	22	20	***34***	***20.8***
2009	Autumn	23	12	24	-	-	-	-	21	-	-	22	***44***	***19.8***	22	24	23	27	24	***41***	***24.0***
	Spring	-	15	12	-	-	23	-	29	-	-	25	***46***	***21.2***	21	-	20	-	23	***33***	***21.0***
2010	Autumn	-	12	14	-	-	12	-	26	-	-	22	***40***	***17.5***	18	-	25	-	22	***36***	***22.0***
	Spring	18	-	19	-	-	-	-	-	-	22	12	***39***	***19.2***	9	-	30	22	-	***34***	***20.3***
2011	Autumn	20	-	19	-	-	-	-	-	-	18	21	***33***	***20.0***	-	-	27	23	-	***34***	***25.0***
	Spring	22	-	21	-	-	-	-	-	-	17	19	***37***	***19.8***	20	-	27	22	-	***35***	***23.0***
2012	Autumn	26	-	19	-	-	-	-	-	-	24	17	***39***	***22.2***	14	-	17	18	-	***26***	***16.3***
	Spring	35	22	17	-	-	-	-	35	-	31	23	***52***	***26.7***	26	-	28	24	-	***41***	***26.0***
2013	Autumn	27	23	23	-	-	26	-	33	-	24	24	***52***	***25.7***	17	-	21	-	-	***22***	***19.0***
	Spring	35	18	27	24	-	26	-	29	21	25	30	***53***	***26.1***	24	-	29	-	-	***32***	***26.4***
2014	Autumn	31	24	15	26	-	29	-	27	25	25	23	***52***	***25.0***	26	-	23	-	-	***31***	***24.5***
	Spring	32	20	25	27	-	22	-	21	21	31	24	***52***	***24.8***	22	-	22	-	-	***30***	***22.0***
2015	Autumn	23	21	13	27	-	23	-	24	21	20	19	***47***	***21.2***	20	-	21	-	-	***28***	***20.5***
	Spring	21	18	10	21	-	20	-	20	18	20	16	***38***	***18.2***	18	-	18	-	-	***23***	***18.0***
2016	Autumn	21	20	13	23	-	22	-	20	24	27	24	***49***	***21.6***	20	-	22	-	-	***27***	***21.0***
	Spring	21	16	20	22	-	23	-	20	24	20	22	***41***	***20.9***	19	-	18	-	-	***26***	***18.5***
2017	Autumn	23	20	18	19	-	22	-	19	22	21	20	***36***	***20.4***	17	-	20	-	-	***25***	***18.5***
	Spring	20	20	18	16	-	26	-	17	21	23	24	***42***	***20.6***	19	-	15	-	-	***22***	***17.5***
2018	Autumn	22	17	14	Dry	-	15	19	16	Dry	19	15	***39***	***17.1***	21	-	20	-	-	***28***	***20.5***
	Spring	21	18	Dry	Dry	-	Dry	20	24	Dry	14	19	***40***	***19.3***	17	-	19	-	-	***22***	***18.0***

Table 6.9 (Cont'd)
Stream Health Monitoring – Macroinvertebrate Diversity

Year	Period	Diversity (No. Taxa)																		
		Bowmans Creek Sites^											Summary		Glennies Creek Sites^					Summary	
		BC Up	BC1	BCLW6B	BCED1	BCED2	BC3	BC4.5	BCLW7A	BCWD2	BC6	BC Down	*Total*	*Mean Site*	GC Up	GCOC Up	GC Mid	GCOC Down	GC Down	*Total*	*Mean*
2019	Autumn	Dry	14	Dry	Dry	-	Dry	18	Dry	Dry	14	21	***30***	***16.8***	18	-	16	-	-	***26***	***17.0***
	Spring	Dry	13	Dry	Dry	-	Dry	Dry	Dry	Dry	Dry	9	***18***	***11.0***	20	-	19	-	-	***25***	***19.5***
2020	Autumn	15	20	16	21	22	20	17	7	Dry	15	9	***28***	***16.2***	22	-	25	-	-	***31***	***23.5***
	Spring	25	23	20	22	21	21	22	21	21	20	20	***39***	***21.5***	26	-	32	-	-	***36***	***29.0***
2021	Autumn	18	23	18	20	18	19	20	10	19	21	13	***40***	***18.1***	23		20			***35***	***21.5***
	Spring	24	19	18	26	29	20	23	15	23	20	19	***44***	***20.5***	20		29			***32***	***24.5***
LTM[1]		***23.3***	***18.0***	***18.0***	***22.5***	***21.5***	***22.0***	***17.4***	***22.2***	***21.8***	***21.5***	***19.2***	***39.6***	***20***	***20.4***	***-[4]***	***22.2***	***-[4]***	***-[4]***	***30.9***	***21.3***
SD LTM[2]		***5.5***	***3.8***	***4.4***	***3.4***	***0.7***	***4.3***	***3.7***	***6.1***	***2.0***	***4.9***	***5.2***	***8.9***	***3.6***	***4.0***	***-[4]***	***4.4***	***-[4]***	***-[4]***	***6.1***	***3.2***
2021 Status[3]	Autumn	In	High	In	In		In	In	Low	Low	In	Low	***In***	***In***	In	-	In	-	-	***In***	***In***
	Spring	In	In	In	High		In	High	Low	In	In	In	***In***	***In***	High	-	High	-	-	***In***	***In***

Note 1: Long Term Mean of results preceding the two seasonal results recorded for the current reporting period. ^ See **Figure 6.1**.

Note 2: Standard deviation of results preceding the two seasonal results recorded for the current reporting period from the Long Term Mean.

Note 3: Status of each site compared to the Long Term Mean (LTM), where 'Low' = results below one standard deviation from the LTM, 'In' = results within one standard deviation from the LTM, and 'High' = results higher than one standard deviation above the LTM.

Note 4: Value not calculated due to low sample number.

Source: Marine Pollution Research Pty Ltd (2022).

Table 6.10
Stream Health Monitoring – SIGNAL Scores

Year	Period	Signal Score																		
		Bowmans Creek Sites^											*Summary*		Glennies Creek Sites^					*Summary*	
		BC Up	BC1	BCLW6B	BCED1	BCED2	BC3	BC4.5	BCLW7A	BCWD2	BC6	BC Down	*Creek Score*	*Mean Site*	GC Up	GCOC Up	GC Mid	GCOC Down	GC Down	*Creek Score*	*Mean Site*
2007	Autumn	2.17	-	-	-	-	-	2.93	3.24	-	-	3.33	***2.95***	***2.92***	3.71	-	3.81	-	3.58	***3.71***	***3.70***
	Spring	3.57	-	-	-	-	-	4.31	3.35	-	-	3.59	***3.64***	***3.69***	4.19	3.92	3.71	3.48	3.65	***3.80***	***3.79***
2008	Autumn	3.84	-	-	-	-	-	4.17	3.81	-	-	4.25	***4.00***	***4.02***	4.16	3.82	3.71	4.13	3.62	***3.90***	***3.89***
	Spring	4.13	3.92	3.89	-	-	-	4.00	3.71	-	-	3.88	***3.93***	***3.92***	3.85	3.84	4.00	3.62	3.40	***3.74***	***3.74***
2009	Autumn	3.87	3.64	3.50	-	-	-	3.76	4.00	-	-	3.70	***3.75***	***3.74***	3.68	4.00	4.10	3.96	4.05	***3.95***	***3.96***
	Spring	-	3.29	3.82	-	-	3.15	-	3.70	-	-	3.74	***3.55***	***3.54***	3.63	-	3.56	-	3.90	***3.71***	***3.70***
2010	Autumn	-	3.36	2.83	-	-	4.09	-	3.63	-	-	3.90	***3.61***	***3.58***	4.00	-	4.25	-	3.68	***3.98***	***3.98***
	Spring	3.33	-	3.84	-	-	-	-	-	-	3.52	3.67	***3.58***	***3.59***	3.22	-	3.61	3.55	-	***3.53***	***3.46***
2011	Autumn	3.60	-	3.47	-	-	-	-	-	-	3.44	3.60	***3.58***	***3.57***	-	-	3.81	3.74	-	***3.78***	***3.78***
	Spring	3.86	-	3.35	-	-	-	-	-	-	4.06	3.68	***3.79***	***3.80***	4.10	-	3.80	4.05	-	***3.97***	***3.98***
2012	Autumn	3.85	-	3.33	-	-	-	-	-	-	3.57	3.44	***3.55***	***3.53***	3.71	-	3.53	3.50	-	***3.57***	***3.58***
	Spring	3.77	3.68	4.00	-	-	-	-	3.85	-	3.62	3.75	***3.82***	***3.83***	3.92	-	3.79	4.50	-	***4.05***	***4.07***
2013	Autumn	3.77	3.73	3.45	-	-	3.73	-	3.61	-	3.83	3.76	***3.70***	***3.70***	3.88	-	4.14	-	-	***4.03***	***4.01***
	Spring	3.76	4.00	3.62	3.45	-	4.04	-	3.74	3.42	3.95	4.11	***3.79***	***3.79***	4.17	-	4.00	-	-	***4.08***	***4.09***
2014	Autumn	3.53	3.21	3.54	3.96	-	3.37	-	3.88	3.35	3.67	3.59	***3.57***	***3.57***	3.91	-	4.38	-	-	***4.14***	***4.15***
	Spring	4.00	3.47	3.63	4.48	-	3.70	-	3.53	3.65	3.63	3.86	***3.67***	***3.66***	4.15	-	4.33	-	-	***4.24***	***4.24***
2015	Autumn	3.83	3.65	3.10	3.44	-	3.70	-	3.23	3.70	3.53	3.72	***3.57***	***3.54***	3.50	-	4.19	-	-	***3.85***	***3.85***
	Spring	3.57	3.39	3.00	3.67	-	3.95	-	3.30	3.88	3.90	4.00	***3.66***	***3.63***	3.81	-	4.29	-	-	***3.97***	***3.97***
2016	Autumn	3.75	4.05	3.77	3.45	-	3.50	-	3.17	3.63	3.40	3.82	***3.61***	***3.61***	3.22	-	3.71	-	-	***3.44***	***3.47***
	Spring	3.52	3.13	3.26	3.70	-	3.38	-	3.00	3.73	3.47	3.50	***3.36***	***3.41***	3.65	-	3.35	-	-	***3.65***	***3.50***
2017	Autumn	3.35	3.78	2.94	3.88	-	4.05	-	3.11	3.38	3.42	3.68	***3.42***	***3.51***	3.94	-	3.53	-	-	***3.56***	***3.73***
	Spring	3.61	3.84	3.59	3.44	-	3.38	-	3.38	3.52	3.55	3.45	***3.42***	***3.53***	3.55	-	3.63	-	-	***3.54***	***3.59***

Table 6.10 (Cont'd)
Stream Health Monitoring – SIGNAL Scores

Year	Period	Signal Score																		
		Bowmans Creek Sites^										Summary		Glennies Creek Sites^					Summary	
		BC Up	BC1	BCLW6B	BCED1	BCED2	BC3	BC4.5	BCLW7A	BCWD2	BC6	BC Down	Creek Score	Mean Site	GC Up	GCOC Up	GC Mid	GCOC Down	GC Down	Creek Score	Mean Site
2018	Autumn	3.71	3.27	2.62	Dry	-	2.92	-	2.69	Dry	3.28	3.20	***3.18***	***3.13***	3.42	-	3.88	-	-	***3.64***	***3.65***
	Spring	3.05	3.18	Dry	Dry	-	Dry	-	3.71	Dry	3.45	3.00	***3.30***	***3.30***	4.14	-	3.75	-	-	***3.93***	***3.95***
2019	Autumn	Dry	3.43	Dry	Dry	-	Dry	-	Dry	Dry	3.08	3.05	***3.18***	***3.19***	3.94	-	3.86	-	-	***3.90***	***3.90***
	Spring	Dry	4.09	Dry	Dry	-	Dry	-	Dry	Dry	Dry	2.75	***3.42***	***3.42***	4.12	-	3.61	-	-	***3.86***	***3.87***
2020	Autumn	3.15	3.38	3.23	3.22	3.11	3.06	3.00	2.00	Dry	3.17	2.50	***3.07***	***2.98***	3.65	-	4.00	-	-	***3.84***	***3.83***
	Spring	3.73	3.76	3.17	3.75	3.37	3.35	3.42	3.25	3.89	3.39	3.32	***3.50***	***3.49***	4.17	-	3.94	-	-	***4.04***	***4.05***
2021	Autumn	4.18	3.73	3.53	3.63	4.18	4.00	4.11	3.50	4.32	4.33	3.91	***4.08***	***3.90***	3.90	-	3.95	-	-	***3.93***	***3.90***
	Spring	3.59	3.58	3.38	3.42	3.59	3.75	3.41	3.62	3.91	3.90	3.63	***3.62***	***3.61***	4.05	-	3.92	-	-	***3.99***	***3.99***
LTM[1]		***3.61***	***3.58***	***3.41***	***3.59***	***3.24***	***3.56***	***3.66***	***3.40***	***3.62***	***3.91***	***3.57***	***3.6***	***3.5***	***3.83***	***-***	***3.87***	***-***	***-***	***3.80***	***3.8***
SD LTM[2]		***0.39***	***0.30***	***0.36***	***0.22***	***0.18***	***0.37***	***0.55***	***0.45***	***0.20***	***0.25***	***0.39***	***0.2***	***0.3***	***0.29***	***-***	***0.27***	***-***	***-***	***0.2***	***0.2***
2021 Status[3]	Autumn	High	In	In	In	-	High	In	In	High	High	In	***High***	***High***	In	-	In	-	-	***In***	***In***
	Spring	In	In	In	In	-	In	In	In	High	In	In	***In***	***In***	In	-	In	-	-	***In***	***In***

Note 1: Long Term Mean of results preceding the two seasonal results recorded for the current reporting period. See **Figure 6.1**

Note 2: Standard deviation of results preceding the two seasonal results recorded for the current reporting period from the Long Term Mean.

Note 3: Status of each site compared to the Long Term Mean (LTM), where 'Low' = results below one standard deviation from the LTM, 'In' = results within one standard deviation from the LTM, and 'High' = results higher than one standard deviation above the LTM.

Note 4: Value not calculated due to low sample number.

Source: Marine Pollution Research Pty Ltd (2022).

Vegetation - Bowmans Creek Riparian Zone

Monitoring of the Bowman Creek riparian vegetation was undertaken during the reporting period between 17 May to 26 May 2021 by DnA Environmental. Monitoring of riparian vegetation is undertaken at the ACP site to assess the condition of vegetation associated with Bowmans Creek, the status of vegetation and rehabilitated areas within the Bowmans Creek Diversion channels, and the condition of local protected River Red Gum (*Eucalyptus camaldulensis*) populations.

A total of 17 riparian vegetation sites were monitored during the reporting period, including nine Casuarina monitoring sites, five Eucalypt Woodland monitoring sites, and three Casuarina reference sites. Monitoring of reference sites which are representative of natural vegetation communities is undertaken in order to inform appropriate completion criteria and ecological targets for rehabilitated areas within the ACP site.

Table 6.11 presents an overview of the performance of each monitoring site against the relevant completion criteria. In summary, rehabilitated casuarina and eucalypt woodland sites have generally formed functional and stable ecosystems comparable to conditions recorded in reference sites not subject to mining-related impacts, with both the reference and monitoring sites showing similar responses to regional-level extreme meteorological conditions. Compared to reference sites, several monitoring sites along both the natural Bowmans Creek channel and Bowmans Creek Diversion displayed lower stability associated with increased animal disturbance, flood-related damage, and a higher diversity and abundance of exotic species. Ecosystem function was higher at all monitoring sites when compared to reference sites except for at Q7 where significant damage was observed from feral pig activity. Other performance targets which have not yet been achieved are primarily dependent upon community maturity, with performance indicators including litter cover, canopy cover, trunk diameter and provision of wildlife habitat expected to develop over time.

Monitoring also indicated that, on average, most of the remnant River Red Gum population was in moderate health, with a viable reproductive population present and high numbers of saplings reflecting previous regeneration and recruitment events. However, there was a significant decline in the health of the old growth and mature trees with a notable increase in the extent of insect damage, especially in the larger trees, causing a ‘perceived’ decrease in tree health rating. Whilst previously ‘healthy’ trees may appear to be in poor health, they can retain the capacity to recover after insect plagues have gone.

No young seedlings were recorded during the reporting period, with this observation likely to be attributable to previous drought conditions, grazing pressure and competition with exotic species. However, a high degree of reproductive capacity was recorded during 2021 with 78 (83%) of the young, mature, and old growth trees bearing buds and/or fruits. There was also an increase in the number of saplings that were in bud with a minor percentage also bearing fruit.

Erosion and decreased soil stability associated with previous cattle presence in riparian areas has been the most significant threat to the health of riparian areas associated with Bowmans Creek. In particular, during drought conditions in 2017 and 2019, increased levels of grazing in riparian areas combined with increased vulnerability of soils and creek banks to erosion threatened rehabilitated areas as well as established remnant vegetation. Subsequently most ACOL farmland areas, including the creek were destocked in 2020 and, with improved seasonal conditions, significant understory growth of grass (and weeds) has occurred. Notwithstanding, some of the old growth trees remain susceptible to degradation as their roots remain exposed and some are on very steep sided banks and may become unstable and fall.

Table 6.11
Bowmans Creek Riparian Zone – Completion Criteria Status

Rehabilitation Phase	Completion Criteria	Performance Indicator	Unit of Measure	Casuarina Monitoring Site									Mixed Eucalypt Monitoring Site				
				C1	C2	C3	C4	Q3	Q4	Q7	Q9	Q10	R1	R3	R5	R6	RRG01
Phase 2: Landform establishment and stability	Landform suitable for final landuse and generally compatible with surrounding topography and final landform design	Slope	< Degrees (18°)	2	2	18	15	3	15	15	14	3	3	1	18	2	22
	Areas of active erosion are limited	No. Rills/Gullies	No.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Phase 3: Growth medium development	Soil properties are suitable for the establishment and maintenance of selected vegetation species	pH	pH (5.6-7.3)	6.7	6.3	6.4	6.5	NA	6.8	NA	6.8	7.0	6.7	6.2	7.4	5.9	7.4
		Organic Matter	% (>4.5)	4.2	5.6	5.9	3.5	NA	5.0	NA	5.1	4.6	2.9	3.4	5.3	6.6	7.2
		Phosphorous	mg/ kg (50)	33.1	27.2	31.8	22.6	NA	22.3	NA	37.1	24.9	38.4	60.0	34.8	23.3	76.1
Phase 4: Ecosystem & Landuse Establishment	Landform is stable and performing as it was designed to do	LFA Stability	%	73.1	67.9	66.6	67.3	64.6	71.1	58	72.4	72.3	65.5	66.5	70.8	72.5	71.4
		LFA Landscape organisation	%	100	100	100	100	100	95	37	97	100	100	100	95	100	80
	Vegetation contains a diversity of species comparable to that of the local remnant vegetation	Diversity of shrubs and juvenile trees	% population	100	100	100	100	NA	0	NA	0	0	100	100	100	100	100
		Total species richness	No./ area	25	21	35	15	NA	34	NA	31	36	35	38	36	38	26
		Native species richness	>No./ area	5	7	12	4	NA	7	NA	7	9	12	14	14	20	8
		Exotic species richness	<No./ area	20	14	23	11	NA	27	NA	24	27	23	24	22	18	18
	Vegetation contains a density of species comparable to that of the local remnant vegetation	Density of shrubs and juvenile trees	No./ area	7	37	33	40	NA	0	NA	0	0	8	3	6	21	2
	The vegetation is comprised by a range of growth forms comparable to that of the local remnant vegetation	Trees	No./ area	1	2	4	1	NA	1	NA	1	1	3	3	3	6	2
		Shrubs	No./ area	0	0	2	0	NA	0	NA	0	1	2	1	0	1	1
		Herbs	No./ area	18	9	15	8	NA	21	NA	18	26	15	14	22	17	15
		Grasses	No./ area	4	4	10	3	NA	7	NA	8	5	10	16	7	9	3

Table 6.11 (Cont'd)
Bowmans Creek Riparian Zone – Completion Criteria Status

Rehabilitation Phase	Completion Criteria	Performance Indicator	Unit of Measure	Casuarina Monitoring Site									Mixed Eucalypt Monitoring Site				
				C1	C2	C3	C4	Q3	Q4	Q7	Q9	Q10	R1	R3	R5	R6	RRG01
Phase 5: Ecosystem & Landuse Sustainability	Landform is ecologically functional and performing as it was designed to do	LFA Infiltration	%	55	51.8	52.5	51.7	46.8	52.4	45	55.5	47.3	51.5	52.2	48.5	50.4	50.6
		LFA Nutrient recycling	%	53.7	51.9	51.8	50.7	43.6	50.8	38.8	54.6	47.1	49.9	52.2	51.4	53.8	49.2
	Ground layer contains protective ground cover and habitat structure comparable with the local remnant vegetation	Perennial plant cover (< 0.5m)	%	51	44	28.5	48.5	27.5	52.5	11	74.5	26.5	20.5	50.5	37.5	36.5	63.5
		Total Ground Cover	%	98	100	97.5	99	90	89	41.5	96	91.5	100	98.5	99.5	100	100
	Vegetation contains a diversity of species per square meter comparable to that of the local remnant vegetation	Native understorey abundance	> species/ m^2	1	0.8	1.2	1.2	1.4	0	0	0	1.8	1.2	1	1.4	2.4	0.2
		Exotic understorey abundance	< species /m^2	5.6	3.8	5.6	4	10.8	5	2	4.6	5.2	7	5.6	4.6	4.8	2
	Native ground cover abundance is comparable to that of the local remnant vegetation	Percent ground cover provided by native vegetation <0.5m tall	%	12.5	7.8	13.3	21.1	10.3	0	0	0	25.4	21.9	18	25.4	29.7	3
	The vegetation is maturing and/or natural recruitment is occurring at rates similar to those of the local remnant vegetation	Shrubs and juvenile trees 0 - 0.5m in height	No./ area	0	0	3	0	NA	0	NA	0	0	2	0	0	2	0
		Shrubs and juvenile trees >2m in height	No./ area	7	35	24	37	NA	0	NA	0	0	3	0	4	14	2
	The vegetation is developing in structure and complexity comparable to that of the local remnant vegetation	Foliage cover 0.5 - 2 m	% cover	23.5	27.1	13.8	17.1	0	8	5.9	29.6	0	2.8	3.9	28.5	7.4	2
		Foliage cover >6m	% cover	9	7	4	16.6	6	12.5	3	1.1	7.6	2	9	0	0	12.1
	Vegetation contains a diversity of maturing tree and shrubs species comparable to that of the local remnant vegetation	Tree diversity	species/ area	1	1	2	1	NA	1	NA	1	1	3	3	3	6	3

Table 6.11 (Cont'd)
Bowmans Creek Riparian Zone – Completion Criteria Status

Rehabilitation Phase	Completion Criteria	Performance Indicator	Unit of Measure	Casuarina Monitoring Site									Mixed Eucalypt Monitoring Site				
				C1	C2	C3	C4	Q3	Q4	Q7	Q9	Q10	R1	R3	R5	R6	RRG01
e	Vegetation contains a density of maturing tree and shrubs species comparable to that of the local remnant vegetation	Tree density	No./ area	29	89	47	104	NA	7	NA	4	10	14	26	4	28	8
	The vegetation is in a condition comparable to that of the local remnant vegetation.	Healthy trees	% population	65.5	37.1	42.6	14.4	NA	71.4	NA	0	20	64.3	23.1	25.0	28.6	37.5
		Medium health	% population	34.5	44.9	46.8	60.6	NA	14.3	NA	50	0	35.7	57.7	75	67.9	12.5
		Advanced dieback	% population	0	13.5	4.3	18.3	NA	14.3	NA	0	0	0	19.2	0	3.6	25
		Dead Trees	% population	0	4.5	6.4	6.7	NA	0	NA	50	80	0	0	0	0	25
		Flowers/fruit: Trees	% population	0	0	6.4	0	NA	0	NA	0	0	35.7	15	0	17.9	25

NA = Not Applicable

Green = Meets or exceeds completion criteria.

Blue = Soil performance indicator target falls within industry guidelines but may not be similar to local soils.

Light Brown = Eucalypt Woodland sites meet or exceed comparable ecological performance targets derived from Casuarina reference sites.

Source: DnA Environmental (2021).

However, stream vegetation has been observed to recover during the reporting period in sections where damage from grazing and flooding was not as pronounced, including in the eastern and western creek diversions which remain intact and appeared to be fully functional riparian ecosystems. Any future grazing to manage understorey weeds and increasing fuel loads will be carefully controlled to avoiding overgrazing.

Exotic species richness was higher than that of native species at all sites except for R6, and the understory for all sites was dominated by exotic species. Fourteen priority and declared weed species were recorded across the Bowmans Creek monitoring sites during the reporting period and will require continued control.

Vegetation - Southern Woodland Conservation Area

A Voluntary Conservation Agreement covering the SWCA was established between ACOL and the Minister for the Environment under the *National Parks and Wildlife Act 1974* on 16 September 2010. The SWCA covers an area of 65.66ha above the existing underground mine (see **Figure 6.1**) and contains remnant Hunter Valley vegetation communities, threatened fauna species and archaeological sites of high significance.

Monitoring of the SWCA was undertaken during the reporting period by DnA Environmental between 17 May and 26 2021. Monitoring methods included the use of the Biometric Assessment Method in areas of subsidence repair, NSW Biodiversity Conservation Division monitoring forms and photo points for three established sites (SVCA01, SVCA02 & SVCA03), transects in areas of subsidence repair and additional photo monitoring points. Three eucalypt woodland reference sites were also used to inform benchmark ecological community values and determine appropriate ecological performance targets and completion criteria.

Table 6.12 presents an overview of the performance of each monitoring site within the SWCA against the relevant completion criteria. In summary, woodland sites SVCA01, SVCA02 and SVCA03 met almost all of the specified completion criteria although diversity of native species, including grass species, was slightly low at sites SVCA02 and SVCA03, and a low diversity of herbs was also observed ad SVCA03. Most completion criteria were also met at site SVCA04 with the exception of lower levels of native species diversity, a low diversity of grass species and observations of extensive subsidence cracking. Within these sites there was a continued absence of trees or observation of tree or shrub regeneration.

Subsidence crack treatment works involving clearing, excavation and backfilling were undertaken at sites SVCA05 and SVCA06 in 2018. These two sites displayed low ecological function, reduced levels of groundcover and perennial cover, limited projected foliage and a predominance of exotic species. It is anticipated that these sites will develop towards the completion criteria as they mature. Additional amelioration works are required at these sites as sink holes have been observed to develop following the reactivation of subsidence cracks.

Eight priority and declared weed species were recorded across the SVCA monitoring sites. Exotic perennial grasses considered to be environmental weeds were also recorded in increasing patches throughout the SVCA, ACOL farmland and roadside areas.

Soil analyses indicate that the soils were typically within local or desirable levels although sulfur levels were slightly elevated in most SVCA sites, and were moderately high in SVCA06.

Table 6.12
Southern Woodland Conservation Area – Completion Criteria Status

Rehabilitation Phase	Aspect or ecosystem component	Completion criteria	Performance Indicators	Primary Performance Indicators	Unit of measure	Woodland ecosystem range 2021		SVCA01	SVCA02	SVCA03	SVCA04	SVCA05	SVCA06
						Lower	Upper						
Phase 2: Landform establishment and stability	Landform slope, gradient	Landform suitable for final landuse and generally compatible with surrounding topography and final landform design	Slope	Landform is generally compatible within the context of the local topography and final landform design.	< Degrees (18°)	5	25	10	7	3	8	8	7
	Subsidence cracking	No visible subsidence cracking	No. Subsidence Cracks	Woodland impacted by mine subsidence are restored and comparable to the reference sites	No.	0	0	0	0	0	1	2	0
			Sum of subsidence cracks width	Provides an assessment of the extent of subsidence cracking and demonstrates that repair works have been satisfactory	m	0	0	0	0	0	0.1	1.70	0
Phase 3: Growth medium development	Soil chemical, physical properties and amelioration	Soil properties are suitable for the establishment and maintenance of selected vegetation species	pH	pH is typical of the surrounding landscape or falls within desirable ranges provided by the agricultural industry	pH (5.6-7.3)	5.4	6.4	5.8	5.8	6.0	6.1	6.3	5.9
			Organic Matter	Organic Matter levels are typical of the surrounding landscape, increasing or fall within desirable ranges provided by the agricultural industry	% (>4.5)	5.1	7.1	5.4	7.5	5.0	4.3	7.5	4.5
			Phosphorous	Available Phosphorus is typical of the surrounding landscape or fall within desirable ranges provided by the agricultural industry	mg/kg (50)	9.8	23.9	9.5	13.1	28.5	12.8	26.6	15.7
Phase 4: Ecosystem & Landuse Establishment	Landscape Function Analysis (LFA): Landform stability and organisation	Landform is stable and performing as it was designed to do	LFA Stability	The LFA stability index is comparable to or trending towards the local remnant vegetation	%	67.0	76.8	76.5	67.5	80.5	83.1	71.3	71.6
			LFA Landscape organisation	The Landscape Organisation Index provides a measure of the ability of the site to retain resources and is comparable to the local remnant vegetation	%	90	100	100	100	100	100	87	87

Table 6.12 (Cont'd)
Southern Woodland Conservation Area – Completion Criteria Status

Rehabilitation Phase	Aspect or ecosystem component	Completion criteria	Performance Indicators	Primary Performance Indicators	Unit of measure	Woodland ecosystem range 2021		SVCA01	SVCA02	SVCA03	SVCA04	SVCA05	SVCA06
						Lower	Upper						
Phase 4: Ecosystem & Landuse Establishment (Cont'd)	Vegetation diversity	Vegetation contains a diversity of species comparable to that of the local remnant vegetation	Diversity of shrubs and juvenile trees	The diversity of shrubs and juvenile trees with a stem diameter < 5cm is comparable to the local remnant vegetation.	species/area	2	4	5	3	0	NA	NA	NA
				The percentage of shrubs and juvenile trees with a stem diameter < 5cm dbh which are local endemic species and these percentages are comparable to the local remnant vegetation	% population	84	100	99.6	91	0	NA	NA	NA
			Total species richness	The total number of live plant species is comparable to the local remnant vegetation	No./area	47	65	58	47	33	NA	NA	NA
			Native species richness	The total number of live native plant species is greater than or comparable to the local remnant vegetation	>No./area	36	43	42	35	20	NA	NA	NA
			Exotic species richness	The total number of live exotic plant species is less than or comparable to the local remnant vegetation	<No./area	11	22	16	12	13	NA	NA	NA
	Vegetation density	Vegetation contains a density of species comparable to that of the local remnant vegetation	Density of shrubs and juvenile trees	The total density of shrubs or juvenile trees with a stem diameter < 5cm is comparable to the local remnant vegetation	No./area	10	154	252	58	0	NA	NA	NA
				The density of endemic shrubs or juvenile trees with a stem diameter < 5cm is comparable to that of the local remnant vegetation	No./area	10	129	251	53	0	NA	NA	NA

Table 6.12 (Cont'd)
Southern Woodland Conservation Area – Completion Criteria Status

Rehabilitation Phase	Aspect or ecosystem component	Completion criteria	Performance Indicators	Primary Performance Indicators	Unit of measure	Woodland ecosystem range 2021		SVCA01	SVCA02	SVCA03	SVCA04	SVCA05	SVCA06
						Lower	Upper						
Phase 4: Ecosystem & Landuse Establishment (Cont'd)	Ecosystem composition	The vegetation is comprised by a range of growth forms comparable to that of the local remnant vegetation	Trees	The number of tree species regardless of age comprising the vegetation community is comparable to the local remnant vegetation	No./area	2	2	3	2	0	NA	NA	NA
			Shrubs	The number of shrub species regardless of age comprising the vegetation community is comparable to the local remnant vegetation	No./area	0	2	4	2	0	NA	NA	NA
			Herbs	The number of herbs or forb species comprising the vegetation community is comparable to the local remnant vegetation	No./area	21	34	29	20	14	NA	NA	NA
			Grasses	The number of grass species comprising the vegetation community is comparable to the local remnant vegetation	No./area	16	19	13	12	11	NA	NA	NA
Phase 5: Ecosystem & Landuse Sustainability	Landscape Function Analysis (LFA): Landform function and ecological performance	Landform is ecologically functional and performing as it was designed to do	LFA Infiltration	LFA infiltration index is comparable to or trending towards the local remnant vegetation	%	45.0	55.5	51.7	57.2	59.6	62.5	44.2	44.4
			LFA Nutrient recycling	LFA nutrient recycling index is comparable to or trending towards the local remnant vegetation	%	46.4	53.1	57	54.6	56	61.1	45.8	47.3
	Protective ground cover	Ground layer contains protective ground cover and habitat structure comparable with the local remnant vegetation	Perennial plant cover (< 0.5m)	Percent ground cover provided by live perennial vegetation (<0.5m in height) is comparable to the local remnant vegetation	%	23	64	73	30.6	49.5	82.9	44	46
			Total Ground Cover	Total groundcover is the sum of protective ground cover components (as described above) and that it is comparable to the local remnant vegetation	%	86	100	100	100	100	100	90	91

Table 6.12 (Cont'd)
Southern Woodland Conservation Area – Completion Criteria Status

Rehabilitation Phase	Aspect or ecosystem component	Completion criteria	Performance Indicators	Primary Performance Indicators	Unit of measure	Woodland ecosystem range 2021		SVCA01	SVCA02	SVCA03	SVCA04	SVCA05	SVCA06
						Lower	Upper						
Phase 5: Ecosystem & Landuse Sustainability (Cont'd)	Ground cover diversity	Vegetation contains a diversity of species per square meter comparable to that of the local remnant vegetation	Native understorey abundance	The abundance of native species per square metre averaged across the site has more than or an equal number of native species as the local remnant vegetation	> species/m2	8.4	10.8	9.6	5.6	6	6.6	6.4	5.4
			Exotic understorey abundance	The abundance of exotic species per square metre averaged across the site has less than or an equal number of exotic species as the local remnant vegetation	< species/m2	0.6	3.2	1	1.4	2.2	2.4	1.4	3.4
	Native ground cover abundance	Native ground cover abundance is comparable to that of the local remnant vegetation	Percent ground cover provided by native vegetation <0.5m tall	The percent ground cover abundance of native species (<0.5m) compared to exotic species is comparable to the local remnant vegetation	%	77	95	94.8	84.7	73.7	78.5	86.6	67.1
	Ecosystem growth and natural recruitment	The vegetation is maturing and/or natural recruitment is occurring at rates similar to those of the local remnant vegetation	shrubs and juvenile trees 0 - 0.5m in height	The number of shrubs or juvenile trees <0.5m in height provides an indication of establishment success and/or natural ecosystem recruitment and is comparable to the local remnant vegetation	No./area	4	39	195	40	0	NA	NA	NA
			shrubs and juvenile trees 0.5 - 1m in height	The number of shrubs or juvenile trees 0.5-1m in height provides an indication of establishment success, growth and/or natural ecosystem recruitment and is comparable to the local remnant vegetation	No./area	0	24	39	12	0	NA	NA	NA
			shrubs and juvenile trees 1.5 - 2m in height	The number of shrubs or juvenile trees 1.5-2m in height provides an indication of establishment success, growth and/or natural ecosystem recruitment and is comparable to the local remnant vegetation	No./area	0	22	1	1	0	NA	NA	NA

Table 6.12 (Cont'd)
Southern Woodland Conservation Area – Completion Criteria Status

Rehabilitation Phase	Aspect or ecosystem component	Completion criteria	Performance Indicators	Primary Performance Indicators	Unit of measure	Woodland ecosystem range 2021		SVCA01	SVCA02	SVCA03	SVCA04	SVCA05	SVCA06
						Lower	Upper						
Phase 5: Ecosystem & Landuse Sustainability (Cont'd)	Ecosystem structure	The vegetation is developing in structure and complexity comparable to that of the local remnant vegetation	Foliage cover 0.5 - 2 m	Projected foliage cover provided by perennial plants in the 0.5 - 2m vertical height stratum indicates the community structure is comparable to the local remnant vegetation	% cover	0	2	4.5	2.5	1.7	6	0	11
			Foliage cover 2 - 4m	Projected foliage cover provided by perennial plants in the 2 - 4m vertical height stratum indicates the community structure is comparable to the local remnant vegetation	% cover	1	7	3	0	0	7	0	0
			Foliage cover >6m	Projected foliage cover provided by perennial plants >6m vertical height stratum indicates the community structure is comparable to the local remnant vegetation	% cover	0	36	20	33	0	13.5	13	2.5
	Tree diversity	Vegetation contains a diversity of maturing tree and shrubs species comparable to that of the local remnant vegetation	Tree diversity	The diversity of trees or shrubs with a stem diameter >5cm is comparable to the local remnant vegetation	Species/ area	1	2	2	2	0	NA	NA	NA
				The percentage of maturing trees and shrubs with a stem diameter >5cm dbh which are local endemic species and these percentages are comparable to the local remnant vegetation	%	100	100	100	100	0	NA	NA	NA
	Tree density	Vegetation contains a density of maturing tree and shrubs species comparable to that of the local remnant vegetation	Tree density	The density of shrubs or trees with a stem diameter > 5cm is comparable to the local remnant vegetation	No./ area	13	80	28	24	0	NA	NA	NA

Table 6.12 (Cont'd)
Southern Woodland Conservation Area – Completion Criteria Status

Rehabilitation Phase	Aspect or ecosystem component	Completion criteria	Performance Indicators	Primary Performance Indicators	Unit of measure	Woodland ecosystem range 2021		SVCA01	SVCA02	SVCA03	SVCA04	SVCA05	SVCA06
						Lower	Upper						
Phase 5: Ecosystem & Landuse Sustainability (Cont'd)	Ecosystem health	The vegetation is in a condition comparable to that of the local remnant vegetation.	Healthy trees	The percentage of the tree population which are in healthy condition and that the percentage is comparable to the local remnant vegetation	% population	19	38	10.7	33.3	0	NA	NA	NA
			Flowers/fruit: Trees	The presence of reproductive structures such as buds, flowers or fruit provides evidence that the ecosystem is maturing, capable of recruitment and can provide habitat resources comparable to that of the local remnant vegetation	% population	0	16	14.3	12.5	0	NA	NA	NA

Green = Meets or exceeds completion criteria.

Blue = Soil performance indicator target falls within industry guidelines but may not be similar to local soils.

NA = Not Applicable.

Source: DnA Environmental (2021)

In addition to the monitoring undertaken by DnA Environmental, a site audit inspection of the SWCA was undertaken by the Biodiversity Conservation Trust (BCT) on 25 May 2021. In follow up correspondence dated 19 August 2021, the BCT noted that the conservation area "*is in a moderate to good condition with much of the remnant vegetation exhibiting a diverse native cover within the lower stratums as a result of recent rainfall in the Hunter Valley.*" It was also noted that "*Areas that generally lacked woody cover were observed to have a high exotic groundcover present limiting the opportunity for native canopy and shrubs to establish*."

The following recommendations were also provided.

1. Weed Control

   Glennies Creek - Weeds of most concern include Vine weeds such as Madeira Vine (*Anredera cordifolia*) and Balloon Vine (*Cardiospermum grandiflorum*). A targeted control program should focus on these two species as they have the potential to smother vegetation, damaging canopy species and limiting native species re-establishment within the lower stratum.

   Hunter River – Weeds including Castor Oil Plant (*Ricinus communis*), Kikuyu (*Cenchrus clandestinus*), Coolatai Grass (*Hyparrhenia hirta*) should be treated once a revegetation and bush regeneration plan is developed and implementation commenced.

   Open Pastures – Weed control as for the Hunter River area with an aim to revegetate with species associated with the adjacent vegetation communities.

   Remnant Vegetation - Scattered occurrences of African Boxthorn (*Lycium ferocissimum*), African Olive (*Olea europaea* subsp. *Cuspidata*), Green Cestrum (*Cestrum parqui*) and three Pear varieties (*Opuntia stricta, O. humifusa, O. aurantiaca*) were present all within remnant vegetation. A weed control program should focus on the removal of these species in a manner that will not result in off-target damage to any native vegetation.

2. Fences

   The fence along the northern boundary of the conservation area is barbed wire. It is recommended that this and any other barbed wire boundary fences be upgraded to "fauna friendly" fences in accordance with the BCT guide.

3. Revegetation

   There is opportunity to undertake strategic revegetation works to increase native canopy and shrub cover which will improve connectivity and provide additional measures to supress groundcover weed species across. Two specific areas were identified, namely open pasture areas, and an area adjacent the Hunter River. A revegetation plan should be developed prior to any works occurring in these areas.

Vegetation - Farmland Underground Mining Area

Monitoring of the agricultural grazing lands, including both pasture and woodland, located above the underground mining area was undertaken by DnA Environmental between 17 and 26 May 2021.

Three eucalypt woodland and three native grassland reference sites were used to develop benchmark ecological values and inform ecological performance targets and completion criteria for woodland and grassland areas within the underground mining affected areas.

Table 6.13 presents an overview of the performance of each monitoring site against the relevant completion criteria. In summary, only one woodland site (UGWood03) was found to be more ecologically functional than any of the reference sites; however, only slight differences were observed between UGWood01, UGWood02 and the remainder of the reference sites. Floristic diversity decreased at all woodland sites compared to the previous reporting period except for SVCA02 and SVCA06. Native species were more abundant than exotic species at all sites; however exotic species diversity was higher than the criteria at sites UGWood1 and SVCA06.

With the exception of site UGPast04 which was rehabilitated in 2018, all underground pasture sites had an increase in perennial groundcover. UGPast03 and UGPast05 had an ecological function comparable to or higher than native grasslands; however, long-term results indicate that the ecological capacity of all three underground pasture sites affected by mining had improved since 2007. Significant decreases in species diversity recorded during the reporting period have been attributed to both the dominance of some native grass species which have excluded other species following the increased rainfall that has occurred since the start of the previous reporting period as well as difficulty locating species during surveys as a result of long grass.

Soil characteristics in the underground woodland and grassland sites were generally similar to those identified in reference sites which have not been subject to mining-related disturbance. Soil analyses indicated that soils in the farmland areas generally displayed elevated levels of iron, however, similar concentrations recorded for refence sites indicate that these elevated levels may occur naturally in the local area. Sites SVCAWood06, UGWood02 and UGPast06 displayed moderately high levels of sulfur compared to reference site values; however these have decreased compared to the previous reporting period. The causes of these abnormal concentrations will be investigated further as a greater database of soil analysis results is developed over coming years.

Both woodland and pasture sites within the underground mining affected areas were subject to variable levels of subsidence-related impacts including subsidence cracking and ponding. Several sites have previously been subject to subsidence rehabilitation works, including ripping, seeding and/or planting, with further general subsidence and subsidence cracking impacts observed during the reporting period requiring further treatment. As predicted, some pasture areas have been subjected to increased ponding in natural drainage lines following subsidence of the natural landform. It is recommended that older rehabilitation sites be inspected in order to identify which sites require additional subsidence repairs and rehabilitation.

Eleven priority and declared weed species were recorded across the underground mining monitoring sites, with the most common species being Galenia (*Galenia pubescens*) and Fireweed (*Senecio madagascariensis*) which were both recorded in 17 of the 20 sites, including most reference sites.

Table 6.13
Farmland – Completion Criteria Status

Rehabilitation Phase	Completion criteria	Performance Indicators	Unit of measure	Pasture						Woodland		
				UGPast01	UGPast02	UGPast03	UGPast04	UGPast05	UGPast06	UGWood01	UGWood02	UGWood03
Phase 2: Landform establishment and stability	Landform suitable for final landuse and generally compatible with surrounding topography and final landform design	Slope	< Degrees (18°)	2	2	3	5	2	2	2	1	4
	No visible subsidence cracking	No. Subsidence Cracks	No.	0	0	0	1	0	0	0	0	0
		Sum of subsidence cracks width	m	0	0	0	1.20	0	0	0	0	0
Phase 3: Growth medium development	Soil properties are suitable for the establishment and maintenance of selected vegetation species	pH	pH (5.6-7.3)	6.8	6.2	5.8	5.9	6.2	5.9	5.4	5.2	5.9
		Organic Matter	% (>4.5)	4.8	5.3	5.9	4.9	7.0	4.1	3.9	3.0	5.6
		Phosphorous	mg/kg (50)	56.7	157.1	10.2	14.4	224.4	29.8	16.4	10.5	10.5
Phase 4: Ecosystem & Landuse Establishment	Landform is stable and performing as it was designed to do	LFA Stability	%	76.3	73.6	80	74.2	77.5	80.4	72.1	69.1	80
		LFA Landscape organisation	%	100	100	100	96	100	100	97	84	100
	Pasture productivity is comparable to analogue sites.	Green Dry Matter Biomass	kg/ha	1200	1200	1800	1000	360	1200	NA	NA	NA
Phase 5: Ecosystem & Landuse Sustainability	Landform is ecologically functional and performing as it was designed to do	LFA Infiltration	%	53.6	51.5	55.5	41.5	57.3	50.1	44.6	39.9	45.1
		LFA Nutrient recycling	%	54.9	51.4	55.7	43.1	59.9	54	44.9	40.1	49.7
	Ground layer contains protective ground cover and habitat structure comparable with the local remnant vegetation	Perennial plant cover (< 0.5m)	%	69	54.5	77.3	60	58	82.5	50	31.5	48.5
		Total Ground Cover	%	99	100	100	89.0	100	100	91.5	79	99.5
	Vegetation contains a diversity of species per square meter comparable to that of the local remnant vegetation	Native understorey abundance	> species/m2	2.4	2.4	5.0	7	1.2	4.8	4	5.2	4.8
		Exotic understorey abundance	< species/m2	6	3.6	5.4	4	4.4	4.6	3.4	1.8	3.2
	Native ground cover abundance is comparable to that of the local remnant vegetation	Percent ground cover provided by native vegetation <0.5m tall	%	33.7	48.5	52.8	62.4	23.1	53.1	50	74	71.6
	The vegetation is developing in structure and complexity comparable to that of the local remnant vegetation	Foliage cover 0.5 - 2 m	% cover	NA	NA	NA	NA	NA	NA	2.3	11	5.9
		Foliage cover 2 - 4m	% cover	NA	NA	NA	NA	NA	NA	7.5	8.6	5
		Foliage cover 4 - 6m	% cover	NA	NA	NA	NA	NA	NA	5.7	8	3.5
		Foliage cover >6m	% cover	NA	NA	NA	NA	NA	NA	0.5	2	0

Green = Meets or exceeds completion criteria. Blue = Soil performance indicator target falls within industry guidelines but may not be similar to local soils.
NA = Not Applicable.

Source: DnA Environmental (2021)

Reportable Incidents

No reportable incidents were recorded during the reporting period.

Further Improvements

As a result of the monitoring undertaken during the reporting period the following improvements are planned.

- Strategic grazing management will be reintroduced to effectively manage weed biomass and fuel loads.
- Within the Bowmans Creek Riparian corridor, investigations will be undertaken to identify crucial erosion areas and where rehabilitation and restoration works are required.
- Habitat enhancement plantings, particularly within the narrow casuarina woodland areas, will also be considered. Plantings will include a high proportion of shrubs, native grasses, and reeds to aid with erosion control.
- The successful establishment of vegetation within areas of subsidence rehabilitation will continue to be monitored and supplementary works undertaken as required.

Ongoing weed control will also continue to be undertaken, including manual methods and use of cut and paste herbicide where existing native trees and shrubs are present to minimise collateral mortality associated with broadcast spraying. Weed control within the SWCA will focus upon the species and locations as identified and recommended by the BCT audit.

The BCT recommendations relating to fencing and revegetation will also be reviewed and a plan of action and timeline developed for implementation.

Further investigation into elevated soil sulfur and iron levels at a number of monitoring sites and the casuarina and eucalypt reference sites is also planned.

6.7 HERITAGE

Management of heritage was undertaken in accordance with the September 2020 Heritage Management Plan. The following heritage inspections and salvage works were undertaken by Stratum Archaeology Pty Ltd during the reporting period in accordance with Aboriginal Heritage Impact Permits.

- ULLD Seam subsidence crack zone ACH salvage works
  Continuation of ULLD Subsidence crack zone LW204 work undertaken in 2020 at AHIMS# 37-3-0006 (Oxbow Site). The 2020 works identified a small area of subsurface artefacts on the northern section of the site comprising of 23 artefacts in a 1m² salvage probe. Additional salvage probes were excavated in February and March 2021 until artefact numbers decreased to 5 to 2 artefacts/m².

  LW206A subsidence crack zone salvage works undertaken in October 2021 including surface walkover of the predicted subsidence crack sone zone and surface collection and two 1m² salvage probes excavated at previously recorded artefact scatter AHIMS# 37-3-1142. One mudstone broken flake recovered.

- 11kv Feeder Relocation LW205

  Salvage works were undertaken in April, May, June 2021 for the relocation of the 11kV feeder in preparation for mining in ULLD LW205. Salvage activities included; inspection of new pole locations, surface collection and salvage probes where required. The majority of new pole locations were located in the lower flood plain of Bowmans Creek outside of Aboriginal cultural heritage site boundaries, however, two new pole locations were located within boundaries of existing archaeological sites. Salvage works included the following. pits were excavated at each pole location to salvage the maximum impact area (1m²).

  – New Pole 6 located within the site boundary of AHIMS #37-3-0496. Approximately 80 artefacts were recovered from the salvage probe.

  – New Pole 10 located within the site boundary of AHIMS #37-3-0799. Four small artefacts were recovered from the salvage probe. Following an amendment to the pole location in June 2021 due to landform constraints, a further 10 artefacts were recovered from the amended pole location.

- Surface walkover and inspections were undertaken for gas wells GW5A-5D ULLD and GW6A. The gas wells are located outside of existing site boundaries and within previously salvaged areas. No artefacts recovered.
- Site walkover and inspection of proposed new access track / upgrade of access track for Dairy Lane. Some surface artefacts located on trackway associated with artefact scatter AHIMS #37-3-0573 were collected.

All works were undertaken with representatives for ACOL Registered Aboriginal Parties and all recovered artefacts were placed in the ACOL secure temporary artefact storage room at the ACOL administration building.

A due diligence assessment was also undertaken by Stratum Archaeology Pty Ltd for the two exploration holes YAC-S and YAC-N as these sites are located outside of the Aboriginal Heritage Impact Permit for Longwalls 1-4. The assessment did not identify any Aboriginal objects or the requirement for further investigation works. As such, the exploration holes could be drilled without the requirement for an Aboriginal Heritage Impact Permit.

Ongoing consultation with the Aboriginal community also continued through the Aboriginal Community Consultative Forums (ACCF), of which two were held during the reporting period on 29 June and 7 December 2021. During the ACCF meetings, Company personnel and representatives of the Aboriginal community discussed current and future mine activities, upcoming cultural heritage and archaeological fieldwork, and any issues associated with the management of cultural heritage on site.

There were no reportable heritage incidents during the reporting period and currently no further improvements or changes to heritage management are planned during the next reporting period.

6.8 SUBSIDENCE

Environmental Management

To date, five Extraction Plans have been prepared/approved for the ACP. Environmental assessments, public safety management plans, subsidence assessments and subsidence monitoring plans have been incorporated into Extraction Plans as required. Copies of all relevant Extraction Plans and approvals are available on the ACP website.

Environmental Performance

Underground longwall mining operations commenced in February 2007, with mining of the PG seam (LW1 to LW8) and ULD seam (LW101 to LW106A) since completed. Mining operations during the reporting period were undertaken in LW204 and LW205, with extraction of LW204 completed in 14 April 2021 and extraction of LW205 commencing 28 May 2021 and completed in 5 December 2021.

Subsidence monitoring was undertaken in accordance with the *Ashton Coal Mine Longwalls 201 to 204 Extraction Plan – November 2016* and *Ashton Coal Mine Longwalls 205 to 208 Extraction Plan – October 2020* and included both regular surveys following longitudinal and transverse subsidence lines as well as visual inspections of environmental, land and infrastructure features. Subsidence monitoring for each longwall includes survey lines located over the start and end line for each panel as well as various traverse cross lines relevant to the panel, surface or strata features. **Table 6.14** summarises the maximum incremental and cumulative subsidence parameters for each of the relevant monitoring locations during the reporting period.

Table 6.14
Subsidence Monitoring Results

Location	Maximum Subsidence (m)	Maximum Tilt (mm/m)	Subsidence Attributable to Longwall (m)	Results Consistent with Extraction Plan Predictions
LW 204				
XL5	5.55	81.0	2.67	Yes
XL10	5.60	22.0	2.68	Yes
LW104-CL1	4.95	59.0	2.72	Yes
LW4-CL2	5.25	135.0	2.55	Yes
LW 205				
XL5	5.46	87.0	2.65	Yes
LW5-CL1	3.50	49.0	2.00	Yes
LW5-CL2	3.80	92.0	1.40	Yes
132kV Set28 (CN-80016)	3.90	35.1	0.00	Yes
132kV Set29 (CN-80017)	2.30	20.4	1.40	Yes
132kV 3-Pole Set (CN-80480-2)	3.30	25.4	1.90	Yes
Source: Ashton Coal Operations Pty Limited (2021 and 2022) – bi-monthly subsidence monitoring reports.				

Subsidence monitoring indicated that no exceedance of the incremental and cumulative subsidence predictions occurred at the locations monitored during the reporting period.

Moderate cracking was observed on both sides of LW204 and minor to moderate cracking was observed at the start of and on both sides of LW205 in areas previously affected by both the Pikes Gully and ULD seam extraction. Moderate cracking was also observed running sub-parallel to the access track near the major farm dam. Major cracking was observed along the triple stacked edge adjacent to the "Blue house". All observed cracking was in accordance with modelling/expectations and was on Ashton owned land, and therefore was not a public safety issue.

Subsidence impacts in the vicinity of the "Blue house" were managed during the reporting period through road closures, barricades, and remedial filling and grading. Repairs to the private Right of Way, the alternate access road and other access tracks in the vicinity of LW204 were undertaken as required to maintain access and ensure the serviceability of roads.

Remediation works were also completed on affected poles where LW204 and LW205 passed beneath the 132kV transmission line. No impacts were recorded for the Ausgrid 11kV power lines and poles.

Ponding of water has also been observed as a consequence of subsidence in areas which were typically flat prior to mining operations. Remediation of areas which display ponding is planned to occur following the completion of multi-seam mining operations below the surface. Ponding is considered low risk and has served to provide temporary water sources for stock and wildlife at the surface. In cases where flooding and water across roads occurred during the reporting period, traffic was diverted until adverse weather passed and repairs could be undertaken.

There were no further recorded or observed subsidence impacts, incidents, service difficulties or community complaints during the reporting period.

Reportable Incidents and Further Improvements

The results of subsidence monitoring indicate that subsidence-related impacts are generally in accordance with predicted impact levels, with no reportable incidents during the reporting period. Monitoring will continue to be undertaken in accordance with the current Extraction Plan during the next reporting period. No further improvements to subsidence management or monitoring are considered necessary at this stage.

6.9 WASTE MANAGEMENT

In accordance with *Schedule 2, Condition 39* of DA 309-11-2001-i, a summary of waste management during the reporting period is provided as follows.

Wastes generated on site during the reporting period included the following.

- Hazardous (Recycled) – sludge, effluent, empty drums, lead acid batteries, oil filters, oily water, waste grease and waste oil.
- Non-Hazardous (Recycled) – paper and cardboard, confidential documents, scrap steel and timber.
- Hazardous (Disposal) – medical and sanitary waste, oily rags, hydraulic hose and chemical anchors.
- Non-Hazardous (Disposal) – diesel particulate filters and mixed solid waste.

As part of ACOL's Environmental Management Strategy and as outlined in the current MOP for the site, appropriate waste segregation and recycling are encouraged through the provision of appropriate on site recycling facilities.

The approximate volume of each waste stream generated during the reporting period is presented in **Table 6.15** together with the proportion of waste recycled. The proportion of waste recycled increased from 41.04% in 2020 to 42.53% in 2021, whilst the total volume of waste increased by

approximately 20.3%. It is considered that the increase in waste volume is likely a result of the increased number of longwall moves during the reporting period resulting in greater waste and lower coal production.

Table 6.15
Approximate Waste Volumes 2018 to 2021

Waste Class	Waste Stream	Total Volume (kg)[1]			
		2018	2019	2020	2021
Hazardous (Recycled)	Sludge	3 078	10 071	11 944	13 158
	Effluent (Off Site)	-	-	16 000	-
	Empty Drums	3 562	2 060	914	3 759
	Lead Acid Batteries	438	1 032	408	696
	Oil Filters	5 325	1 345	2 202	2 500
	Oily Water (Off Site)	19 258	66 942	59 167	72 284
	Waste Coolant	-	1 370	-	3 506
	Waste Grease	624	286	290	346
	Waste Oil	23 662	21 100	37 802	32 900
	Coagulant	-	1 936	-	-
	Activated Carbon	150	-	-	-
	Recycled (%)	**9.36%**	**15.76%**	**17.90%**	**14.93%**
Non-Hazardous (Recycled)	Paper and Cardboard	6 685	6 710	7 605	11 481
	Confidential Documents	605	288	418	187
	Scrap Steel	145 760	149 440	157 380	214 080
	Timber (Uncontaminated)	12 200	9 340	920	13 060
	Recycled (%)	**27.58%**	**24.62%**	**23.13%**	**27.60%**
Hazardous (Disposal)	Medical and Sanitary Waste	261	465	293	270
	Hydraulic Hose	1 282	-	2 006	794
	Asbestos	-	2 200	-	-
	Oily Rags	499	580	378	466
	Chemical Anchors	1 039	1 050	669	585
	Recycled (%)	**0.51%**	**0.64%**	**0.47%**	**0.24%**
Non-Hazardous (Disposal)	Diesel Particulate Filters	10 563	17 145	22 321	28 857
	Mixed Solid Waste	364 132	379 920	398 252	466 169
	Recycled (%)	**62.54%**	**58.97%**	**58.50%**	**57.22%**
Total Waste		**599 123**	**673 280**	**718 969**	**865 098**
Recycled Waste		**221 347**	**271 920**	**295 050**	**367 957**
Recycled Waste (%)		**36.95%**	**40.39%**	**41.04%**	**42.53%**

Note 1: Combined waste volume generated by both the ACP open cut and underground mining operations.

Source: J R Richards & Sons total waste management report – ACP open cut and underground.

There were no reportable incidents relating to waste during the reporting period. Waste volumes will continue to be monitored into the future and opportunities to minimise waste or increase recycling implemented, where appropriate.

7. WATER MANAGEMENT

7.1 WATER TAKE AND BALANCE

The ACP has three primary water demands: aboveground dust suppression, underground supply, and supply to the CHPP. **Table 7.1** presents the water take under each of the applicable water licences for the ACP over the 2020/2021 water year (i.e. 1 July 2020 to 30 June 2021).

Table 7.1
Water Take – 2020/2021 Water Year

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WAL	Reference Number (Security Level)	Water Sharing Plan, Source and Management Zone	Entitlement (ML)	Passive Take / Inflows (ML)	Active Pumping (ML)	Total (ML)
Surface Water						
984	20AL201282 (General Security)	Hunter Regulated Water Sharing Plan, surface water, zone 3A (Glennies Creek)	9	18.77	392.61	411.38
997	20AL201311 (High Security)	Hunter Regulated Water Sharing Plan, surface water, zone 3A (Glennies Creek)	11			
8404	20AL200491 (High Security)	Hunter Regulated Water Sharing Plan, surface water, zone 3A (Glennies Creek)	80			
15583	20AL204249 (General Security)	Hunter Regulated Water Sharing Plan, surface water, zone 3A (Glennies Creek)	354			
		Total	***454***			
1120	20AL201624 (High Security)	Whole Water Source (Hunter Regulated River Water Source)	3	7.01	77.49	84.50
1121	20AL201625 (General Security)	Hunter Regulated Water Sharing Plan, surface water, zone 1B (Hunter River from Goulburn River Junction to Glennies Ck Junction)	335			
19510	20AL211015 (High Security)	Hunter Regulated Water Sharing Plan, surface water, zone 1B (Hunter River from Goulburn River Junction to Glennies Creek Junction)	130			
		Total	***468***			
23912	20AL211423 (Unregulated)	Hunter Unregulated and Alluvial Water Sources 2009, surface water, Whole Water Source (Jerry's Water Source) (Bowmans Creek)	14	21.11	0	21.11
36702	20AL212975 (Unregulated)	Hunter Unregulated and Alluvial Water Sources 2009, Surface water, Jerry's Management Zone (Jerry's Water Source) (Bowmans Creek)	116			
36703	20AL212976 (Unregulated)d	Hunter Unregulated and Alluvial Water Sources 2009, Surface water, Jerry's Management Zone (Jerry's Water Source) (Bowmans Creek)	150			
		Total	***280***			
29566	20AL212287 (Unregulated)	Hunter Unregulated and Alluvial Water Sources 2009, Aquifer, Jerry's Management Zone (Jerry's Water Source)	358	22.23	0	22.23
1358	20AL203056 (Supplementary)	Hunter Regulated Water Sharing Plan, surface water, zone 3A (Glennies Creek)	4	0	0	0
6346	20AL203106 (Supplementary)	Hunter Regulated Water Sharing Plan, surface water, zone 1B (Hunter River from Goulburn River Junction to Glennies Creek Junction)	15.5	0	0	0

Table 7.1 (Cont'd)
Water Take – 2020/2021 Water Year

WAL	Reference Number	Water Sharing Plan, Source and Management Zone	Entitlement (ML)	Passive Take / Inflows (ML)	Active Pumping (ML)	Total (ML)
Groundwater						
41501	20AL216171	North Coast Fractured and Porous Rock Groundwater Sources 2016, Sydney Basin-North Coast Groundwater Source	100	0	0	0
41552	20AL219014		511	330.33	0	330.33
41553	20AL219015		81	0	0	0
		Total 2020/2021		**399.45**	**470.10**	**869.55**
		Total 2019/2020		*121.92*	*378.46*	*500.38*
		Total 2018/2019		*173.57*	*248.10*	*421.67*
		Total 2017/2018		*53.01*	*262.33*	*315.34*
Source: Ashton Coal Operations Pty Limited.						

Water take is measured and partitioned in accordance with the protocol detailed within the Water Management Plan (WMP), which incorporates a combination of site observations, measurements and predictions of the site water balance model. Water take occurs via two separate methods: incidental (or passive) take, and pumped surface water take. Incidental take occurs through mining-induced fracturing of aquifers which report to the underground workings. This water is removed from the mine by a network of dewatering pumps. Pumped surface water take involves active pumping from Glennies Creek and the Hunter River to provide higher quality water for a variety of uses including potable water, use in equipment and as fire-fighting water at the mine.

Both passive and active water take during the reporting period remained within licenced entitlements associated with individual WALs.

In addition to measuring water take, ACOL separately reports the ACP's water balance annually in accordance with the Mineral Council of Australia's *Water Accounting Framework for the Minerals Industry* (2012). **Table 7.2** provides a summary of the water inputs and outputs as well as the changes in water storage at the ACP during the reporting period.

Table 7.2
Input / Output Water Balance – 2021 Calendar Year

Input / Output	Component	Sub – Component	Water Volume (ML)[1]
2021 Inputs	Surface Water	Precipitation and Runoff	1 309.3
		Rivers and Creeks	302.7
		External Surface Water Storages	0.0
	Groundwater	Aquifer Interception	353.3
		Bore Fields	.0
		Entrainment	132.2
	Third Party Water	Contract / Municipal	0.9
		Waste Water	0.0
		Total Inputs	**2 098.4**

Table 7.2 (Cont'd)
Input / Output Water Balance – 2021 Calendar Year

Input / Output	Component	Sub–Component	Water Volume (ML)[1]
2021 Outputs	Surface Water	Discharge	0.0
		Environmental Flows	0.0
	Groundwater	Seepage	471.8
		Reinjection	0.0
	Supply to Third Party		
	Other	Evaporation	180.9
		Entrainment	625.6
		Other (e.g. ventilation moisture loss)	255.3
		Total Outputs	**1 533.6**
		Total Inputs minus Total Outputs	**564.8**
		Storage at the Start of 2021	**1 843**
		Storage at the End of 2021	**2 555**
		Overall Water Imbalance	**145**

Note 1: Volumes represent a combination of measured, simulated and estimated volumes with variable levels of confidence (low to high).

Source: Hydro Engineering and Consulting Pty Ltd (2022).

7.2 SURFACE WATER

Environmental Management

Surface water management at the ACP is conducted in accordance with the approved WMP and associated surface water monitoring program. The ACP site is a zero discharge site. No discharge off site occurred during the reporting period and no compensatory water was required by or provided to private landholders during the reporting period.

Environmental Performance

Water quality for the creeks and river surrounding ACP is monitored monthly by an independent consultant at fourteen (14) approved monitoring sites (see **Figure 7.1**) with sample analysis by a NATA accredited laboratory. Surface water quality (SWQ) monitoring data for the reporting period is summarised in **Table 7.3** and presented graphically in **Figure 7.2.** Data since 2012 is presented in **Figure 7.3**.

SWQ trigger levels specified within the WMP (and reproduced in **Table 7.3**) must be exceeded on three consecutive readings, or differ significantly from the preceding three readings, before an action response is required. **Table 7.4** provides a summary of instances during the reporting period where trigger levels were exceeded on three (or more) occasions.

In summary, three (or more) consecutive exceedances of pH, EC or TDS trigger values were recorded across ten monitoring sites on fifteen occasions during the reporting period. For the Bowmans Creek monitoring sites SM5 and SM6, the period of elevated pH levels in exceedance of trigger levels began in the previous reporting period.

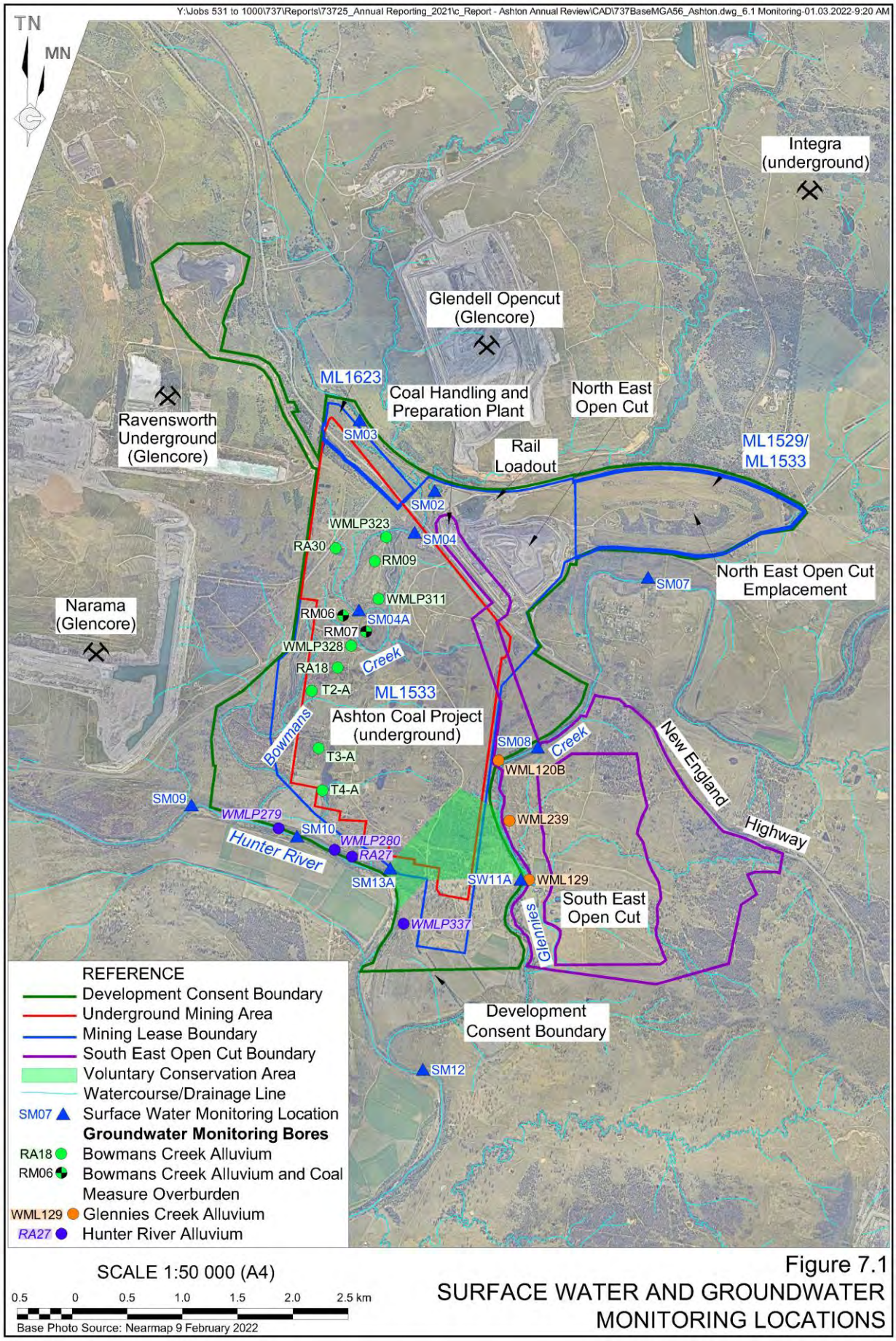


Figure 7.1
SURFACE WATER AND GROUNDWATER MONITORING LOCATIONS

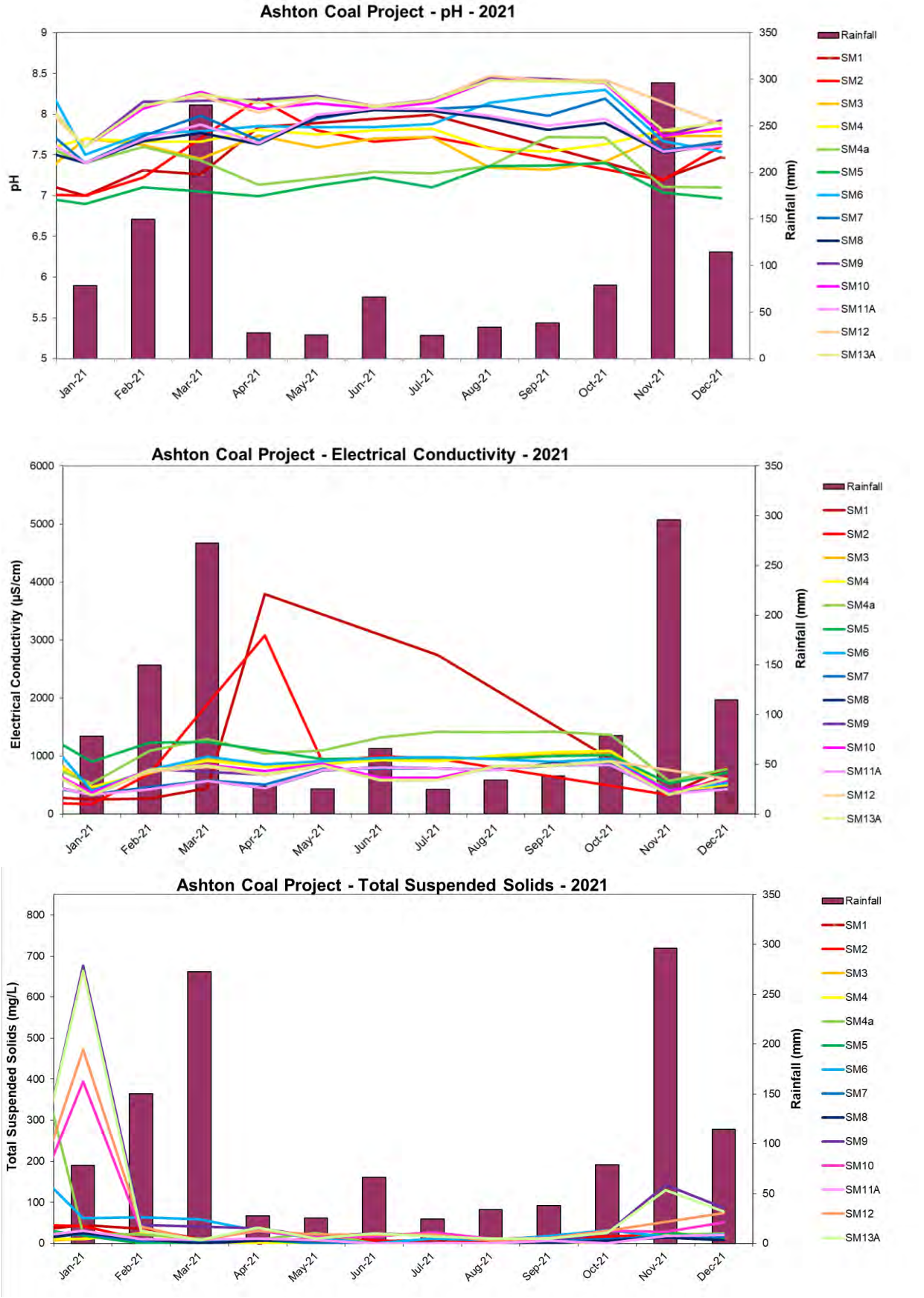


Figure 7.2
SURFACE WATER QUALITY MONITORING RESULTS – 2021

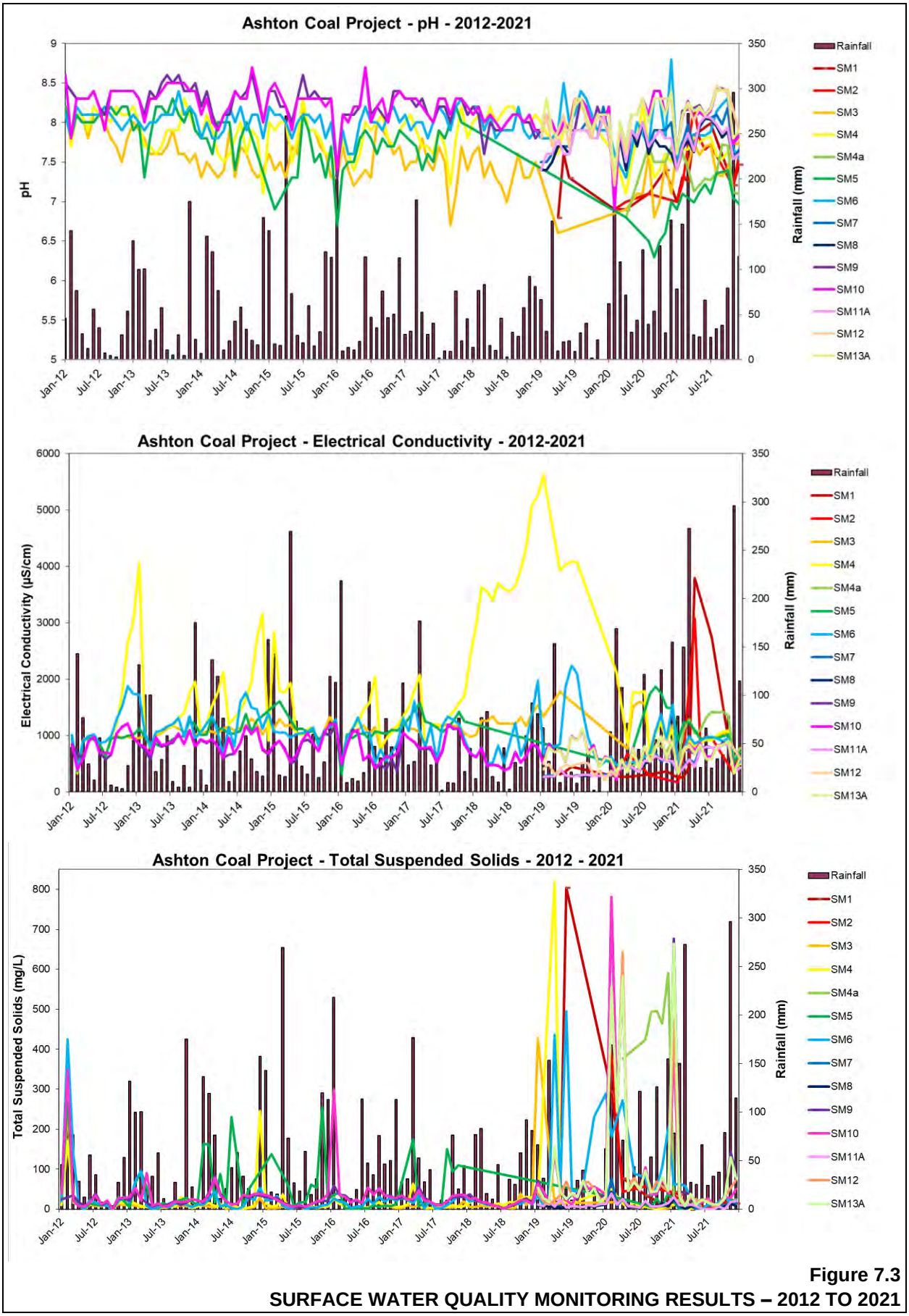


Figure 7.3
SURFACE WATER QUALITY MONITORING RESULTS – 2012 TO 2021

Table 7.3
Surface Water Monitoring Summary - 2021

Sampling Site^	pH	pH Trigger Value[1]	EC (µS/cm)	EC Trigger Value[2]	TDS (mg/L)	TDS Trigger Value[2]	TSS (mg/L)	TSS Trigger Value[2]
Bettys Creek								
SM1	7.0 – 8.0 (7.4)	<6.97 - >7.70 [<6.6 - >8.0]	249 – **3 790** **(1 232)**	>1 198 [>1 811]	234 – **3 020** **(937)**	>794 [>1 193]	<5 – 44 (22)	>122 [>273]
SM2	7.0 – **8.2** (7.5)	<6.87 - >7.63 [<6.6 - >7.6]	167 – **3 080** (969)	>1 144 [>1 803]	277 – **2 100** (642)	>732 [>1 105]	<5 – 42 (15)	>116 [>116]
Bowmans Creek								
SM3	7.3 – 7.7 (7.6)	<7.42 - >7.88 [<7.2 - >8.1]	391 – 1 040 (801)	>1 440 [>1 620]	254 – 564 (481)	>878 [>965]	7 – **28** (16)	>20 [>62]
SM4	7.5 **-7.8** **(7.7)**	<7.71 - >8.09 [<7.4 - > 8.3]	393 – 1 090 (808)	>3 656 [>10 790]	257 – 588 (484)	>2 270 [>6 331]	6 – 24 (14)	>37 [>104]
SM4A	7.1 – 7.7 (7.4)	<7.60 - >8.10 [<7.4 - >8.3]	526 – **1420** (1110)	>1 140 [>1 796]	351 – **806** **(667)**	>653 [>1 067]	5 – **26** (17)	>19 [>44]
SM5	**6.9** – 7.4 (7.1)	<7.66 - >7.97 [<7.5 - > 8.1]	524 – 1240 (962)	>1 542 [>1 796]	314 – 791 (602)	>891 [>1 031]	7 – **27** (14.6)	>20 [>31]
SM6	**7.5 – 8.3** (7.9)	<7.84 - >8.23 [<7.6 - >8.4]	402 – 993 (801)	>1 108 [>1 831]	260 – 570 (475)	>642 [>810]	8 – **63** **(30)**	>26 [>60]
Glennies Creek								
SM7	7.4 – **8.2** (7.9)	<7.66 - >8.03	338 – **850** **(623)**	>577	249 **– 466** **(356)**	>342	5 – 23 (12)	>19
SM8	7.4 – **8.1** (7.8)	<7.62 - >7.96	328 – **877** **(613)**	>562	238 **– 502** **(356)**	>334	6 – 26 (11)	>22
SM11A	7.4 – **8.1** (7.8)	<7.74 - >8.02	326 – **853** **(610)**	>564	246 **– 460** **(351)**	>332	6 – 30 (14)	>20
Hunter River								
SM9	**7.6 – 8.5** **(8.1)**	<8.00 - >8.32	313 – 904 (659)	>942	242 – 472 (374)	>541	7 – **676** (99)	>34
SM10	**7.6 – 8.4** **(8.1)**	<8.00 - >8.32	362 – 913 (699)	>942	267 – 536 (413)	>526	9 – 394 (55)	>42]
SM12	7.6 – **8.5** (8.1)	<7.84 - >8.24	324 – **906** (700)	>728	329 – **500** (407)	>415	7 – **472** **(67)**	>36
SM13A	**7.6 – 8.4** (8.1)	<8.02 - >8.32	322 – **907** (676.3)	>927	245 – 513 (400)	>516	8 – **644** **(86)**	>41

( ) = Average [ ] = no / low flow trigger value NS – Not Sampled (Dry)

^ See **Figure 7.1** **Bold Red Text –** Exceedance of Trigger Level for three consecutive samples.

pH trigger values are less than the 20th and 5th percentile of baseline values (i.e. to December 2011) for each site during flow and no / low flow conditions respectively.

EC and TSS trigger values are greater than the 80th and 95th percentile of baseline values (i.e. to December 2011) for each site during flow and no / low flow conditions respectively.

Source: Ashton Coal Operations Pty Limited.

Table 7.4
Consecutive Surface Water Trigger Level Exceedances

Parameter	Monitoring Location[1]	Period
pH	SM4a	Apr - Aug
	SM5	Aug 2020 - Dec
	SM6	Dec 2020 - Feb
	SM9	Aug – Nov
	SM10	Aug – Dec
	SM12	Aug – Nov[2]
	SM13a	Aug - Dec
EC	SM7	May - Oct
	SM8	May - Oct
	SM11	May - Oct
	SM12	Aug – Oct
TDS	SM7	May - Oct
	SM8	May - Oct
	SM11	May - Oct
	SM12	Aug - Oct
TSS	SM9	Jan 2020 – April[3]
	SM10	Feb 2020 – Jan
	SM12	Feb 2020 – Feb
	SM13a	Feb 2020 - Fan
	SM6	Nov 2020 - Feb

Note 1: see **Figure 7.1**.
Note 2: inaccessibility of monitoring location SM12 precluded sampling at this location during December 2021.
Note 3: inaccessibility of monitoring location SM9 precluded sampling at this location during March 2021

An external assessment of the exceedances in surface water quality trigger levels between January 2020 and December 2021 was completed by Hydro Engineering and Consulting Pty Ltd (HEC). The following presents a summary of the key findings of the external assessment:

- Exceedances of the pH, TDS, EC and TSS trigger levels at the Hunter River monitoring sites are likely caused by upstream influences and related to low river flow and low rainfall in 2019 followed by periods of increased rainfall and high flow in 2020 and 2021.
- Exceedances of the TDS and EC trigger levels at the Glennies Creek monitoring sites are likely caused by upstream influences, given the low variability in recorded TDS and EC with distance along Glennies Creek during periods of exceedances.
- Exceedances of the pH impact criteria for Bowmans Creek at:
  - SM3 are likely due to upstream influences given it is located upstream of ACP activities;
  - SM6 are likely due to influence from the Hunter River, or from lower pH recorded at SM5; and

  - SM4a and SM5 are likely related to the location of these sites within diverted sections of Bowmans Creek in combination with regional drought conditions and low flow in 2019, leading to oxidation of sulphides in surficial sediment, followed by periods of increased rainfall and high flow in 2020 and 2021. Notably, the lowest pH recorded was only 6.3, with an average pH of 7.0 (i.e. neutral).

- No clear apparent cause for the period of exceedance of the TSS impact criteria for Bowmans Creek at SM6 between November 2020 and February 2021 could be determined; however, based on the proximity of the Hunter River and SM6, there exists potential for influence of backwater from the Hunter River. No visible evidence of localised erosion or sediment generation was observed during these periods, and no further exceedances were recorded during the current reporting period and no ongoing or residual effects have been identified.

Reportable Incidents

As the external assessment of trigger action response levels determined water quality was not affected by the ACP, in accordance with the approved WMP, the exceedance of trigger levels was not reportable. No reportable incidents occurred during the reporting period.

Further Improvements

In accordance with the recommendations from the external assessment completed by HEC, monthly water quality monitoring at the Bowmans Creek monitoring sites will also include sulphate analysis. Additionally, any exceedance of TSS trigger levels in any one month at Bowmans Creek Site SM6 will be followed up with a site inspection to confirm if there are any local sources of elevated sediments and any relation to ACP activities. No alteration to current surface water control measures are planned or currently considered necessary.

7.3 GROUNDWATER

Environmental Management

Groundwater management at the ACP is conducted in accordance with the approved WMP and associated groundwater monitoring program. A groundwater model based on mine plans and past groundwater monitoring results is employed to predict changes to the local hydrological regime and potential impacts on groundwater associated with ACP activities. In order to determine if groundwater impacts associated with ACP operations remain consistent with those predicted, a groundwater monitoring network has been established (see **Figure 7.1**) targeting the following aquifers.

- Saturated quaternary sediments (alluvium) including:
  - Bowmans Creek Alluvium (BCA);
  - Glennies Creek Alluvium (GCA); and
  - Hunter River Alluvium (HRA).
- Shallow Permian sandstone and minor coal seams, referred to as coal measures overburden (CMOB).
- Permian coal measures of varying thickness targeted by mining (Coal Measure).

As part of the approved WMP, impact assessment criteria and TARPs have been developed to investigate and, if necessary, respond to any monitoring results that are inconsistent with predicted impacts / defined criteria.

Groundwater monitoring was undertaken by Australasian Groundwater and Environmental Consultants Pty Ltd (AGE) throughout the reporting period including both water level and water quality. A detailed annual groundwater summary prepared by AGE is presented as **Appendix 2**, with key monitoring observations from the AGE report summarised in the following sections.

Groundwater Levels

Monitoring results for BCA bores indicated that, except for an increase in March/April and November/December 2021, groundwater levels were stable throughout the reporting period and remained above established trigger levels.

Monitoring results for GCA bores also indicated that groundwater levels were relatively stable during the reporting period excluding increases in groundwater levels occurring in April and December 2021 following higher than average rainfall. A minor decline in groundwater levels was recorded between January and March 2021 at bores WML120B and WML129. Groundwater levels at all GCA bores remained above the relevant groundwater level trigger values during the reporting period.

Similarly, groundwater levels recorded for HRA bores remained relatively stable, with the exception of increases in groundwater levels following above average rainfall. Groundwater levels at all HRA bores remained above the relevant groundwater level trigger values during the reporting period.

Monitoring results for Coal Measures Overburden (CMOB) bores were also stable throughout the reporting period excluding the rise in groundwater levels at the beginning and end of the reporting period.

Groundwater results recorded during the reporting period for longwall specific monitoring bores indicated that water levels remained relatively stable for bores adjacent panels LW204/LW205. In particular, vibrating wire piezometer (VWP) readings in sensors at 30m and 59m remained relatively stable in bore WMLP269 throughout the reporting period. However, the deeper sensors recorded erroneous data from July 2021, likely due to fracturing of strata in which the deeper sensors are located.

Groundwater Quality

Groundwater pH measurements remained stable throughout the reporting period for all monitored aquifers. There were no consecutive exceedances of pH trigger values and the slight changes in pH are attributed to natural variation. As previously recorded, pH within alluvial bores was slightly acid to neutral and groundwater within Coal Measure and CMOB bores was generally neutral to slightly alkaline within the following ranges.

- BCA – pH 6.52 (T5) to 7.24 (WMLP326).
- GCA – pH 6.20 (WMLP358) to 6.95 (WMLP343 and WMLP129).
- HRA – pH 6.40 (WMLP336) to 7.14 (WMLP337 and WMLP277).
- Coal Measure – pH 6.22 (WMLP302) to 8.05 (WML262).
- CMOB - pH 6.56 (T2P) to 7.44 (T3P and T4P).

During the reporting period the electrical conductivity (EC) within all monitored aquifers ranged from fresh to brackish as follows.

- BCA – 492µS/cm (WMLP323) to 3 306µS/cm (RM02).
- GCA – 303µS/cm (WMLP358) to 1 186µS/cm (WMLP349).
- HRA – 430µS/cm (WMLP279) to 3 018µS/cm (WMLP337).
- Coal Measure – 636µS/cm (WML120A) to 4 666µS/cm (RSGM1).
- CMOB – 749µS/cm (WMLP324) to 2 359µS/cm (WMLT3P).

EC levels recorded for GCA and HRA bores were steady overall throughout the reporting period, with the exception of GCA bores WMLP343 and WMLP349 and HRA bore WMLP279 which displayed variably declining EC levels. EC levels within BCA bores were variable throughout the reporting period. Two bores exceeded trigger levels during the reporting period (WMLP279 - HRA and WMLP349 - GCA8), however, only WMLP349 exceeded the trigger levels on three consecutive occasions, triggering the response plan outlined in the WMP. The investigation concluded that the water table was rising through the historically unsaturated zone following heavy rainfall and natural salts were likely being mobilised. Over time, natural flushing is likely to occur and EC levels will return to levels below the trigger.

Coal measure and CMOB EC levels were also relatively steady during the year, except for RSGM1 which recorded a sharp increase in EC between the February and May monitoring round; decreasing in the August monitoring period before stabilising in November. No other prevailing trends were evident.

Analysis of major ions indicated that the similar CMOB, BCA and HRA water types are distinguishable from the GCA and the Coal Measure water types, due to the differing water source and recharge/discharge mechanism associated with each body. Dissolved metals, select nutrients, turbidity and cyanide concentrations were also compared against ANZECC|ARMCANZ livestock limits (ANZECC and ARMCANZ, 2000). There were no exceedances for any of the analytes assessed.

Generally, the site has experienced no mining impacts to the BCA, GCA and HRA alluvial aquifers and impacts are within predictions in the coal measures.

Reportable Incidents

No reportable incidents occurred during the reporting period. Whilst the trigger action response within the WMP was enacted for elevated EC results in one alluvial bore, subsequent investigation concluded that these trigger events were attributable to heavy rainfall raising water levels and naturally mobilising salts with no further action (except continued monitoring) required.

Further Improvements

Monitoring will continue in accordance with the current Water Management Plan (WMP). Excluding repairs to the headwork and concrete pad for WMLP349, no further improvements are planned at this stage.

8. REHABILITATION

8.1 REHABILITATION PERFORMANCE DURING THE REPORTING PERIOD

Figure 8.1 shows the status of rehabilitation and a summary of the areas of rehabilitation is provided in **Table 8.1**.

Table 8.1
Rehabilitation Summary

Mine Area Type	Previous Reporting Period (Actual) 2020 (ha)	This Reporting Period (Actual) 2021 (ha)	Next Reporting Period (Forecast)[3] 2022 (ha)
Total mine footprint[1]	918.3	921.8	921.8
Total active disturbance[1]	182.0	184.0	182.0
Land being prepared for rehabilitation	0	0	0
Land under active rehabilitation[1]	736.3	737.8	739.8
Completed rehabilitation[2]	0	0	0

Note 1: Includes subsidence remediation areas.
Note 2: Areas which have been formally relinquished or signed off by the relevant agency.
Note 3: Estimates of additional areas of subsidence remediation have not been included within forecast values.

During the reporting period minor rehabilitation works totalling 1.5ha were completed in accordance with Ground Disturbance Permits for activities including exploration drilling, subsidence repairs, archaeological investigations, and various infrastructure repairs or relocations (see Section 4.3). Rehabilitation of subsidence-related impacts generally included excavation to the limit of the crack, backfilling, compaction, topsoil spreading and seeding of the impacted areas.

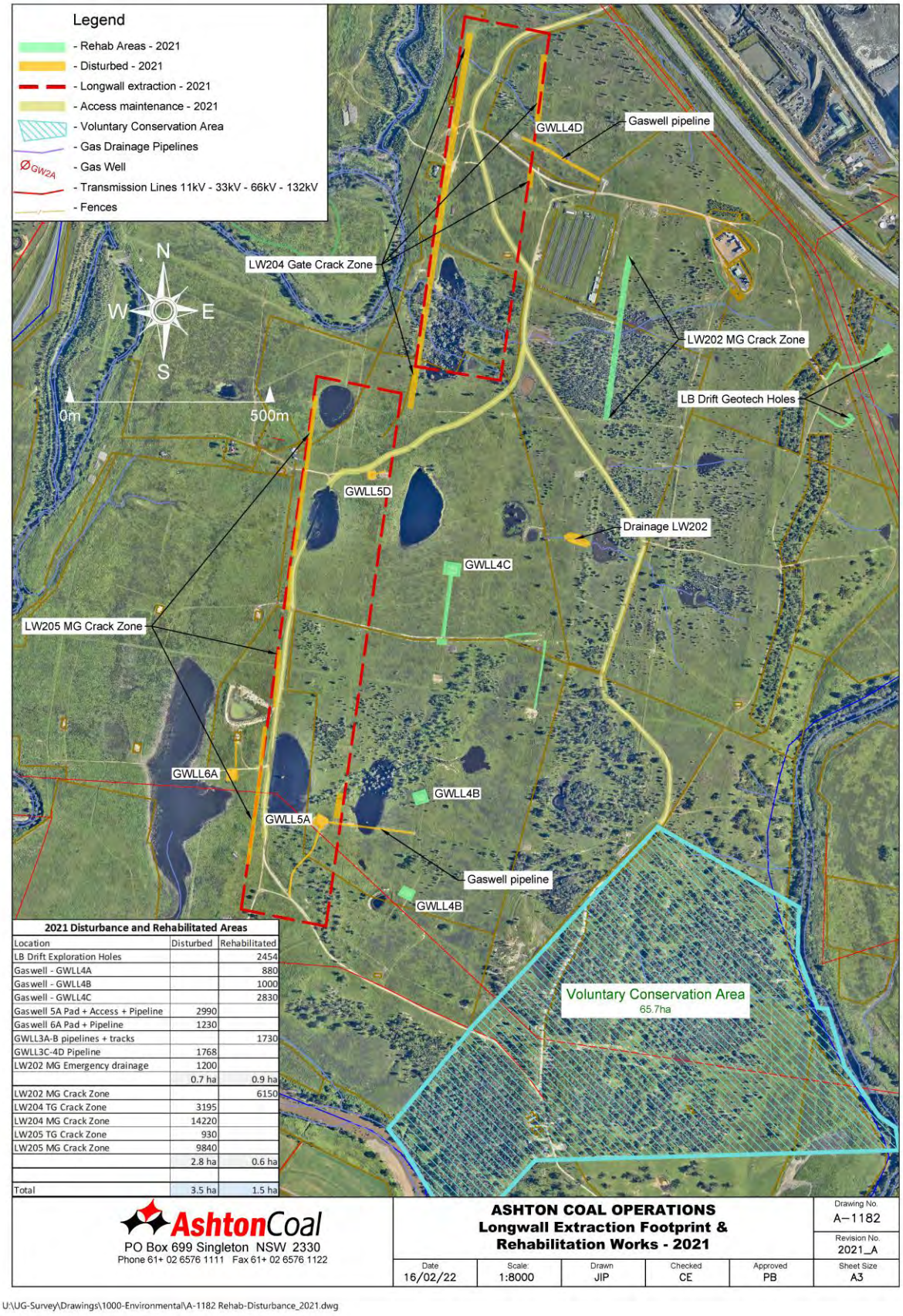
No permanent buildings were structurally altered, renovated or removed during the reporting period and no rehabilitation trials or research was undertaken during the reporting period. A summary of rehabilitation monitoring and activities is provided as follows.

North-east Open Cut Rehabilitation

Monitoring of NEOC rehabilitation was undertaken between 17 to 26 May 2021 by DnA Environmental. Revised completion and performance criteria were developed and utilised for performance evaluation, and are planned to be reflected in the RMP to be submitted during the next reporting period.

Monitoring of the NEOC rehabilitation area includes assessment of areas rehabilitated to *mixed woodland habitat* (formerly "Trees Over Grass") and *exotic pastures*. Rehabilitation of the NEOC overburden emplacement commenced in 2005, with the entire ~140ha of rehabilitation being completed in 2012. There is currently ~68ha of rehabilitated exotic pasture and ~71ha of native trees and shrubs.

During the 2019 reporting period it was decided, following advice from DnA Environmental, that livestock grazing was no longer considered an appropriate post-mining landuse option for the NEOC rehabilitation. Instead, a single final land use domain, *"Mixed eucalypt woodland habitat",* consisting of additional woodland habitat of various densities and a higher diversity of shrubs, will cover the areas formerly referred to as *Pasture* and *Trees-over-Grass*.



2021 Disturbance and Rehabilitated Areas

Location	Disturbed	Rehabilitated
LB Drift Exploration Holes		2454
Gaswell - GWLL4A		880
Gaswell - GWLL4B		1000
Gaswell - GWLL4C		2830
Gaswell 5A Pad + Access + Pipeline	2990	
Gaswell 6A Pad + Pipeline	1230	
GWLL3A-B pipelines + tracks		1730
GWLL3C-4D Pipeline	1768	
LW202 MG Emergency drainage	1200	
	0.7 ha	0.9 ha
LW202 MG Crack Zone		6150
LW204 TG Crack Zone	3195	
LW204 MG Crack Zone	14220	
LW205 TG Crack Zone	930	
LW205 MG Crack Zone	9840	
	2.8 ha	0.6 ha
Total	3.5 ha	1.5 ha

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ASHTON COAL OPERATIONS
Longwall Extraction Footprint & Rehabilitation Works - 2021

Date	Scale:	Drawn	Checked	Approved	Sheet Size
16/02/22	1:8000	JIP	CE	PB	A3

Drawing No. A–1182
Revision No. 2021_A

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Figure 8.1
REHABILITATION ACTIVITIES – UNDERGROUND AREA (1 JANUARY – 31 DECEMBER 2021)

It is intended to convert approximately 15ha of exotic pasture areas into areas of eucalypt woodland habitat over the next five years (subject to suitable meteorological conditions). This updated rehabilitation strategy will also be reflected within the RMP to be submitted during the next reporting period.

Rehabilitation monitoring continued to assess the performance of both the existing mixed woodland habitat and exotic perennial pastures, with three woodland rehabilitation sites and four exotic pasture rehabilitation sites being monitored in 2021. Rehabilitation performance is compared against a range of ecological performance targets and completion criteria obtained from non-mining-disturbed reference sites. Three mixed eucalypt woodland and three native grassland reference sites were established in 2019. The range values of each performance indicator will be measured annually to reflect seasonal conditions and disturbance events.

Rehabilitation performance is assessed against the completion criteria summarised in **Table 8.2**. Completion criteria targets are met if they are within the specified target ranges recorded at corresponding woodland or grassland reference sites, as represented by an appropriately coloured box.

The outcomes of the 2021 monitoring demonstrate that many completion targets have been met, with some exceptions. Ecological performance indicators for the mixed eucalypt woodland habitat and exotic pastures demonstrate these rehabilitated areas have generally developed into highly functional and stable communities, functionally comparable to the local woodlands and native grasslands. It was also noted that the extreme seasonal conditions experienced over the past 12 years, combined with simultaneous changes in total grazing pressure (both livestock and macropods), has had a significant impact on the composition and diversity of both the NEOC vegetation and the reference sites.

Observations in the vicinity of rehabilitation habitat structures (large upside-down tree trunks) show a high abundance of native species known to be dispersed by birds. In particular, *Einadia nutans* (Climbing Saltbush) and *Enchylaena tomentosa* (Ruby Saltbush) were in high abundance in the immediate vicinity of the erected trunk, however, weed species (e.g. *Solanum sp*., *Lycium ferocissimum*) may also be introduced in these areas. DnA Environmental suggest that additional habitat structures such as tree, logs, rock piles and nest boxes would likely increase available habitat within the NEOC.

Due to the age of the woodland rehabilitation and positive monitoring results, DnA Environmental suggest that monitoring effort and rehabilitation objectives in existing woodland and pasture rehabilitation areas could be revised, with monitoring effort being focussed on assessing the development of new woodland areas established as part of the proposed pasture-to-woodland conversion program. It was also recommended that, whilst areas of exotic perennial pastures previously established on the NEOC are likely to persist, additional sowing of exotic species should be avoided, as these highly competitive species can restrict germination and establishment of native tree and shrub seed and reduce the diversity of desirable grasses and herbs in the longer-term.

Pest and Weed Control

A programmed range of pest and weed control activities were also undertaken across ACP rehabilitation areas, biodiversity conservation areas and buffer land during the reporting period. Pest control activities included wild dog and fox baiting programs completed during autumn (May to July 2021) and spring (October to November 2021). The baiting program accounted for a total of 40 wild dogs and 81 foxes, with target species accounting for 26.8% of baits taken.

Table 8.2
North East Open Cut Rehabilitation Area – Rehabilitation Sites Completion Criteria Status 2021

Rehabilitation Phase	Completion criteria	Performance Indicators	Unit of measure	Exotic Pasture Sites				Woodland Sites		
				M2008 01	M2008 02	M2009 01	M2010 01	M2008 03	M2012 03	M2012 04
Phase 2: Landform establishment and stability	Landform suitable for final landuse and generally compatible with surrounding topography and final landform design	Slope	< Degrees (18°)	14	14	14	14	4	2	1
	Areas of active erosion are limited	No. Rills/Gullies	No.	0	0	0	0	0	0	0
		Cross-sectional areas of rills	M^2	0	0	0	0	0	0	0
Phase 3: Growth medium development	Soil properties are suitable for the establishment and maintenance of selected vegetation species	pH	pH (5.6-7.3)	7.2	7.2	8.07	7.3	8.4	9.3	8.6
		EC	dS/m (<0.150)	0.060	0.066	0.127	0.124	0.114	0.180	0.107
		Organic Matter	% (>4.5)	5.7	7.5	10.2	9.9	5.7	4.5	8.2
		Phosphorous	mg/kg (50)	11.8	405.4	171.9	94.5	101.7	7.2	8.2
		Nitrate	mg/kg (>12.5)	1.7	1.6	1.1	3.0	1.1	1.7	0.9
		Cation Exchange Capacity (CEC)	Cmol+/kg (>14)	13.5	13.0	22.7	16.8	18.4	16.0	13.8
		Exchangeable Sodium Percentage (ESP)	% (<5)	1.4	1.7	2.2	0.9	1.4	8.1	1.5
Phase 4: Ecosystem & Landuse Establishment	Landform is stable and performing as it was designed to do.	LFA Stability	%	74.2	76	73.5	83.4	78.3	64.2	64.5
		LFA Landscape organisation	%	100	100	100	100	95	98	100
	Pasture productivity is comparable to analogue sites.	Green Dry Matter Biomass	kg/ha	>3000	>3000	>3000	>3000	NA	NA	NA
Phase 5: Ecosystem & Landuse Sustainability	Landform is ecologically functional and performing as it was designed to do	LFA Infiltration	%	47.3	48.1	53.6	64.3	56.3	45.2	53.1
		LFA Nutrient recycling	%	47.5	46.4	52.7	62.1	53.4	43	53.2
	Ground layer contains protective ground cover and habitat structure comparable with the local remnant vegetation.	Litter cover	%	41	69.5	40	22.6	34.5	65.5	81.4
		Annual plants	<%	4	0	0	0	0	0	1
		Cryptogram cover	%	6	0	0	0	0	0	0
		Rock	%	0	0	0	0	0	1	5.5
		Log	%	0	0	3	0	0	0	0

Table 8.2 (Cont'd)
North East Open Cut Rehabilitation Area – Rehabilitation Sites Completion Criteria Status 2020

Rehabilitation Phase	Completion criteria	Performance Indicators	Unit of measure	Exotic Pasture Sites				Woodland Sites		
				M2008 01	M2008 02	M2009 01	M2010 01	M2008 03	M2012 03	M2012 04
Phase 5: Ecosystem & Landuse Sustainability (Cont'd)		Bare ground	<%	1	6	6	0	0.5	4.5	3
		Perennial plant cover (< 0.5m)	%	48	25	51	77.4	65	29	9.1
		Total Ground Cover	%	99	94.5	94	100	99.5	95.5	97
	Vegetation contains a diversity of species per square meter comparable to that of the local remnant vegetation.	Native understorey abundance	>species/m^2	1.4	0.4	0.0	0.0	0.6	0.2	0.8
		Exotic understorey abundance	<species/m^2	7	2.8	2.4	1.6	3	2.4	1.8
	Native groundcover abundance is comparable to that of the local remnant vegetation.	Percent groundcover provided by native vegetation <0.5m tall.	%	11.8	5.1	0.0	0.0	8.9	3.3	21.7
	The vegetation is developing in structure and complexity comparable to that of the local remnant vegetation.	Foliage cover 0.5m – 2m	% cover	4.6	18.2	24	0	7	11	5
		Foliage cover 2m – 4m	% cover	0	0	0	0	16	9	32
		Foliage cover 4m – 6m	% cover	0	0	0	0	7	4	13
		Foliage cover >6m	% cover	0	0	0	0	2	2	2

Green = Meets or exceeds completion criteria.

Blue = Performance indicator target falls within industry guidelines or desirable ranges but may not be similar to reference sites

NA = Not Applicable.

Source: DNA (2021)

A feral pig management program, including trapping, baiting and open range opportunistic shooting, was implemented in March, May, June, and July 2021 in response to observed feral pigs and feral pig wallows on site. A total of 48 feral pigs were trapped and dispatched during the reporting period, nine observed deaths were attributed to poison consumption and a further eight were shot and killed during rabbit culling activities.

ACOL maintains an open range shooting program at the ACP site as part of a kangaroo culling program approved and licenced by the NSW National Parks and Wildlife Service; however, no kangaroo culling activities were undertaken during the reporting period. Open range shooting to control other mammalian pest populations was undertaken in throughout June and July 2021, with a total of 60 rabbits, 40 hares, 1 wild dog and 1 fox culled during the reporting period.

Active weed control treatment was also completed across approximately 385 hectares of land owned by ACOL, targeting African boxthorn (*Lycium ferocissimum*), African olive (*Olea europaea* subsp. *cuspidata*), coolatai grass (*Hyparrhenia hirta*), galenia (*Galenia pubescens*), lantana (*Lantana camara*) mimosa bush (*Vachellia farnesiana*), mother of millions (*Kalanchoe daigremontiana*), oleander (*Nerium oleander*), prickly pear (*Opuntia stricata*), St John's wort (*Hypercum perforatum*), sweet briar (*Rosa rubiginosa*), tiger pear *(Opuntia aurantiaca*) and general weeds around infrastructure and disturbed areas. **Figure 8.2** displays the areas treated for weeds during the reporting period.

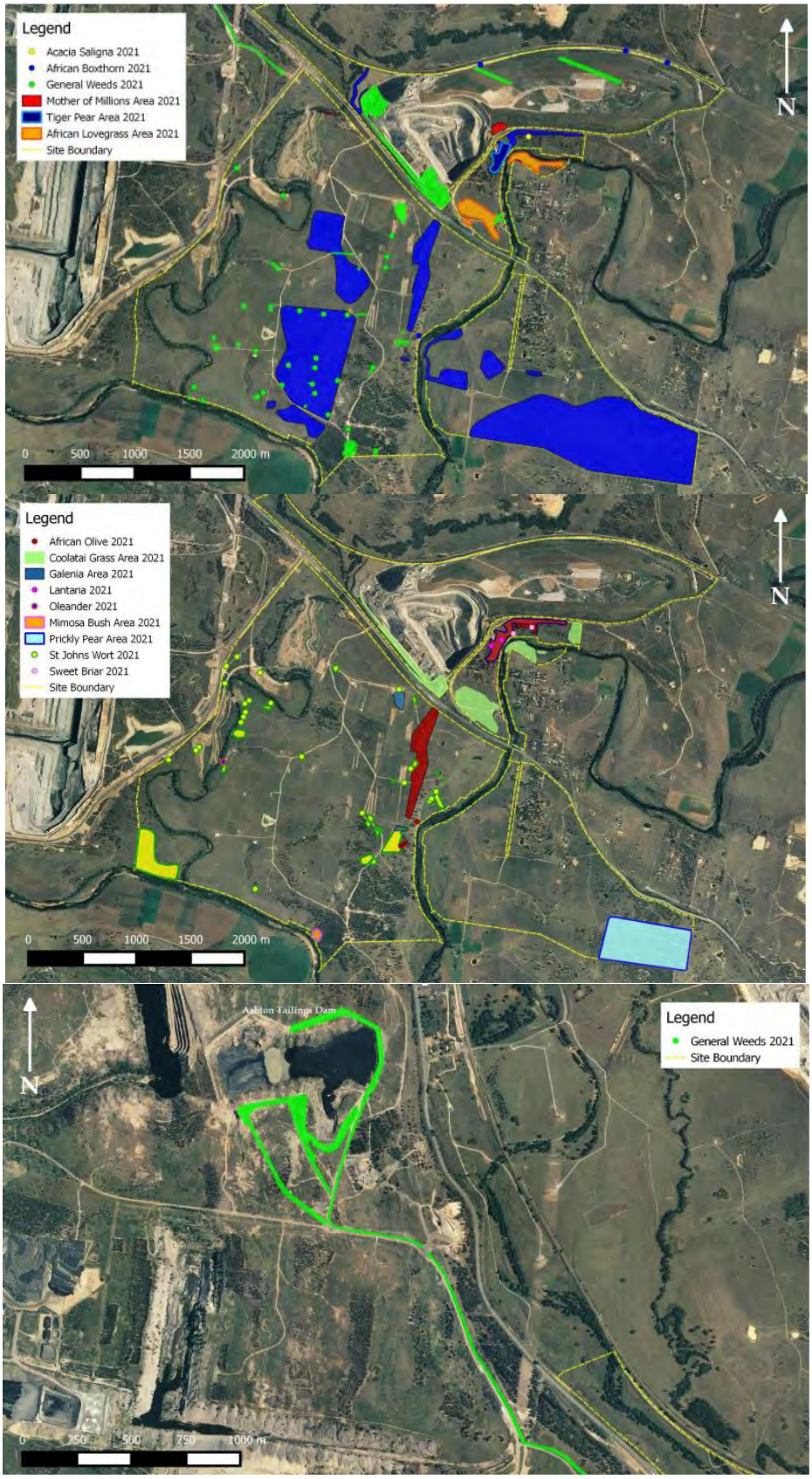
8.2 ACTIONS FOR THE NEXT REPORTING PERIOD

Rehabilitation during the next reporting period will principally relate to rehabilitation of disturbance associated with gas drainage network development and other minor infrastructure projects, as needed. Should favourable meteorological conditions persist, the first block of the woodlands rehabilitation conversion program may be undertaken within the NEOC area.

As discussed in Section 8.1, the RMP to be submitted next reporting period will include revised completion and performance criteria and proposed conversion of pasture rehabilitation to mixed eucalypt woodland within the NEOC emplacement area. The RMP will also address the recommendations raised by the Resources Regulator as part of their targeted assessment program for final landform establishment (see Sections 4.4 and 5).

Rehabilitation of subsidence impacts will also be undertaken, as required, including surface crack backfilling, compaction, and vegetation enhancement. Ongoing repairs will be made to any subsidence-damaged infrastructure, including the right of way access road, in accordance with the approved subsidence monitoring and management plans.

Maintenance works, such as erosion and sediment control, and ongoing control of weeds and feral pests will also be undertaken as required. Additional feral pest control options may also be investigated including those targeting feral cats, hares, rabbits and feral pigs. Other measures to improve biodiversity outcomes, as outlined in Section 6.6 of this Annual Review, will also be investigated and implemented as appropriate.



Source: ENRIGHT Land Management (2022) – Maps 1, 2 and 3

Figure 8.2
WEED TREATMENT AREAS – 2021

9. COMMUNITY

9.1 COMMUNITY COMPLAINTS

All complaints during the reporting period were recorded in the complaints register (available on the Ashton Coal Website) which is reproduced as **Table 9.1**. Two complaints were received during the 2021 reporting period, both of which were related to noise. Investigations following the receipt of these complaints concluded that operations at the ACP site were unlikely to have contributed significantly to noise levels in either complaint.

Table 9.1
Community Complaints Summary - 2021

Date and Time	Nature of Complaint	Details
4/4/2021 (8:00am)	Noise	Complainant called to report a noise complaint regarding noise that started half an hour prior to calling. CHPP was not operating on the weekend. Two employees drove around the ACP site and Camberwell village and were unable to identify the noise. Also advised that they had talked to two other separate people in the village who said that they did not notice any loud noises in the morning. Advised complainant that Ashton is inaudible in Camberwell.
19/9/21 (7:38am)	Noise	Complainant called to report a noise complaint regarding perceived elevated noise levels. An investigation was undertaken at the time and there was no unusual noise emanating from site. One truck was transporting reject down into the void and there was one dozer working on a stockpile. The CHPP supervisor also did a drive around Camberwell village shortly after the complaint but was unable to identify Ashton as the source of the noise. We were also unable to identify any noise sources on the noise monitor in the village at the time. Complainant advised of results of investigation.
Source: ACOL		

A summary of all complaints received over the life of the mine is presented as **Figure 9.1** and illustrates a decreasing trend in complaints, with the greatest reduction occurring following completion of the NEOC. Previously the nature of complaints was predominantly noise, followed by dust and blasting.

9.2 COMMUNITY LIAISON

The principal formal community consultation undertaken is via the Ashton Community Consultative Committee. In accordance with *Condition 7* of *Schedule* 5 of DA 309-11-2001-i, ACOL has established a Community Consultative Committee for the ACP. During the reporting period, the committee consisted of:

- three representatives of the local community (Mr John McInerney, Mrs Debbie Richards, Mr Michael Bestic);
- a representative from Singleton Council (Clr. Godfrey Adamthwaite); and
- four representatives from ACOL (Mr Aaron McGuigan, Mr Phillip Brown, Mr Amrish Trivedi, and Mr Cameron Eckersley).

The committee was chaired by Mrs Margaret MacDonald-Hill, an independent chairperson appointed as the independent Chair by the Secretary, DPE.

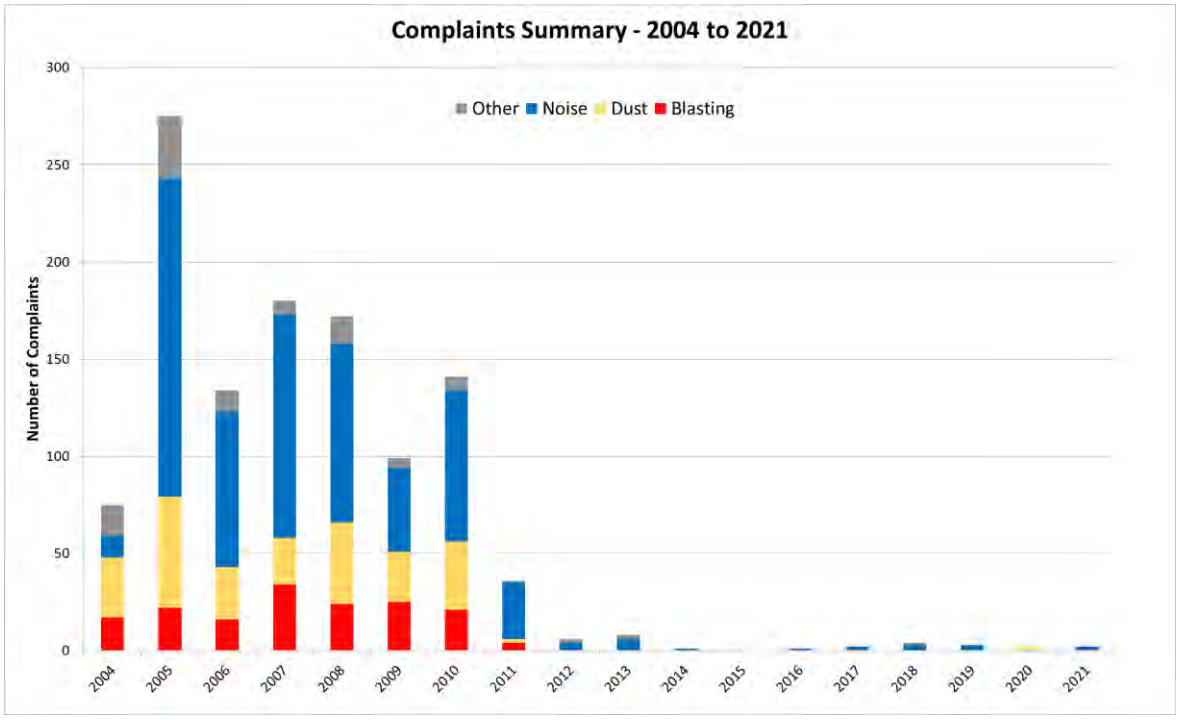


Figure 9.1
COMMUNITY COMPLAINTS – MINE LIFE

The committee held a total of three meetings during the reporting period (25 February, 10 June and 2 December 2021). The meetings have continued to provide an opportunity for ACOL to keep the community up to date with activities undertaken and programmed at the ACP and for community members to table issues relating to the ACP for ACOL's consideration. It is noted that ACOL provided presentations during each meeting to provide updates on mine development, environmental monitoring and performance, subsidence management, planning, and other relevant matters.

Copies of minutes, presentations and annual CCC Chairperson's reports to DPE are available on the Ashton Coal website at www.ashtoncoal.com.au.

ACOL also undertakes engagement through the Aboriginal Community Consultation Forum (ACCF). The ACCF is a community engagement process in place to ensure ongoing dialogue between the Aboriginal Community and Ashton Coal. ACCF meetings regularly discuss planned mining operations, potential impacts to Country, upcoming projects and salvage works. Two meetings were held during the reporting period on 29 June and 7 December 2021 and regular meetings will continue during the next reporting period (see Section 6.7 for further information).

9.3 COMMUNITY SUPPORT PROGRAM

ACOL provides support to local community groups, initiatives and sponsorships through the Community Support Program. Following applications made via ACOL's website (https://www.ashtoncoal.com.au/page/sustainability/community/community-support-program/), opportunities to generate positive community impacts through either monetary grants or in-kind support are identified with a focus on four categories including: social and community, environment and education, health, and training.

During the reporting period, a total of $26,884 was allocated directly by ACOL to the following community groups and causes.

- Singleton Heights Preschool – solar panels.
- Singleton Police Citizens Youth Club – upgrade female changeroom.
- Singleton Pony Club – 2021 instructor training.
- Singleton Theatrical Society – 2020 annual musical.
- Singleton Gymkhana – open multidiscipline training day.
- RUN DIPG - fundraising.
- Australian Christian College – safe water.

10. INDEPENDENT AUDIT

In accordance with the requirements of DA 309-11-2001i (MOD5), an independent environmental audit of the ACP was undertaken by Barnett & May on 5 December 2019 and finalised on 5 March 2020. The audit covered the period from 20 June 2016 to 30 September 2019. A total of six non-compliances were recorded, four with EPL 11879 and one each with ML1533 and ML1623 relating to the following.

- Failure of air quality monitoring equipment resulting in non-continuous monitoring (EPL Condition M2.2).
- Piezometers being destroyed resulting in inability to sample all locations specified by EPL Point 8 (EPL Condition M2.3).
- The telephone complaints line was identified in 2017 as being inactive (EPL Condition M6.1).
- The annual noise compliance report was not submitted to EPA (EPL Condition R5.1).
- Inspection by Resources Regulator on 29 May 2018 identified not all requirements of the MOP were fully implemented (ML1533 Condition 2.1 / ML1623 Condition 3a).

No non-compliances were recorded against DA 309-11-2001i (MOD5). The non-compliances for the mining leases were both rectified during the 2018 reporting period and non-compliances for EPL 11879 are reported separately as part of the EPL Annual Return.

A number of recommendations were provided within the audit with a response plan submitted to the (then) DPIE on 6 March 2020 together with the final Audit Report. A review of the status of the response plan as at the end of this reporting period is provided in **Table 10.1**.

The next independent environmental audit is due in the next reporting period.

Table 10.1
2019 Independent Audit – Action Response Plan Status

Ref	Audit Observation	Auditor Recommendation	ACOL Response	Proposed Action	Timeline	Status Update
EPL Cond M2.2	In 2016 PM_{10} data was not able to be captured for a period of 19 days at Site 2 due to equipment failure. In 2017 PM_{10} data was not captured on multiple occasions from Points 7, 9 and 10, due to equipment failures and supply delays in replacement of the faulty equipment. Air monitoring stations are inspected regularly.	There is no recommendation related to this non-compliance. Ashton's existing equipment monitoring program is appropriate.	In 2016, the 19 days of non-captured data represents 5% of total annual data. 2017 non-captured data represented 1.8% of total annual data. ACOL has an existing monitoring and maintenance regime for the three onsite AQ monitors (TEOM), including daily checks of TEOM function and data receipt, monthly field audit and servicing, and quarterly calibration	Introduction of automated alarm that notifies ACOL staff and contracted environmental monitoring database managers upon nonreceipt of monitoring data. Incorporate this requirement into the ACOL Air Quality and Greenhouse Gas Management Plan (AQGGMP).	Complete	The AQGGMP was updated during the 2020 reporting period (version dated September 2020). Alerts are now received by ACOL personnel upon nonreceipt of monitoring data.
EPL Cond M2.3	In 2017 groundwater samples were not collected from all piezometers associated with Point 8. It is noted that failure to collect water from a dry piezometer does not trigger a non-compliance against this condition. However, if piezometers have been destroyed by the mining operations, then, in consultation with the EPA, those piezometers should be either replaced (relocated) or removed from the groundwater monitoring plan (refer to EPL Condition P1.3).	Consult with the EPA regarding the modification of the groundwater monitoring requirements for Point 8.	Selection of replacement EPL groundwater monitoring sites in consultation with EPA has been completed. EPA have incorporated new groundwater monitoring sites into latest version of EPL11879 (21 November 2019) as Sites 20 to 31.	New EPL groundwater monitoring sites to be documented in groundwater monitoring program, as part of Water Management Plan (WMP) review.	Complete	The WMP was updated during the 2020 reporting period (version dated September 2020). Additional EPL bores YAP016 (EPL site 20) and WMLP320 (EPL site 21) have been incorporated into the WMP.

Table 10.1 (Cont'd)
2019 Independent Audit – Action Response Plan Status

Ref	Audit Observation	Auditor Recommendation	ACOL Response	Proposed Action	Timeline	Status Update
EPL Cond M6.1	Ashton's website provides both email and telephone enquiries and complaints lines. In 2017 the telephone complaints line was found to be inactive by DPE on 1 February 2017.	Schedule checks of the complaints line (monthly) to ensure that it is operational.	Following the February 2017 incident, complaints handling protocols were revised to ensure notification of ACOL staff following community complaints, and the requirement for a monthly test of the Community Enquiries Line was introduced.	Requirement for monthly test of the Community Enquiries Line to be documented in the Complaints Handling Procedure (Doc No: 4.3.1.1.2).	Complete	The update of the Complaints Handling Procedure has been completed and monthly tests are undertaken.
EPL Cond R5.1	No evidence was sighted by the Auditor to confirm that annual noise compliance assessment reports were prepared and issued to the EPA.	Prepare annual Noise Compliance Assessment Reports and issue those reports to the EPA	Annual Noise Compliance Assessment Reports (NCAR) were submitted to NSW EPA subsequent to IEA, with no further action required by EPA. 2019 NCAR submitted to NSW EPA with 2019 EPL Annual Return.	Requirement to check for, and include, supporting reports as part of EPL Annual Return to be documented in the Environmental Management Strategy	Complete	Environmental Management Strategy updated during the 2020 reporting period (version dated September 2020).
ML1533 Cond 2.1/ ML1623 Cond 3(a)	An inspection by DRE inspectors on 29 May 2018 identified several instances where the requirements of the MOP were not being fully implemented. The DRE recommendations were fully implemented.	Ensure that all commitments in the MOP (and other management plans) are fully implemented. Ensure that all Annual Reviews are submitted with the required time frames.	Non-compliance resulted from (a) lack of clarity regarding topsoil management for minor disturbance projects, and (b) inconsistency between MOP and Fauna and Flora Management Plan commitments regarding handling of cleared vegetation. Both issues were rectified during the drafting of the latest MOP (September 2018)	No additional action proposed	Not Applicable	No further actions required.

11. INCIDENTS AND NON-COMPLIANCES DURING THE REPORTING PERIOD

During the reporting period there were no:

- non-compliances with the mining leases or water access licences; or
- official cautions, warning letters, penalty notices or prosecution proceedings.

A non-compliance was recorded with Schedule 3, Condition 12 of Development Consent 309-11-2001-i for three exceedances of 24 hour average PM_{10} criteria at monitoring Site 10. As outlined in Section 6.5, these exceedances were reported to DPIE and follow up reporting completed confirming that ACP was not a significant contributor to the exceedance. No further actions were required.

Non-compliances with EPL 11879 relating to monitoring frequencies have been reported separately through the 2021 EPL Annual Return.

12. ACTIVITIES TO BE COMPLETED IN THE NEXT REPORTING PERIOD

Activities planned to be completed during the next reporting period are outlined in Section 4.4 and planned improvements in environmental management practices in Sections 6 and 7. In summary, the key actions for the next reporting period are summarised in **Table 12.1**.

Table 12.1
Actions to be Completed Next Reporting Period

Action	Indicative Completion Date
1. Submit RMP and Forward Program to replace the existing MOP. As part of the RMP, - revise rehabilitation / biodiversity completion criteria in consideration of ecological monitoring undertaken; - reflect planned changes to the NEOC emplacement rehabilitation strategy (pasture to woodland); and - address Resource Regulator recommendations regarding final landform establishment.	02.06.2022
2. Investigate controlled grazing within the Bowmans Creek Riparian area to manage weeds and fuel loads and implemented as appropriate.	31.12.22
3. Continue planning towards (and subject to improved meteorological conditions, implementation of) program to convert areas of NEOC pasture rehabilitation to mixed eucalypt woodland.	31.12.22 (subject to meteorological conditions)
4. Undertake investigation within the Bowmans Creek Riparian corridor to identify crucial erosion areas and where rehabilitation and restoration works are required.	31.12.22
5. Plan for and, subject to improved meteorological conditions) undertaken habitat enhancement plantings, particularly within the narrow casuarina woodland areas.	31.12.22 (subject to meteorological conditions)
6. Commence of sulphate monitoring in Bowmans Creek and inspections following elevated TSS results.	Ongoing
7. Review BCT recommendations and prepare implementation plan with timeframes.	30.06.22

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Appendices

(No. of pages including blank pages = 506)

Appendix 1 Noise Compliance Assessment Report 2021 (404 pages)

Appendix 2 Annual Groundwater Monitoring Review 2021 (100 pages)

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Appendix 1

Noise Compliance

Assessment Report 2021

(No. of pages including blank pages = 404)

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17 January 2022

Cameron Eckersley
Environment and Community Coordinator
Ashton Coal Operations Pty Ltd
PO Box 699
Singleton NSW 2330 Australia

Re: EPL 11879 - Noise compliance assessment report 2021

Dear Cameron,

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 2021 to 31 December 2021. The Noise Compliance Assessment Report is required as per Condition R5.1 of Environment Protection Licence (EPL) 11879 dated 3 February 2020 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 not varied during the 2021 reporting period.

3 Compliance

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

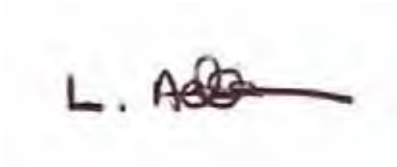
As presented in the attached monthly reports, results of routine attended monitoring confirm that noise emissions from Ashton Coal operations satisfied the relevant EPL noise limits (Condition L4.1 of EPL 11879) at all assessment locations during periods when noise limits were applicable.

4 Conclusion

Monthly attended noise monitoring undertaken during the relevant reporting period (1 January 2021 to 31 December 2021) 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
Senior Acoustic Consultant
ladamson@emmconsulting.com.au

Review: Alex Dundon (22/12/21)

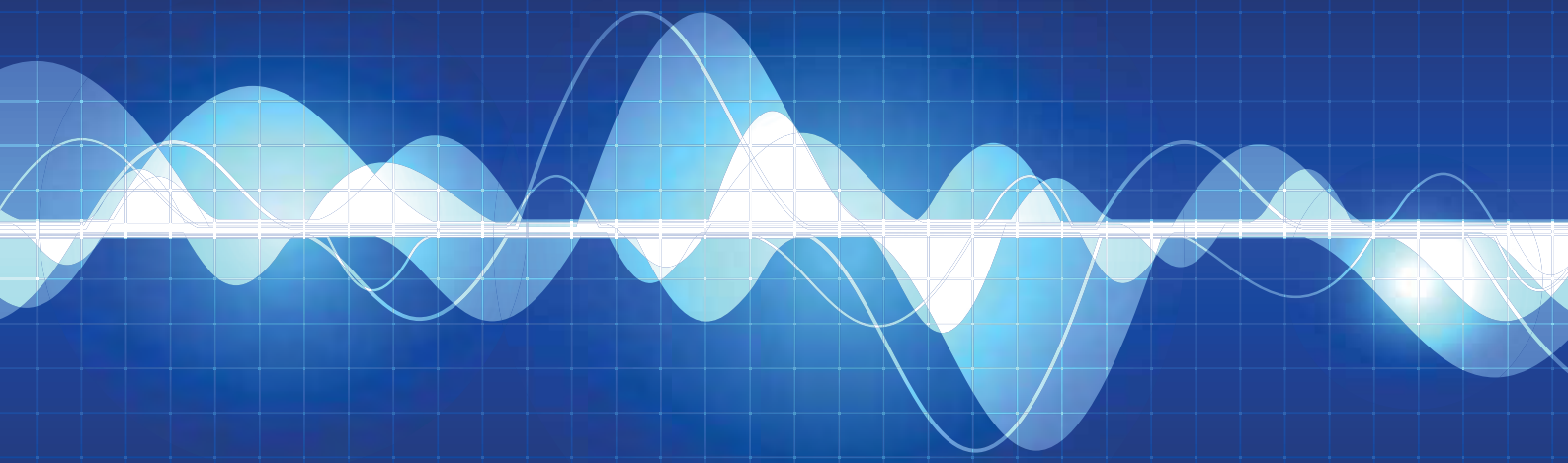
Appendix A

Monthly attended noise monitoring report - January 2021

Ashton Coal

Monthly attended noise monitoring
January 2021

Prepared for Ashton Coal Operations Pty Ltd
February 2021



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Monthly attended noise monitoring - January 2021

Prepared for Ashton Coal Operations Pty Ltd
February 2021

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Ashton Coal

Monthly attended noise monitoring - January 2021

Report Number

H200894 RP1

Client

Ashton Coal Operations Pty Ltd

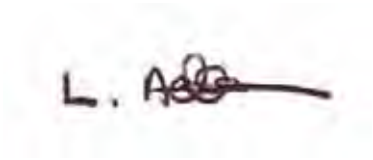
Date

10 February 2021

Version

v1-0 Final

Prepared by



Lucas Adamson
Senior Acoustic Consultant
10 February 2021

Approved by

Katie Teyhan
Associate
10 February 2021

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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 25 January 2021.

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 25 January 2021);
- Environment Protection Authority (EPA), Environment Protection License 11879, as varied on 3 February 2020 (current as of 25 January 2021);
- Ashton Coal Project Noise Management Plan (NMP), approved by DPIE on 23 September 2020 (current as of 25 January 2021);
- 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

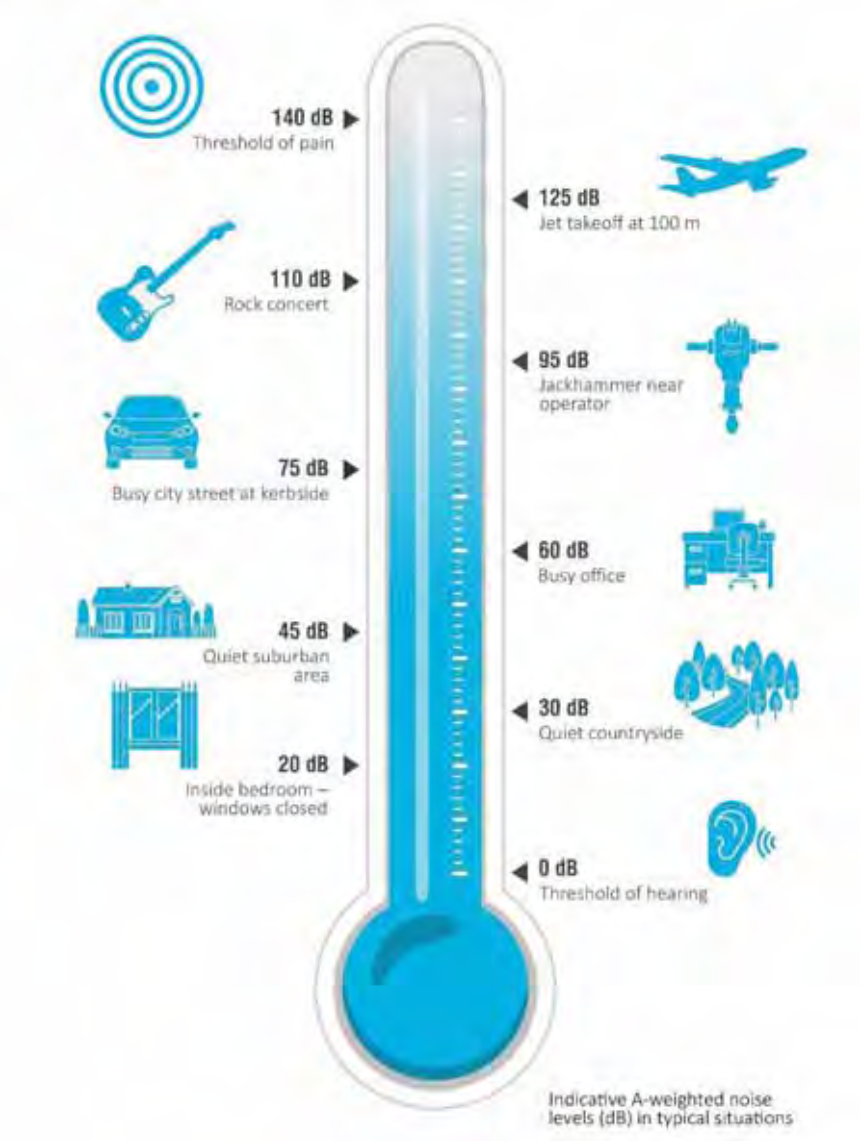

Figure 2.1 Common noise levels

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 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 completion of the noise monitoring 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

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

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

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 25 January 2021. Noise from Ashton Coal operations was audible during all three operator-attended noise surveys.

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 initially 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. Total measured LFN levels did not exceed the relevant LFN thresholds at location N2, the most exposed to noise sources on site. However, LFN thresholds were exceeded during the measurements at N3 and N4 and therefore a more detailed analysis of overall mining noise contributions was conducted. The surveys were reviewed for periods with low levels of extraneous noise (such as traffic and other mines in the area) as to determine and assess the Ashton Coal low-frequency noise contributions toward the LFN thresholds. It was determined that the relevant LFN thresholds would not have been exceeded solely by noise emissions from Ashton Coal due to the following:

- the relative contribution of Ashton Coal;
- the relative contribution of other mines in the area;
- the relative contribution from traffic on the New England Highway; and
- onsite operations were consistent for all measurements (ie fixed and mobile plant activities); and

Therefore, in accordance with the NPfI, LFN modifying factors were not applied to estimated site noise levels at any of the locations.

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

Table 5.1 Ashton Coal attended noise monitoring results – January 2021

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	25/1	22:05	32	35	45	49	54	62	57	Nil	33	34	36	46	2.5 m/s @ 174° E class stability 1.1°C/100m VTG Y	Nil	**Ashton Coal conveyor hum consistently audible.** Other mines in the vicinity, traffic on the New England Highway, insects and frogs consistently audible. Bird noise, Livestock, Distant dogs barking and a train on the main line (unrelated to Ashton Coal) occasionally audible.
N3	25/1	22:22	32	36	42	46	51	62	58	Nil	32	33	36	46	2.5 m/s @ 176° E class stability 1.0°C/100m VTG Y	Nil	**Ashton Coal conveyor hum consistently audible.** Other mines in the vicinity, traffic on the New England Highway, insects and frogs consistently audible. Nearby animals occasionally audible.
N4	25/1	22:43	34	36	39	40	43	65	59	Nil	33	34	36	46	2.2 m/s @ 184° E class stability 1.5°C/100m VTG Y	Nil	**Ashton Coal conveyor hum consistently audible.** Other mines in the vicinity, traffic on the New England Highway, insects and frogs 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 N2 - Camberwell Village (west)

Ashton Coal operations were consistently audible during the operator-attended noise survey including conveyor hum. The Ashton Coal mine noise contribution was estimated at up to 33 dB $L_{Aeq,15\ minute}$. Conveyor hum from site generated an estimated 34 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, insects, frogs, traffic on the New England Highway, bird noise, livestock, distant dogs barking and a train on the main line (unrelated to Ashton Coal). A graph of the total linear noise levels measured in each one-third octave frequency bands is shown in Figure 5.1.

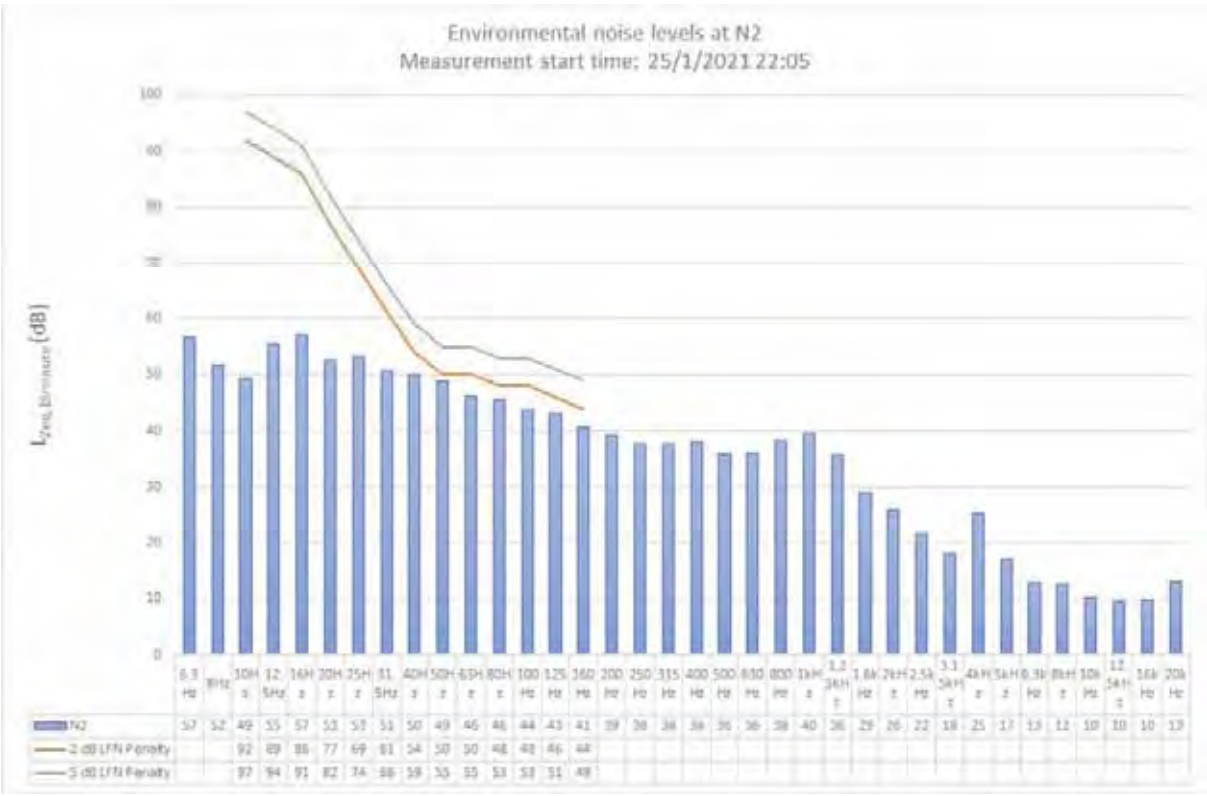

Figure 5.1 N2 total measured one-third octave band frequencies

Other mining operations in the vicinity were also 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 ($L_{Aeq,15\ minute}$ 37 dB - 3 dB as per NPfI methodology). This 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 hum. The Ashton Coal mine noise contribution was estimated at up to 32 dB $L_{Aeq,15\ minute}$. Conveyor hum from site generated an estimated 33 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, insects, frogs, traffic on the New England Highway and nearby animals. A graph of the total linear noise levels measured in the one-third octave frequency bands is shown in Figure 5.2.

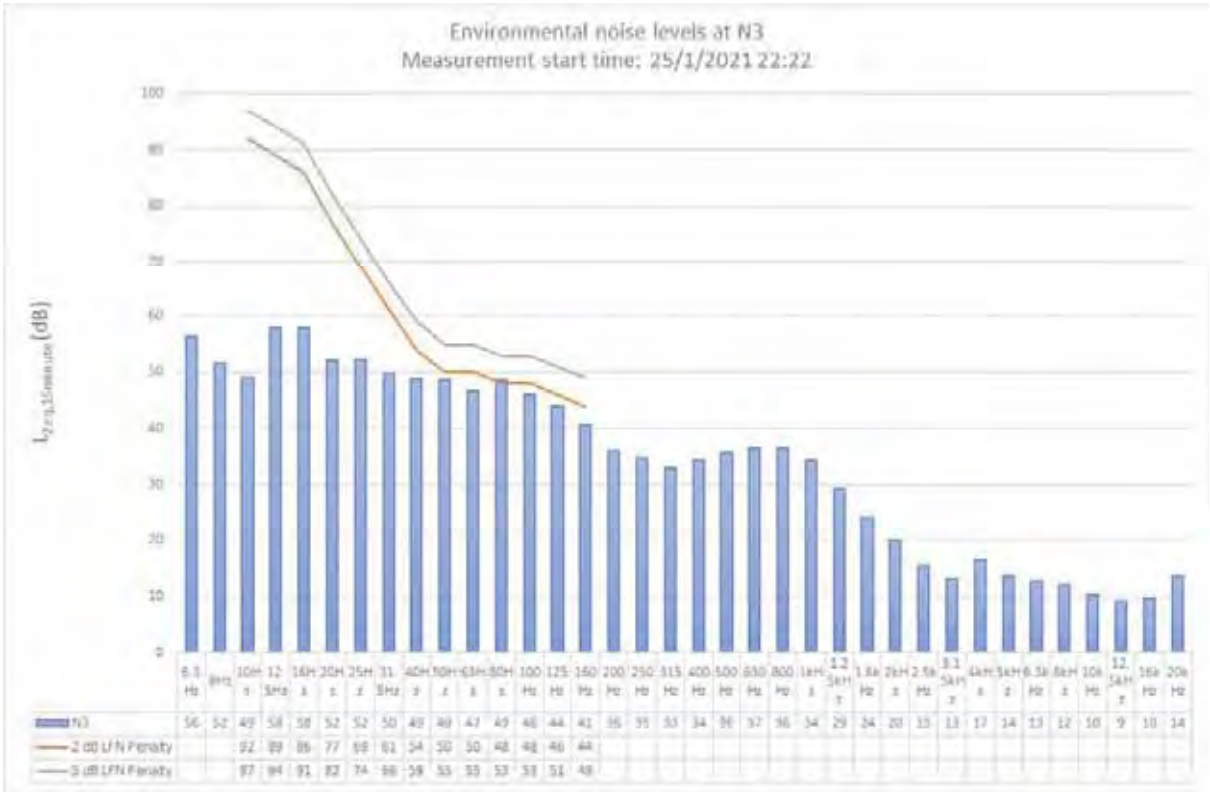

Figure 5.2 N3 total measured one-third octave band frequencies

Other mining operations in the vicinity were also consistently audible during the operator-attended noise survey at monitoring location N3. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ 34 dB (ie $L_{Aeq,15\ minute}$ 35 dB - 3 dB + 2 dB as per NPfI methodology), which included a 2 dB positive adjustment for LFN. This 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 consistently audible during the operator-attended noise survey including conveyor hum. The Ashton Coal mine noise contribution was estimated at up to 33 dB $L_{Aeq,15\ minute}$. Conveyor hum from site generated an estimated 34 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, insects, frogs and traffic on the New England Highway. A graph of the total linear noise levels measured in one-third octave frequency bands is shown below in Figure 5.3.

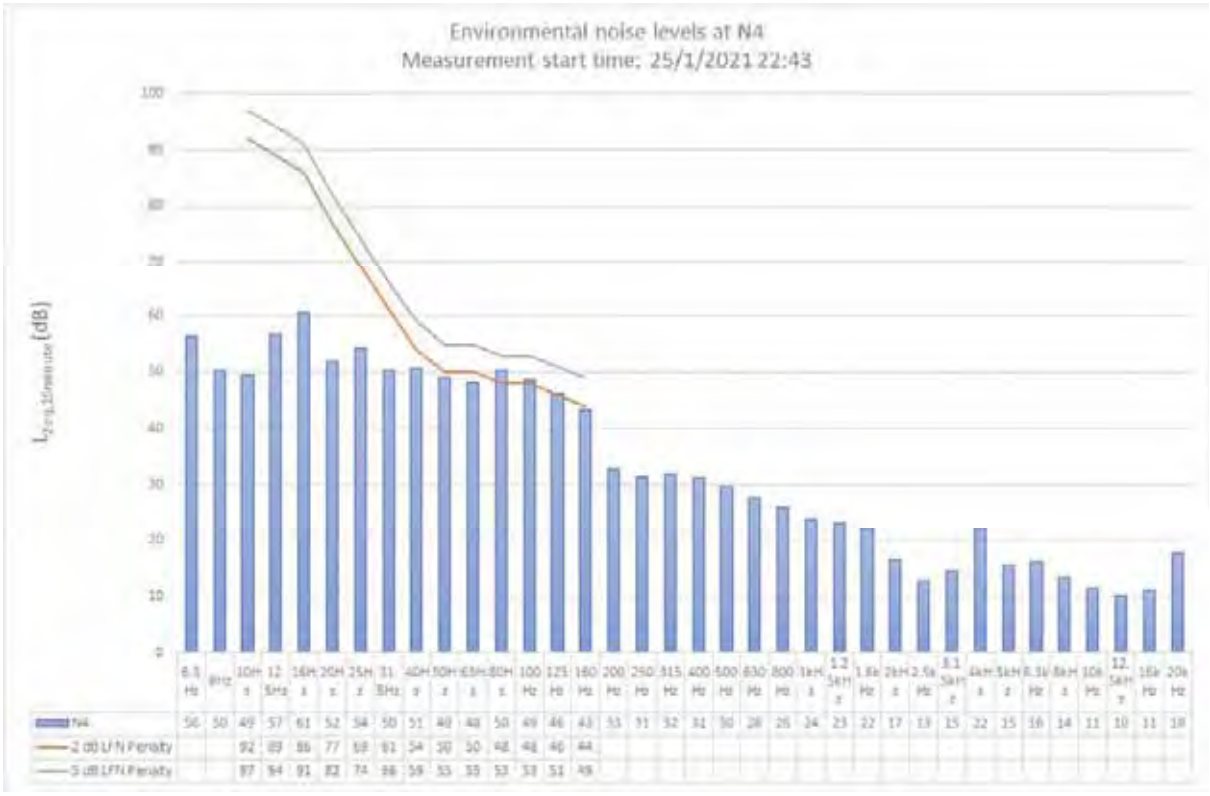

Figure 5.3 N4 total measured one-third octave band frequencies

Other mining operations in the vicinity were also consistently audible during the operator-attended noise survey at monitoring location N4. The total cumulative mine noise contribution was estimated to be $L_{Aeq,night}$ 35 dB ($L_{Aeq,15\ minute}$ 36 dB - 3 dB +2 dB as per NPfI methodology), which included a 2 dB positive adjustment for LFN. This 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 25 January 2021.

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 DC and EPL.

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

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.

L3.2 The Licensee must not dispose of waste on the premises unless authorised by a condition of 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 12 and 32.

4 Operating Conditions

Appendix C

Calibration certificates

CERTIFICATE OF CALIBRATION

CERTIFICATE NO: 26290

EQUIPMENT TESTED: Sound Level Calibrator

Manufacturer: B & K
Type No: 4230 **Serial No:** 1276091
Owner: EMM Consulting
Level 3, 175 Scott 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	93.84	990.59	2.82
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: 1007 hPa ±1.5 hPa **Relative Humidity:** 49% ±5%
Temperature: 24 °C ±2° C
Date of Calibration: 05/02/2020 **Issue Date:** 05/02/2020
Acu-Vib Test Procedure: AVP02 (Calibrators)
Test Method: AS IEC 60942 - 2017
CHECKED BY: KB **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
WORLD RECOGNISED 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 NO.: SLM 26291 & FILT 5615

The performance characteristics listed below were tested. The tests are based on the relevant clauses of IEC 61672-3:2013

Tests Performed:	*Clause*	*Result*
Absolute Calibration	10	Pass
Acoustical Frequency Weighting	12	Pass
Self Generated Noise	11.1	Entered
Electrical Noise	11.2	Entered
Long Term Stability	15	Pass
Electrical Frequency Weightings	13	Pass
Frequency and Time Weightings	14	Pass
Reference Level Linearity	16	Pass
Range Level Linearity	17	NA
Toneburst	18	Pass
Peak C Sound Level	19	Pass
Overload Indicator	20	Pass
High Level Stability	21	Pass

Statement of Compliance: The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent organization responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2013, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2013, the sound level meter submitted for testing conforms to the class 1 requirements of IEC61672-1:2013.
A full technical report is available if required.

This Sound Level Meter included an Octave Filter Set. Tests were based on IEC 1260: 1995 and AS/NZS 4476 - 1997 and were conducted to test the following performance characteristics:

1. Relative attenuation clause 5.3

Date of Calibration: 05/02/2020 **Issue Date:** 05/02/2020

Checked by: IKB

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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web site: www.acu-vib.com.au

CERTIFICATE OF CALIBRATION

CERTIFICATE NO.: SLM 26291 & FILT 5615

Equipment Description:	Sound Level Meter		
Manufacturer:	B & K		
Model No:	2250	**Serial No:**	2759405
Microphone Type:	4189	**Serial No:**	2888134
Preamplifier Type:	ZC0032	**Serial No:**	16037
Filter Type:	1/3 Octave	**Serial No:**	2759405
Comments:	All tests passed for class 1. (See over for details)		
Owner:	EMM Consulting Level 3, 175 Scott Street Newcastle, NSW 2300		
Ambient Pressure:	1007 hPa ±1.5 hPa		
Temperature:	24 °C ±2° C	**Relative Humidity:**	53% ±5%
Date of Calibration:	05/02/2020	**Issue Date:**	05/02/2020

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

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.

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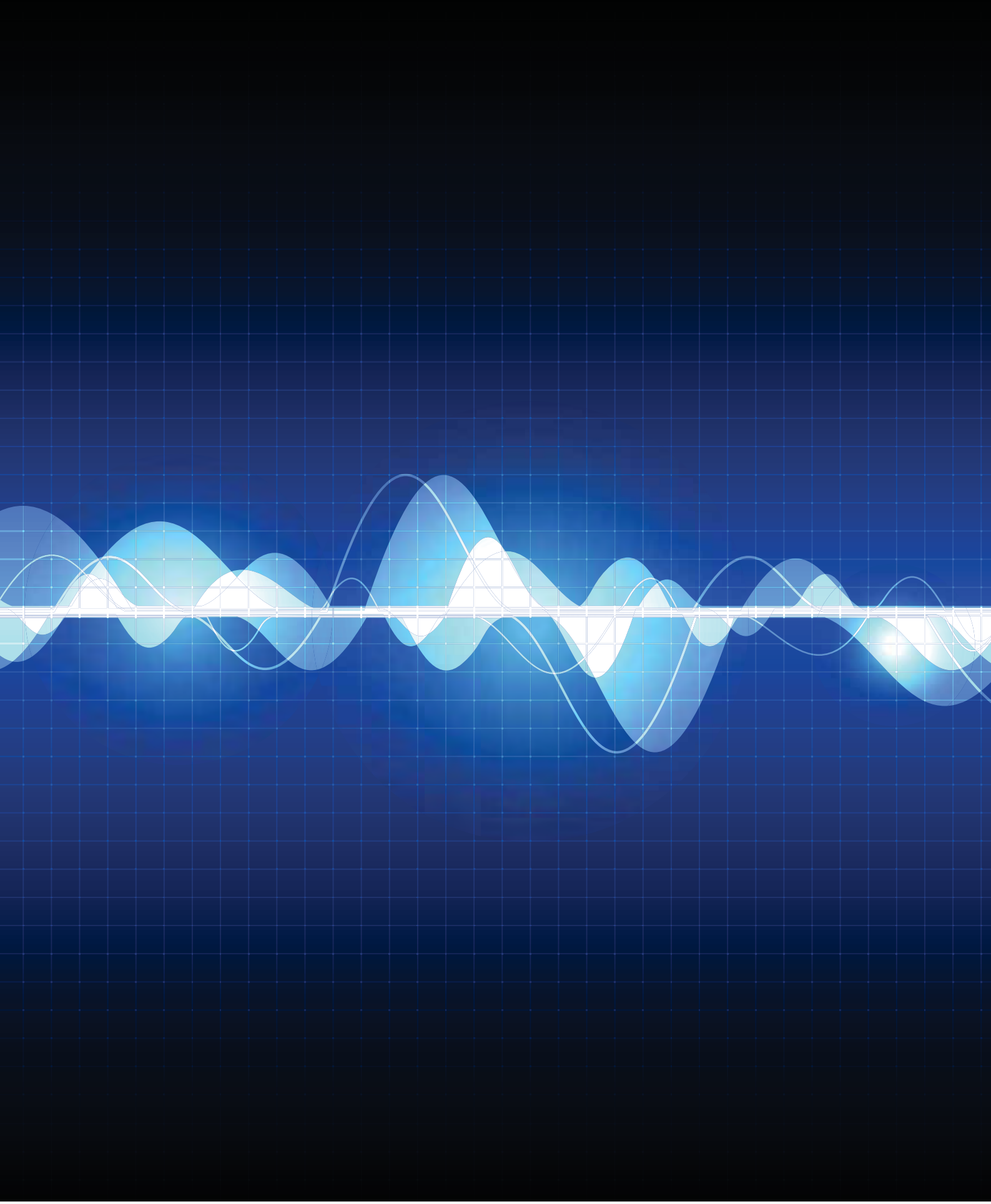


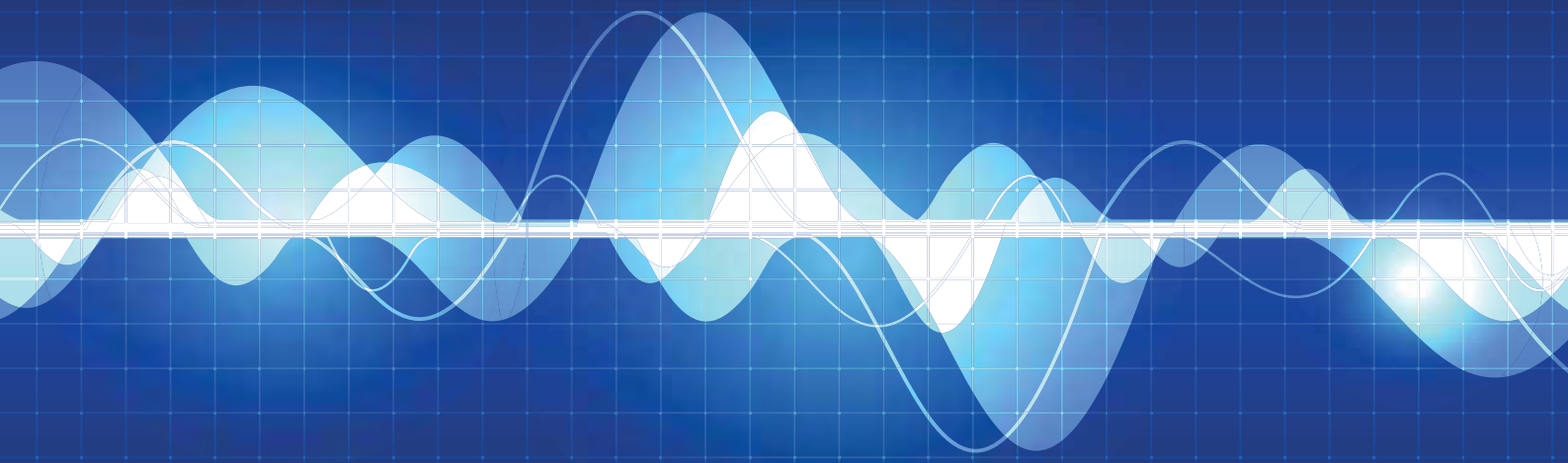
Appendix B

Monthly attended noise monitoring report - February 2021

Ashton Coal

Monthly attended noise monitoring
February 2021

Prepared for Ashton Coal Operations Pty Ltd
March 2021



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Monthly attended noise monitoring - February 2021

Prepared for Ashton Coal Operations Pty Ltd
March 2021

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www.emmconsulting.com.au

Ashton Coal

Monthly attended noise monitoring - February 2021

Report Number

H200894 RP2

Client

Ashton Coal Operations Pty Ltd

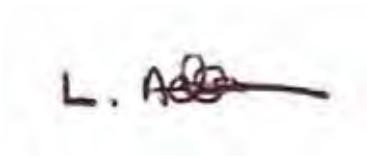
Date

9 March 2021

Version

v1-0 Final

Prepared by



Lucas Adamson
Senior Acoustic Consultant
9 March 2021

Approved by

Katie Teyhan
Associate
9 March 2021

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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 25 February 2021.

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 25 February 2021);
- Environment Protection Authority (EPA), Environment Protection License 11879, as varied on 3 February 2020 (current as of 25 February 2021);
- Ashton Coal Project Noise Management Plan (NMP), approved by DPIE on 23 September 2020 (current as of 25 February 2021);
- 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

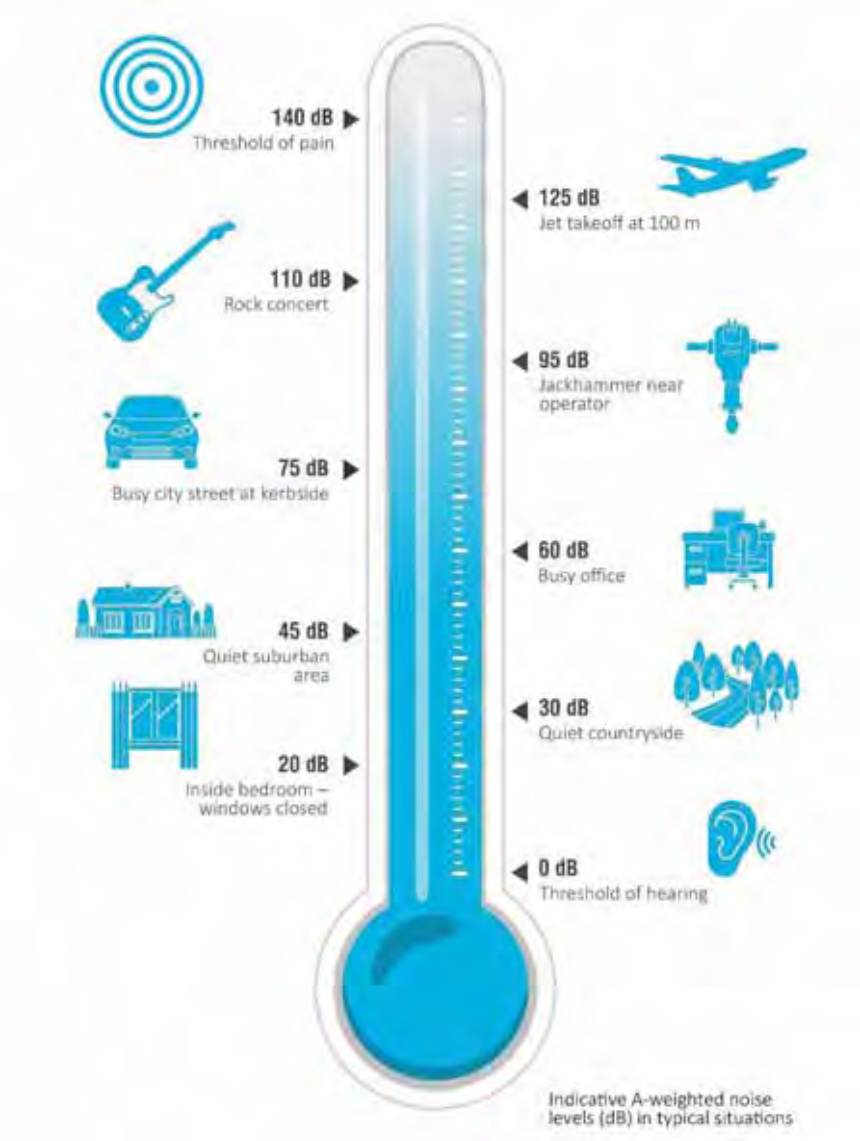

Figure 2.1 Common noise levels

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 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 completion of the noise monitoring 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

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

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

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 is required to determine the stability categories throughout the attended monitoring period using the direct measurement method as per Appendix E2 of the INP (EPA 2000).

As one of the weather stations (M2) specified in Condition L4.4 was not operational at the time of the February noise monitoring (due to a Telstra outage), the method of direct measurement to determine the relevant stability categories was not possible.

Hence, stability categories throughout the attended monitoring period was determined using the sigma-theta (ST) method as per Appendix E of the INP (EPA 2000). The ST data was obtained from weather station M1 specified in Condition L4.4.

Table E1 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 also been sourced directly from meteorological station M1.

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 2021. Noise from Ashton Coal operations was audible during all three operator-attended noise surveys.

The meteorological data for the monitoring period was sourced from Ashton Coal's weather station (M1) to determine applicability of criteria in accordance with the DC and EPL. Noise limits were found to not be applicable during all three measurements due to a G class atmospheric stability category 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. Total measured noise levels exceeded the relevant LFN thresholds during all three measurements however, noise limits were not applicable during the times of these measurements due to a G class atmospheric stability category. Therefore, in accordance with the NPfI, LFN modifying factors were not applied to estimated site (or cumulative) noise levels at any of the locations.

Ashton Coal noise contributions and cumulative mine noise contributions were below (i.e. complied with) the relevant noise limits, had they applied, at all monitoring locations.

Table 5.1 Ashton Coal attended noise monitoring results – February 2021

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	22:04	38	41	48	51	58	67	61	Nil	34	38	36	46	0.4 m/s @ 214° G class stability N	N/A	**Ashton Coal conveyor hum consistently audible with engine revs on occasion.** Other mines in the vicinity, traffic on the New England Highway, insects and frogs consistently audible. Bird noise and aircraft noise occasionally audible.
N3	25/2	22:21	37	40	43	45	48	53	59	Nil	34	41	36	46	0.2 m/s @ 215° G class stability N	N/A	**Ashton Coal conveyor hum consistently audible with engine revs on occasion.** Other mines in the vicinity, traffic on the New England Highway, insects and frogs consistently audible. Bird noise, distant dogs barking and train horns (unrelated to Ashton Coal) occasionally audible.
N4	25/2	22:42	44	46	49	51	52	63	64	Nil	32	33	36	46	0.2 m/s @ 215° G class stability N	N/A	**Ashton Coal conveyor hum consistently audible.** Other mines in the vicinity, traffic on the New England Highway, insects and frogs 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 N2 - Camberwell Village (west)

Ashton Coal operations were consistently audible during the operator-attended noise survey including conveyor hum. The Ashton Coal mine noise contribution was estimated at up to 34 dB $L_{Aeq,15\ minute}$. Engine revs from site generated an estimated 38 dB L_{Amax}. Ashton Coal noise contributions would have complied with the DC and EPL noise limits, had they applied. Other ambient noise sources included other mines in the vicinity, insects, frogs, traffic on the New England Highway, bird noise and aircraft noise. A graph of the total linear noise levels measured in each one-third octave frequency bands is shown in Figure 5.1.

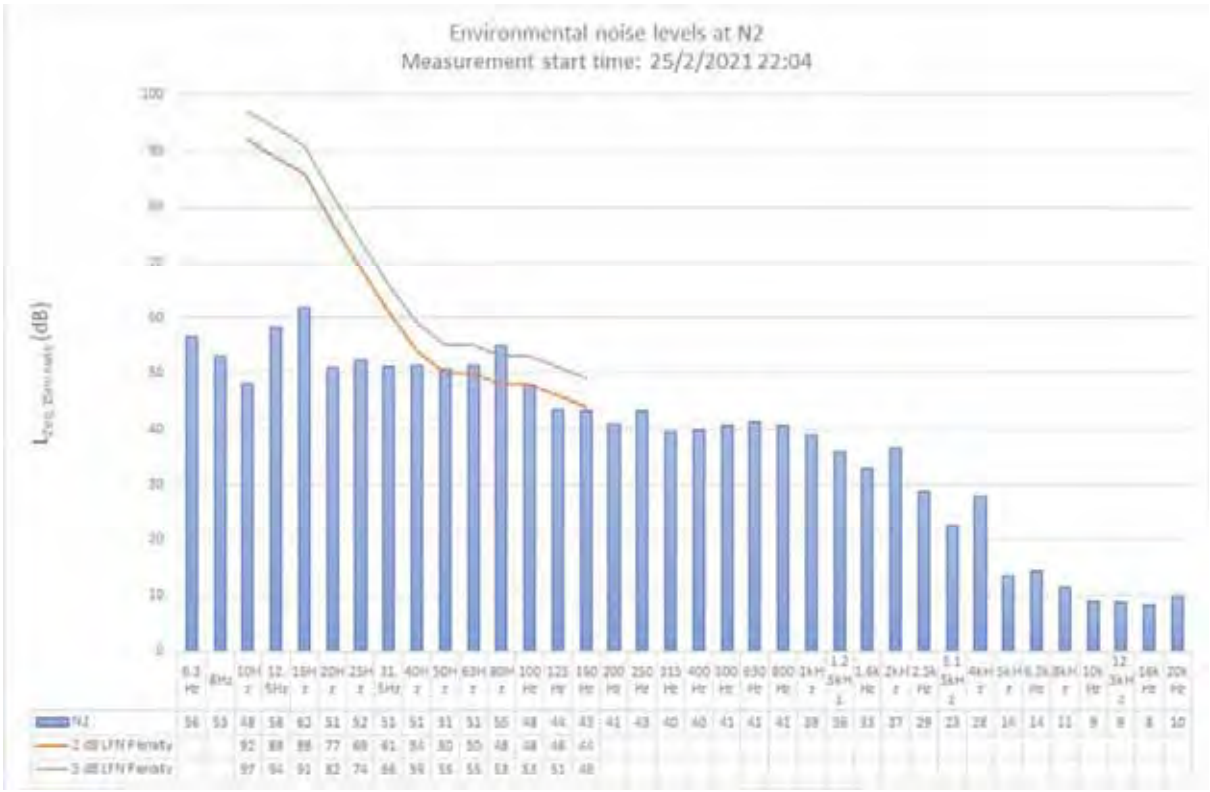

Figure 5.1 N2 total measured one-third octave band frequencies

Other 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). This 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 hum. The Ashton Coal mine noise contribution was estimated at up to 34 dB $L_{Aeq,15\ minute}$. Engine revs from site generated an estimated 41 dB L_{Amax}. Ashton Coal noise contributions would have complied with the DC and EPL noise limits, had they applied. Other ambient noise sources included other mines in the vicinity, insects, frogs, traffic on the New England Highway, bird noise, distant dogs barking and train horns (unrelated to Ashton Coal). A graph of the total linear noise levels measured in the one-third octave frequency bands is shown in Figure 5.2.

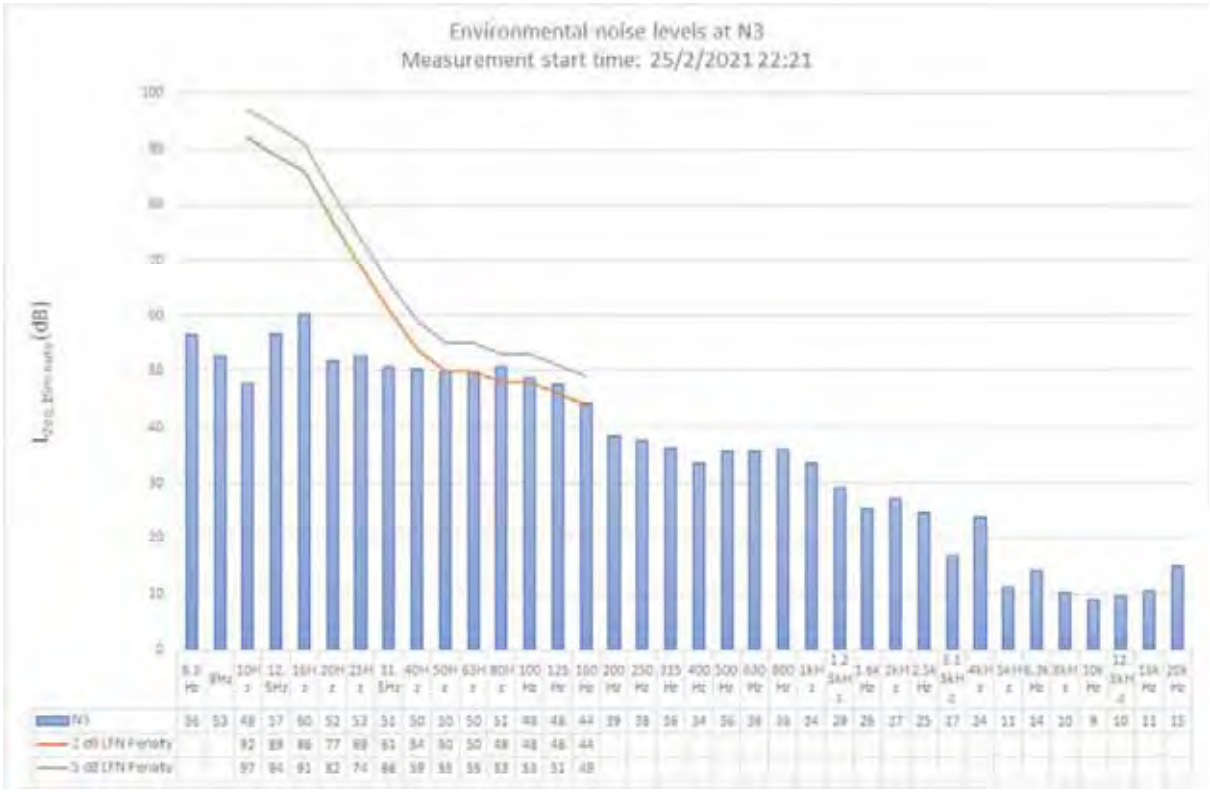

Figure 5.2 N3 total measured one-third octave band frequencies

Other 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 (ie $L_{Aeq,15\ minute}$ 39 dB - 3 dB as per NPfI methodology). This 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 consistently audible during the operator-attended noise survey including conveyor hum. The Ashton Coal mine noise contribution was estimated at up to 32 dB $L_{Aeq,15\ minute}$. Conveyor hum from site generated an estimated 33 dB L_{Amax}. Ashton Coal noise contributions would have complied with the DC and EPL noise limits, had they applied. Other ambient noise sources included other mines in the vicinity, insects, frogs and traffic on the New England Highway. A graph of the total linear noise levels measured in one-third octave frequency bands is shown below in Figure 5.3.

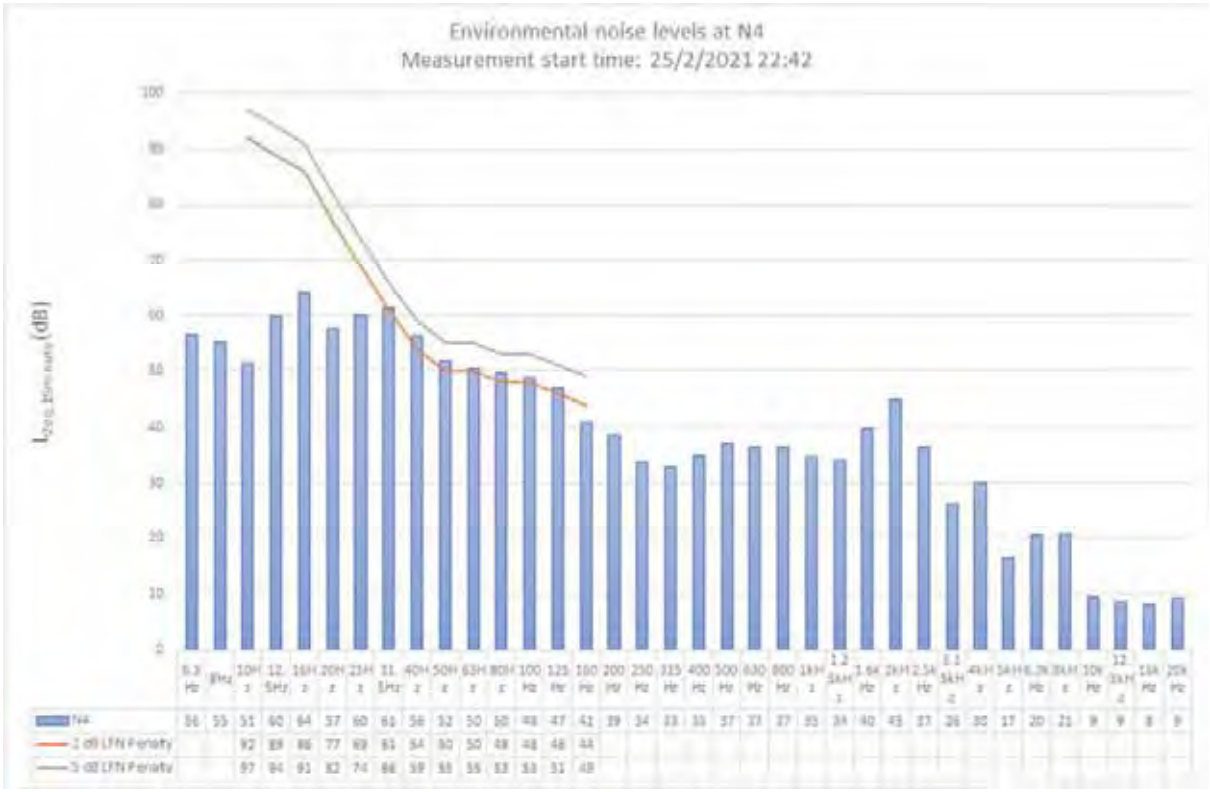

Figure 5.3 N4 total measured one-third octave band frequencies

Other 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). This 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 25 February 2021.

The applicability of noise limits was assessed with reference to Ashton Coal's meteorological station (M1) located to the east of the site. Noise limits were found to not be applicable during all three measurements due to a G class atmospheric stability category 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 DC and EPL.

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

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.

L3.2 The Licensee must not dispose of waste on the premises unless authorised by a condition of 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 12 and 32.

4 Operating Conditions

Appendix C

Calibration certificates

CERTIFICATE OF CALIBRATION

CERTIFICATE NO: C28769

EQUIPMENT TESTED: Sound Level Calibrator

Manufacturer: B & K
Type No: 4230 **Serial No:** 1276091
Owner: EMM Consulting
Level 3, 175 Scott 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	93.83	996.49	1.41
Level 2:	NA	N	NA	NA	NA
Uncertainty:			±0.11 dB	±0.05%	±0.20 %
Uncertainty (at 95% c.l.) k=2					

CONDITIONS OF TEST:

Ambient Pressure: 994 hPa ±1.5 hPa **Relative Humidity:** 59 % ±5%
Temperature: 23 °C ±2° C
Date of Calibration: 05/02/2021 **Issue Date:** 08/02/2021
Acu-Vib Test Procedure: AVP02 (Calibrators)
Test Method: AS IEC 60942 - 2017

CHECKED BY: ..... **AUTHORISED SIGNATURE:** .....
Hein Soe

.Accredited for compliance with ISO/IEC 17025 – Calibration
Results of the tests, calibration and/or measurements included in this document are traceable to SI units through reference equipment that has been calibrated by the Australian National Measurement Institute or other NATA accredited laboratories demonstrating traceability.

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
WORLD RECOGNISED 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 26291 & FILT 5615

Equipment Description:	Sound Level Meter		
Manufacturer:	B & K		
Model No:	2250	**Serial No:**	2759405
Microphone Type:	4189	**Serial No:**	2888134
Preamplifier Type:	ZC0032	**Serial No:**	16037
Filter Type:	1/3 Octave	**Serial No:**	2759405
Comments:	All tests passed for class 1. (See over for details)		
Owner:	EMM Consulting Level 3, 175 Scott Street Newcastle, NSW 2300		
Ambient Pressure:	1007 hPa ±1.5 hPa		
Temperature:	24 °C ±2° C	**Relative Humidity:**	53% ±5%
Date of Calibration:	05/02/2020	**Issue Date:**	05/02/2020

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

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.

NATA
WORLD RECOGNISED ACCREDITATION

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Accredited Lab. No. 9262
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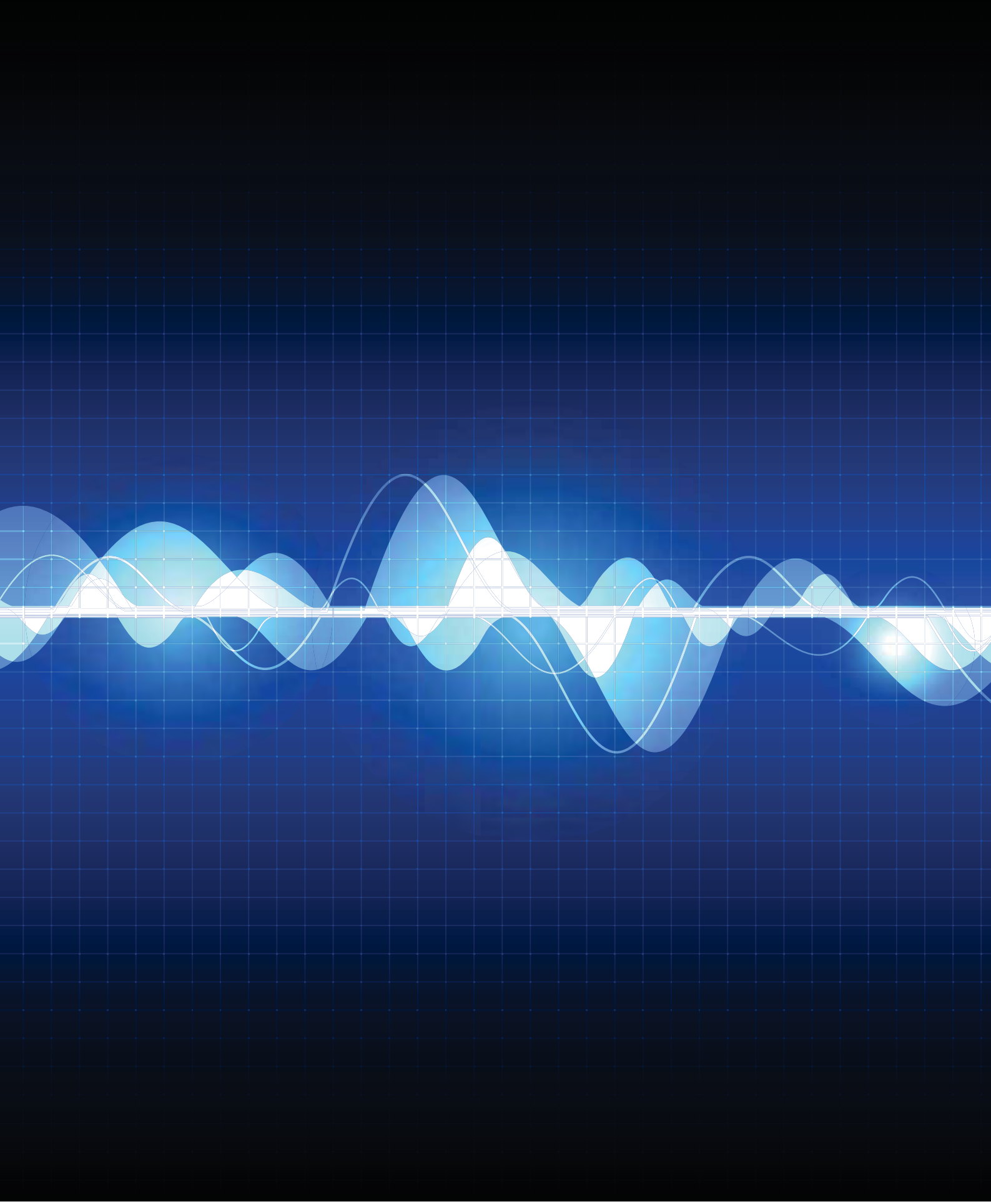


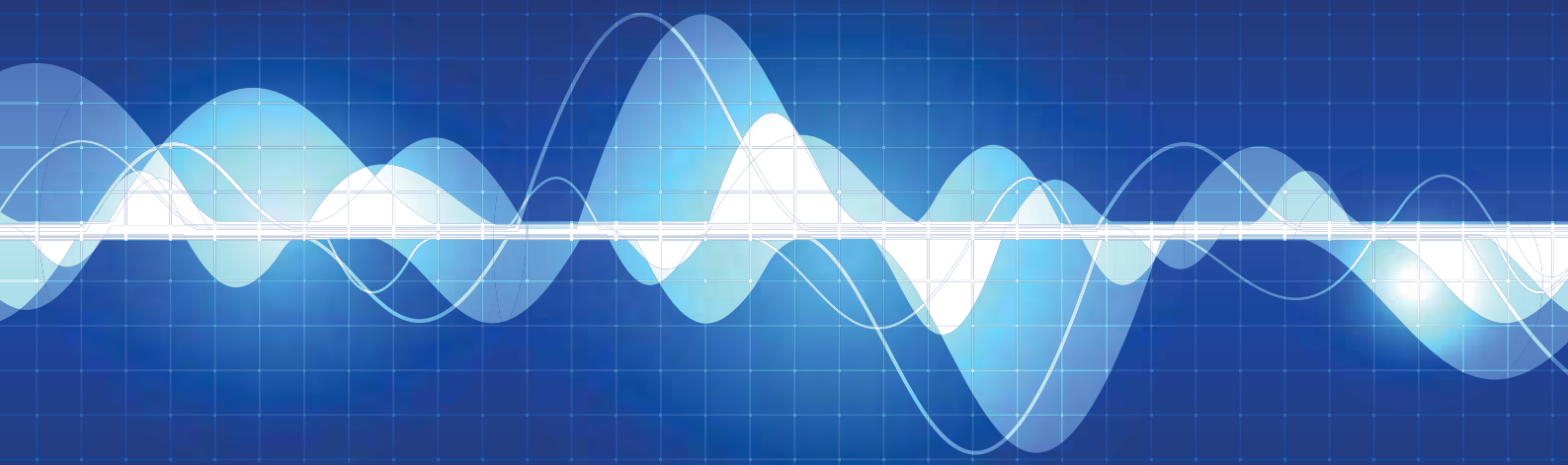
Appendix C

Monthly attended noise monitoring report - March 2021

Ashton Coal

Monthly attended noise monitoring
March 2021

Prepared for Ashton Coal Operations Pty Ltd
April 2021



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Ashton Coal

Monthly attended noise monitoring - March 2021

Report Number

H200894 RP3

Client

Ashton Coal Operations Pty Ltd

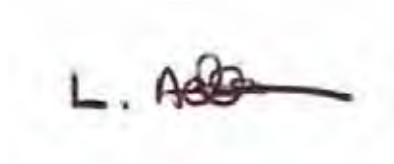
Date

15 April 2021

Version

v1-0 Final

Prepared by



Lucas Adamson
Senior Acoustic Consultant
15 April 2021

Approved by

Katie Teyhan
Associate
15 April 2021

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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 16 March 2021.

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 16 March 2021);
- Environment Protection Authority (EPA), Environment Protection License 11879, as varied on 3 February 2020 (current as of 16 March 2021);
- Ashton Coal Project Noise Management Plan (NMP), approved by DPIE on 23 September 2020 (current as of 16 March 2021);
- 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

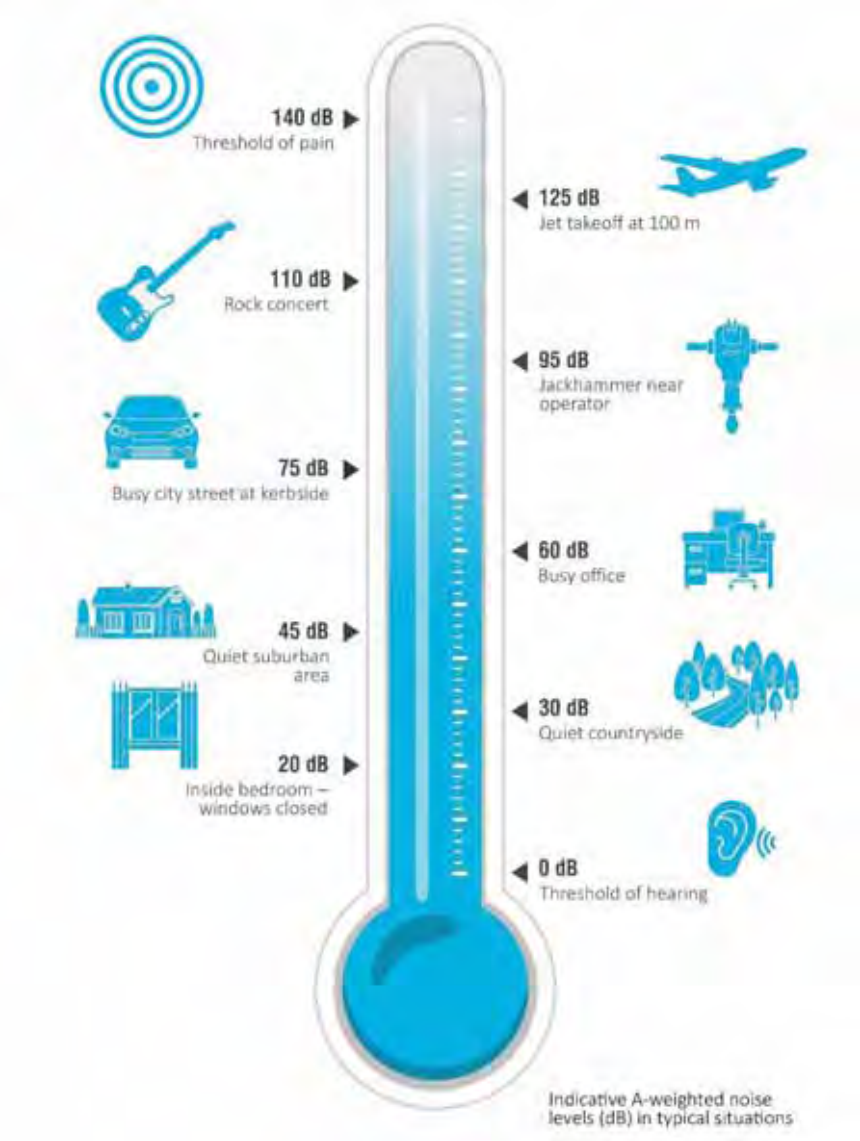

Figure 2.1 Common noise levels

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:

- 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 in 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 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 completion of the noise monitoring 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

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

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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 E1 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 16 March 2021. Noise from Ashton Coal operations was inaudible during all three operator-attended noise surveys.

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, where site was audible. Given that Ashton Coal was not audible during any of the three measurements, LFN modifying factors were not applied to site noise levels at any of the monitoring locations. Total measured noise levels exceeded the relevant LFN thresholds during two of the three measurements (at N2 and N4). Therefore, in accordance with the NPfI, LFN modifying factors were applied to estimated cumulative noise levels at locations N2 and N4.

Ashton Coal noise contributions and cumulative mine noise contributions were below (i.e. complied with) the relevant noise limits at all monitoring locations.

Table 5.1 Ashton Coal attended noise monitoring results – March 2021

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	16/3	22:03	32	36	43	46	53	59	56	Nil	IA	IA	36	46	2.2 m/s @ 122° E class stability -0.5°C/100m VTG Y	Nil	**Ashton Coal inaudible.** Other mines in the vicinity (<30 dB $L_{Aeq,15\ minute}$), traffic on the New England Highway, insects and frogs consistently audible. Bird noise and train horns (unrelated to Ashton Coal) occasionally audible.
N3	16/3	22:21	31	33	37	38	42	64	52	Nil	IA	IA	36	46	1.5 m/s @ 122° E class stability -0.4°C/100m VTG Y	Nil	**Ashton Coal inaudible.** Other mines in the vicinity (<30 dB $L_{Aeq,15\ minute}$), traffic on the New England Highway, insects and frogs consistently audible. Bird noise, dogs barking and nearby animals occasionally audible.
N4	16/3	22:42	39	42	44	45	47	56	59	Nil	IA	IA	36	46	1.2 m/s @ 127° E class stability -0.3°C/100m VTG Y	Nil	**Ashton Coal inaudible.** Other mines in the vicinity (<35 dB $L_{Aeq,15\ minute}$), powerline hum, insects and frogs consistently audible. Traffic on the New England Highway 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 inaudible during the entire operator-attended noise survey. Given this and the measured background noise level of 36 dB L_{A90}, the Ashton Coal $L_{Aeq,15\ minute}$ mine noise contribution was below the relevant noise limit. Ashton Coal noise contributions complied with the DC and EPL noise limits. Other ambient noise sources included other mines in the vicinity, insects, frogs, traffic on the New England Highway, bird noise and train horns (unrelated to Ashton Coal). A graph of the total linear noise levels measured in each one-third octave frequency bands is shown in Figure 5.1.

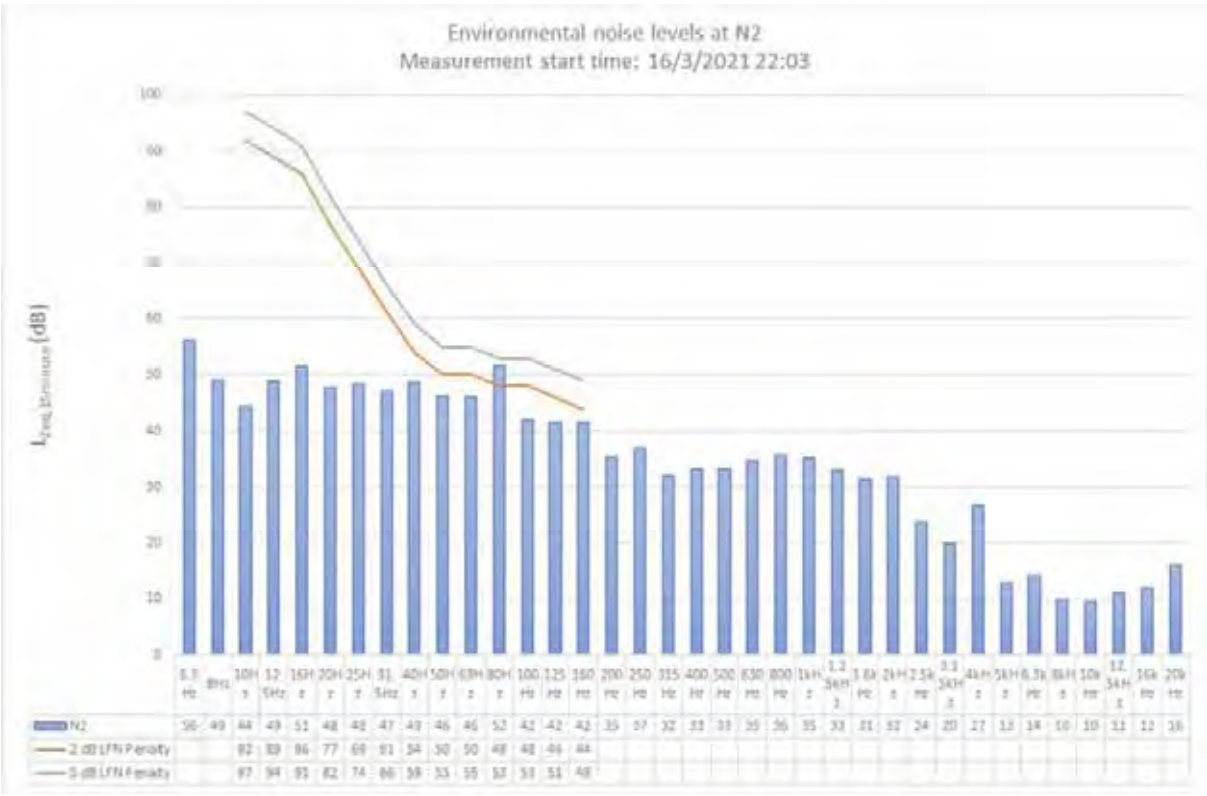

Figure 5.1 N2 total measured one-third octave band frequencies

Other 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 $L_{Aeq,night}$ <29 dB ($L_{Aeq,15\ minute}$ <30 dB - 3 dB + 2 dB as per NPfI methodology), including a 2 dB positive adjustment for LFN. This 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 entire operator-attended noise survey. Given this and the measured background noise level of 33 dB L_{A90}, the Ashton Coal $L_{Aeq,15\ minute}$ mine noise contribution was below the relevant noise limit. Ashton Coal noise contributions complied with the DC and EPL noise limits. Other ambient noise sources included other mines in the vicinity, insects, frogs, traffic on the New England Highway, bird noise, dogs barking and nearby animals. A graph of the total linear noise levels measured in the one-third octave frequency bands is shown in Figure 5.2.

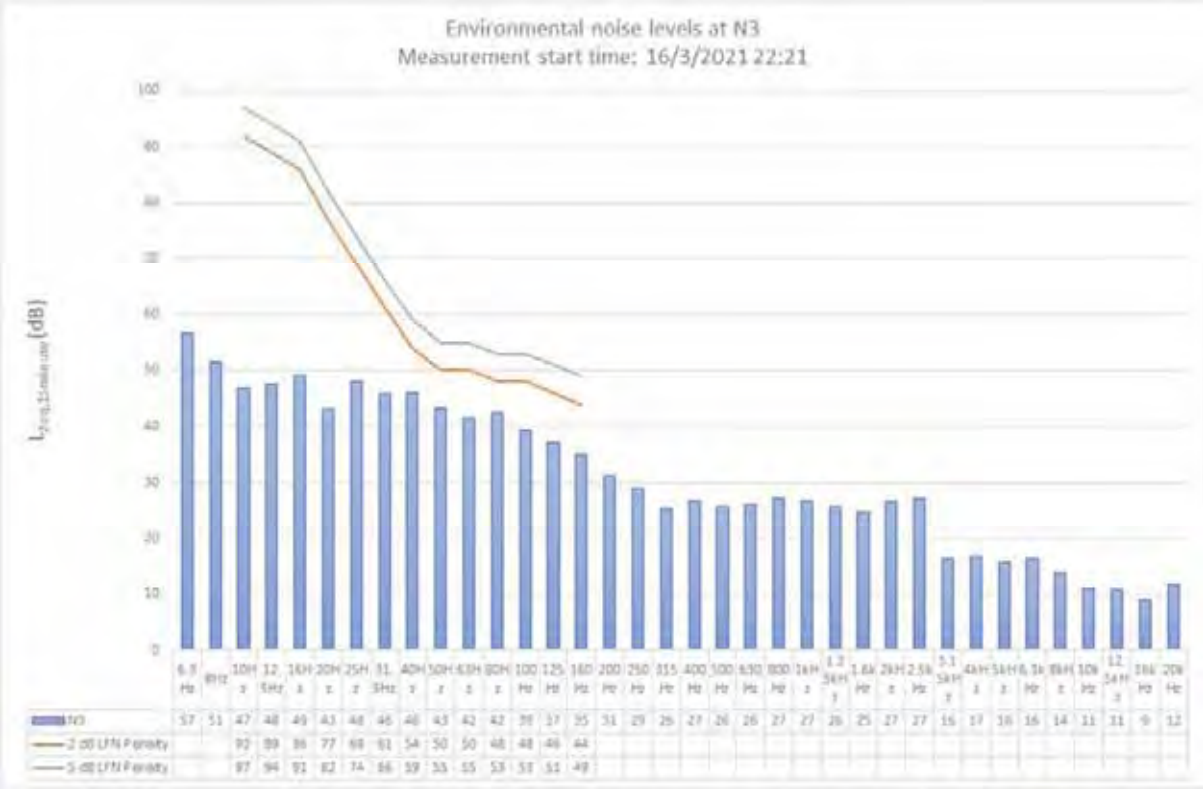

Figure 5.2 N3 total measured one-third octave band frequencies

Other 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 (ie $L_{Aeq,15\ minute}$ <30 dB - 3 dB as per NPfI methodology). This 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 entire operator-attended noise survey. Given this and the measured background noise level of 42dB L_{A90}, the Ashton Coal $L_{Aeq,15\ minute}$ mine noise contribution was below the relevant noise limit. Ashton Coal noise contributions complied with the DC and EPL noise limits. Other ambient noise sources included other mines in the vicinity, insects, frogs, traffic on the New England Highway and powerline hum. A graph of the total linear noise levels measured in one-third octave frequency bands is shown below in Figure 5.3.

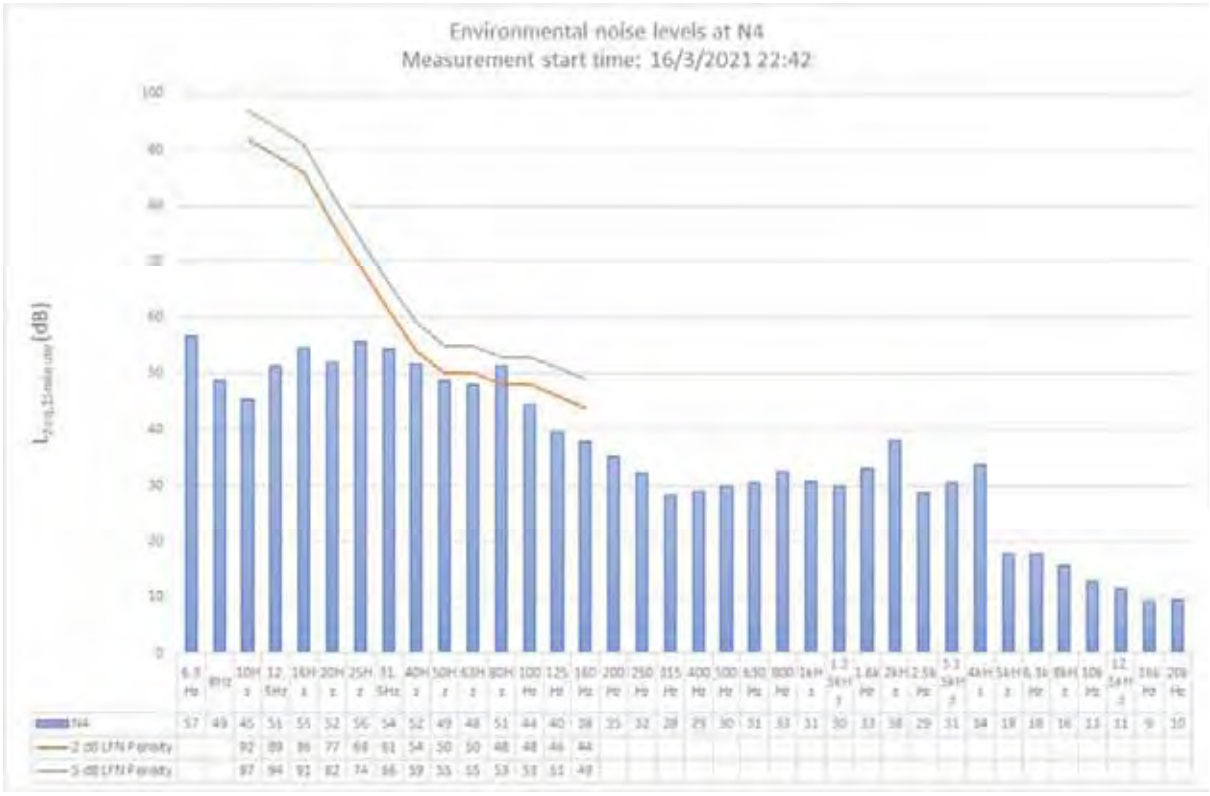

Figure 5.3 N4 total measured one-third octave band frequencies

Other 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 ($L_{Aeq,15\ minute}$ <35 dB - 3 dB + 2 dB as per NPfI methodology), including a 2 dB positive adjustment for LFN. This 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 16 March 2021.

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 DC and EPL.

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

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.

L3.2 The Licensee must not dispose of waste on the premises unless authorised by a condition of 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 12 and 32.

4 Operating Conditions

Appendix C

Calibration certificates

CERTIFICATE OF CALIBRATION

CERTIFICATE NO: C28769

EQUIPMENT TESTED: Sound Level Calibrator

Manufacturer: B & K
Type No: 4230 **Serial No:** 1276091
Owner: EMM Consulting
Level 3, 175 Scott 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	93.83	996.49	1.41
Level 2:	NA	N	NA	NA	NA
Uncertainty:			±0.11 dB	±0.05%	±0.20 %
Uncertainty (at 95% c.l.) k=2					

CONDITIONS OF TEST:

Ambient Pressure: 994 hPa ±1.5 hPa **Relative Humidity:** 59 % ±5%
Temperature: 23 °C ±2° C
Date of Calibration: 05/02/2021 **Issue Date:** 08/02/2021
Acu-Vib Test Procedure: AVP02 (Calibrators)
Test Method: AS IEC 60942 - 2017

CHECKED BY: ..... **AUTHORISED SIGNATURE:** .....
Hein Soe

.Accredited for compliance with ISO/IEC 17025 – Calibration
Results of the tests, calibration and/or measurements included in this document are traceable to SI units through reference equipment that has been calibrated by the Australian National Measurement Institute or other NATA accredited laboratories demonstrating traceability.

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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Tel: (02) 96808133 Fax: (02)96808233
Mobile: 0413 809806
Web site: www.acu-vib.com.au

CERTIFICATE OF CALIBRATION

CERTIFICATE NO.: SLM 26291 & FILT 5615

Equipment Description:	Sound Level Meter		
Manufacturer:	B & K		
Model No:	2250	**Serial No:**	2759405
Microphone Type:	4189	**Serial No:**	2888134
Preamplifier Type:	ZC0032	**Serial No:**	16037
Filter Type:	1/3 Octave	**Serial No:**	2759405
Comments:	All tests passed for class 1. (See over for details)		
Owner:	EMM Consulting Level 3, 175 Scott Street Newcastle, NSW 2300		
Ambient Pressure:	1007 hPa ±1.5 hPa		
Temperature:	24 °C ±2° C	**Relative Humidity:**	53% ±5%
Date of Calibration:	05/02/2020	**Issue Date:**	05/02/2020

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

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

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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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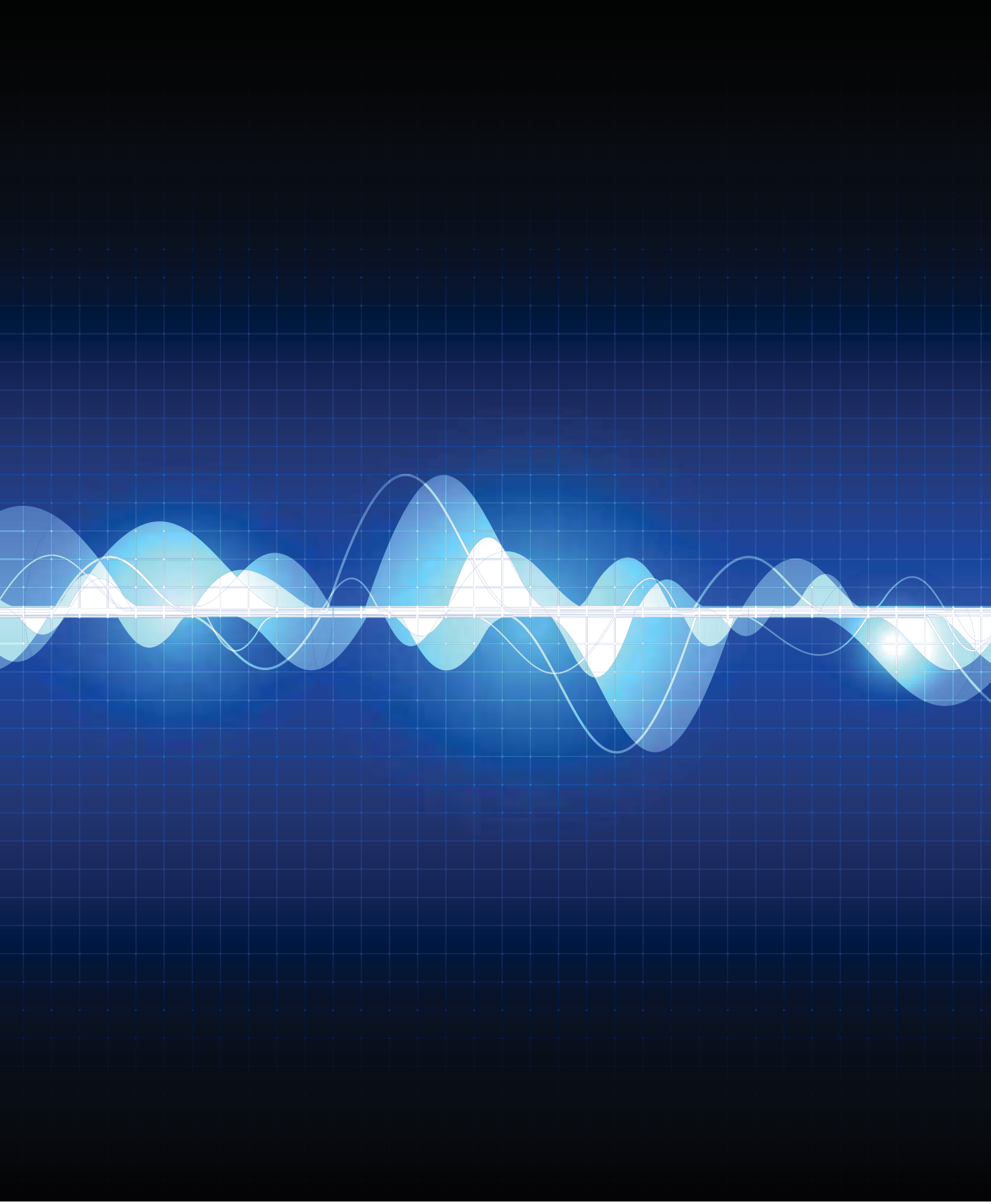
Acoustic and Vibration Measurements



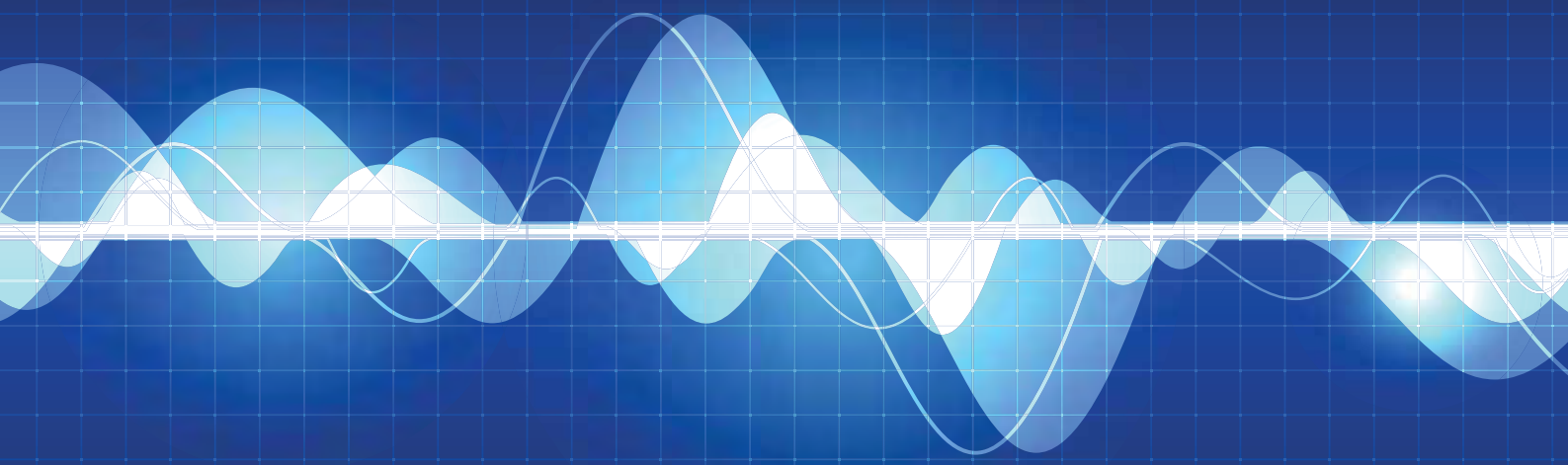
Appendix D

Monthly attended noise monitoring report - April 2021

Ashton Coal

Monthly attended noise monitoring
April 2021

Prepared for Ashton Coal Operations Pty Ltd
May 2021



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Prepared for Ashton Coal Operations Pty Ltd
May 2021

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Ashton Coal

Monthly attended noise monitoring - April 2021

Report Number

H200894 RP4

Client

Ashton Coal Operations Pty Ltd

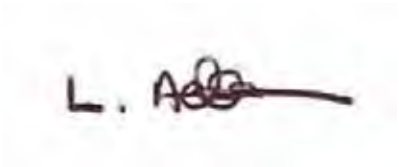
Date

7 May 2021

Version

v1-0 Final

Prepared by



Lucas Adamson
Senior Acoustic Consultant
7 May 2021

Approved by

Katie Teyhan
Associate
7 May 2021

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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 26 April 2021.

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 26 April 2021);
- Environment Protection Authority (EPA), Environment Protection License 11879, as varied on 3 February 2020 (current as of 26 April 2021);
- Ashton Coal Project Noise Management Plan (NMP), approved by DPIE on 23 September 2020 (current as of 26 April 2021);
- 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

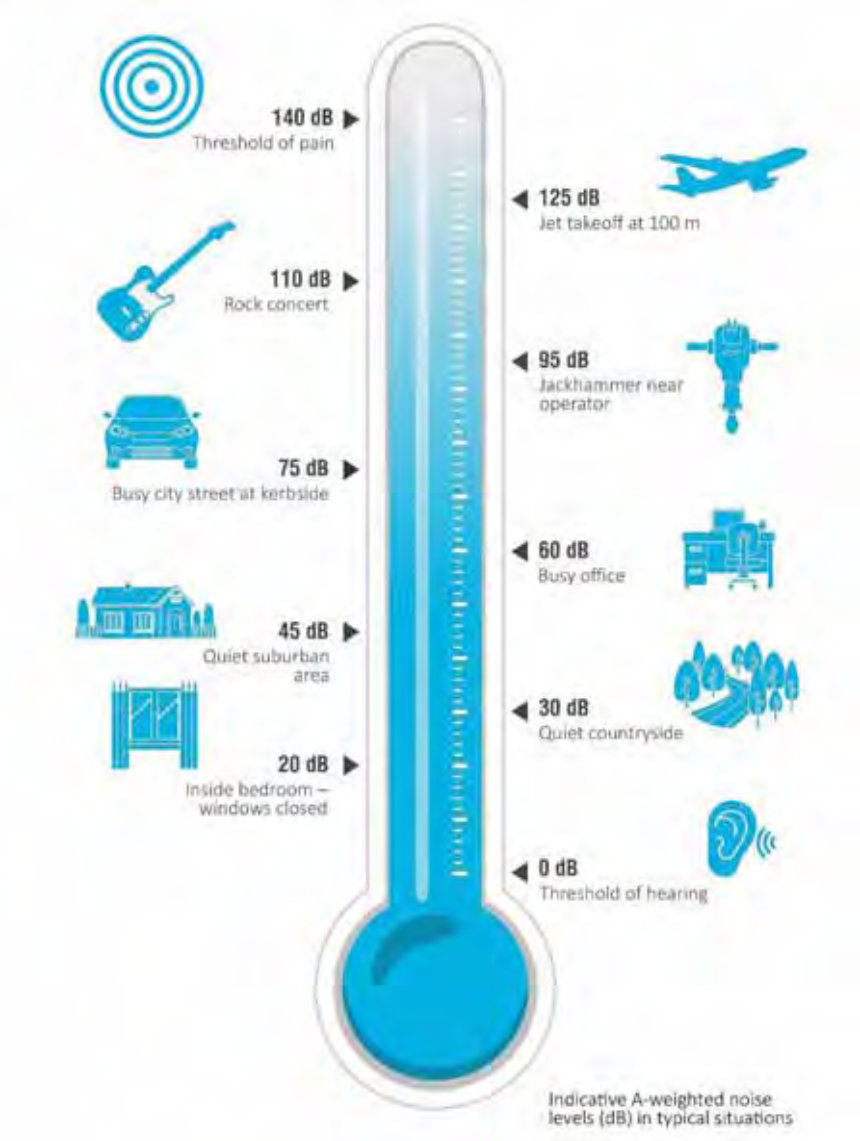

Figure 2.1 Common noise levels

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 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 completion of the noise monitoring 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

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

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

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 E1 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 Ashton Coal 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 26 April 2021. Noise from Ashton Coal operations was inaudible during all three operator-attended noise surveys.

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 not to be applicable during any of the three measurements due to the presence of an atmospheric stability Category G at the time of the measurements.

Low frequency noise is typically 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, where site is audible. Given that Ashton Coal was not audible during any of the three measurements, LFN modifying factors were not applied to site noise levels at any of the locations. Notwithstanding the preceding, it is noted that total measured noise levels exceeded the relevant LFN thresholds during one of the three measurements (at N2). Therefore, in accordance with the NPfI, LFN modifying factors were applied to estimated cumulative noise levels at location N2..

Ashton Coal noise contributions and cumulative mine noise contributions were below (i.e. complied with) the relevant noise limits, had they applied, at all monitoring locations.

Table 5.1 Ashton Coal attended noise monitoring results – April 2021

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	26/4	22:18	30	36	47	51	56	62	57	Nil	IA	IA	36	46	2.3 m/s @ 142° G class stability 7.4°C/100m VTG N	N/A	**Ashton Coal inaudible.** Other mines in the vicinity (<29 dB $L_{Aeq,15\ minute}$), insects and frogs consistently audible. Traffic on the New England Highway frequently audible. Bird noise, nearby animals and a train on the main line (unrelated to Ashton Coal) occasionally audible.
N3	26/4	22:36	31	36	48	49	61	66	58	Nil	IA	IA	36	46	1.7 m/s @ 154° G class stability 6.0°C/100m VTG N	N/A	**Ashton Coal inaudible.** Other mines in the vicinity (<31 dB $L_{Aeq,15\ minute}$), insects and frogs consistently audible. Traffic on the New England Highway frequently audible. Bird noise and a train on the main line (unrelated to Ashton Coal) occasionally audible.
N4	26/4	22:58	26	29	37	41	47	56	52	Nil	IA	IA	36	46	0.9 m/s @ 193° G class stability 5.5°C/100m VTG N	N/A	**Ashton Coal inaudible.** Other mines in the vicinity (<29 dB $L_{Aeq,15\ minute}$), insects and frogs consistently audible. Traffic on the New England Highway 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 inaudible during the entire operator-attended noise survey. Given this and the measured background noise level of 36 dB L_{A90}, the Ashton Coal $L_{Aeq,15\ minute}$ mine noise contribution was below the relevant noise limit. Ashton Coal noise contributions would have complied with the DC and EPL noise limits, had they applied. Other ambient noise sources included other mines in the vicinity, insects, frogs, traffic on the New England Highway, bird noise, nearby animals and a train on the main line (unrelated to Ashton Coal). A graph of the total linear noise levels measured in each one-third octave frequency bands is shown in Figure 5.1.

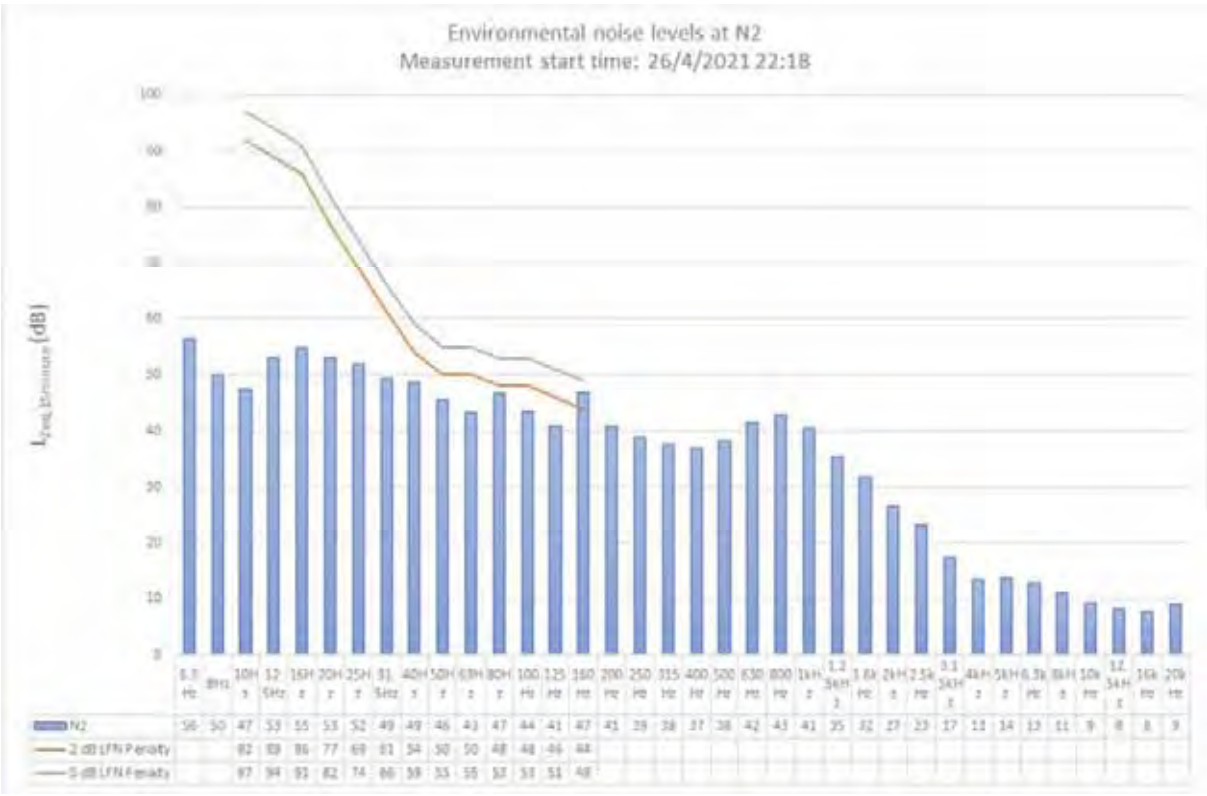

Figure 5.1 N2 total measured one-third octave band frequencies

Other 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 $L_{Aeq,night}$ <27 dB ($L_{Aeq,15\ minute}$ <29 dB - 3 dB + 2 dB as per NPfI methodology), including a 2 dB positive adjustment for LFN. This 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 entire operator-attended noise survey. Given this and the measured background noise level of 36 dB L_{A90}, the Ashton Coal $L_{Aeq,15\ minute}$ mine noise contribution was below the relevant noise limit. Ashton Coal noise contributions would have complied with the DC and EPL noise limits, had they applied. Other ambient noise sources included other mines in the vicinity, insects, frogs, traffic on the New England Highway, bird noise and a train on the main line (unrelated to Ashton Coal). A graph of the total linear noise levels measured in the one-third octave frequency bands is shown in Figure 5.2.

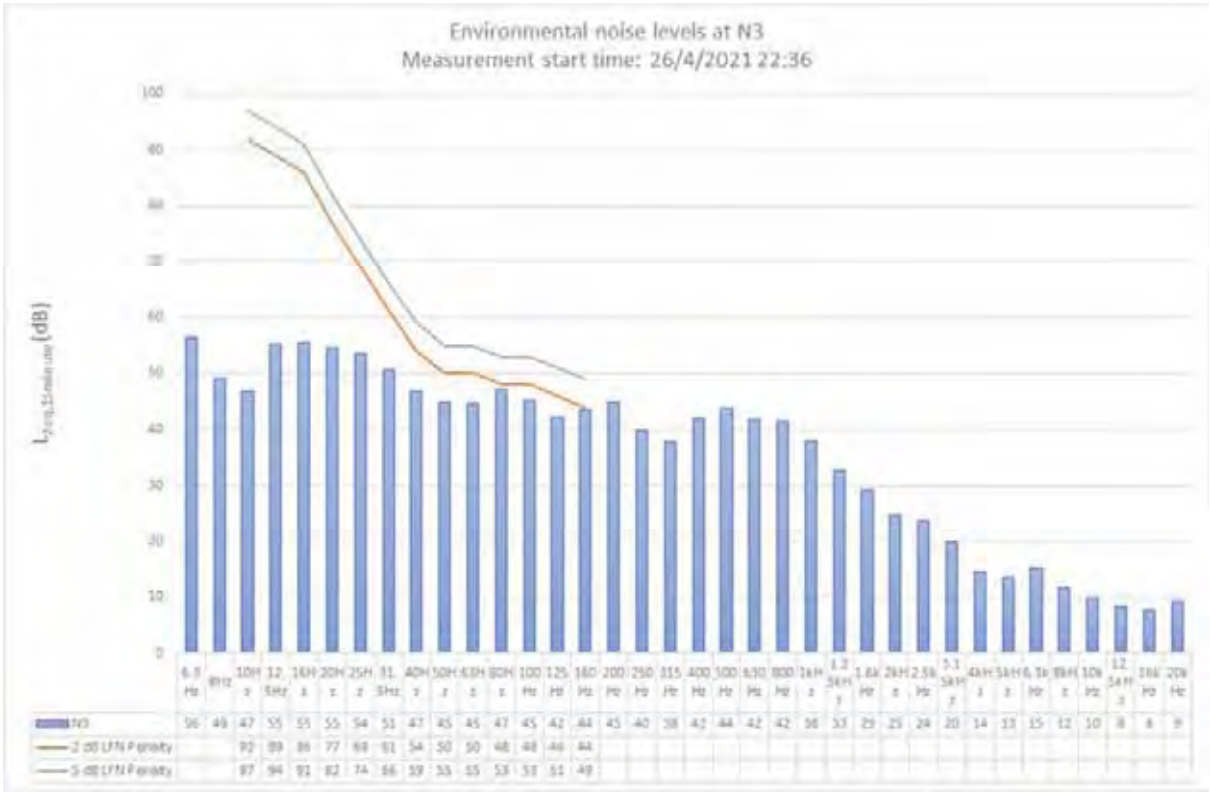

Figure 5.2 N3 total measured one-third octave band frequencies

Other 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 $L_{Aeq,night}$ <28 dB (ie $L_{Aeq,15\ minute}$ <31 dB - 3 dB as per NPfI methodology). This 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 entire operator-attended noise survey. Given this and the measured background noise level of 29 dB L_{A90}, the Ashton Coal $L_{Aeq,15\ minute}$ mine noise contribution was below the relevant noise limit. Ashton Coal noise contributions would have complied with the DC and EPL noise limits, had they applied. Other ambient noise sources included other mines in the vicinity, insects, frogs and traffic on the New England Highway. A graph of the total linear noise levels measured in one-third octave frequency bands is shown below in Figure 5.3.

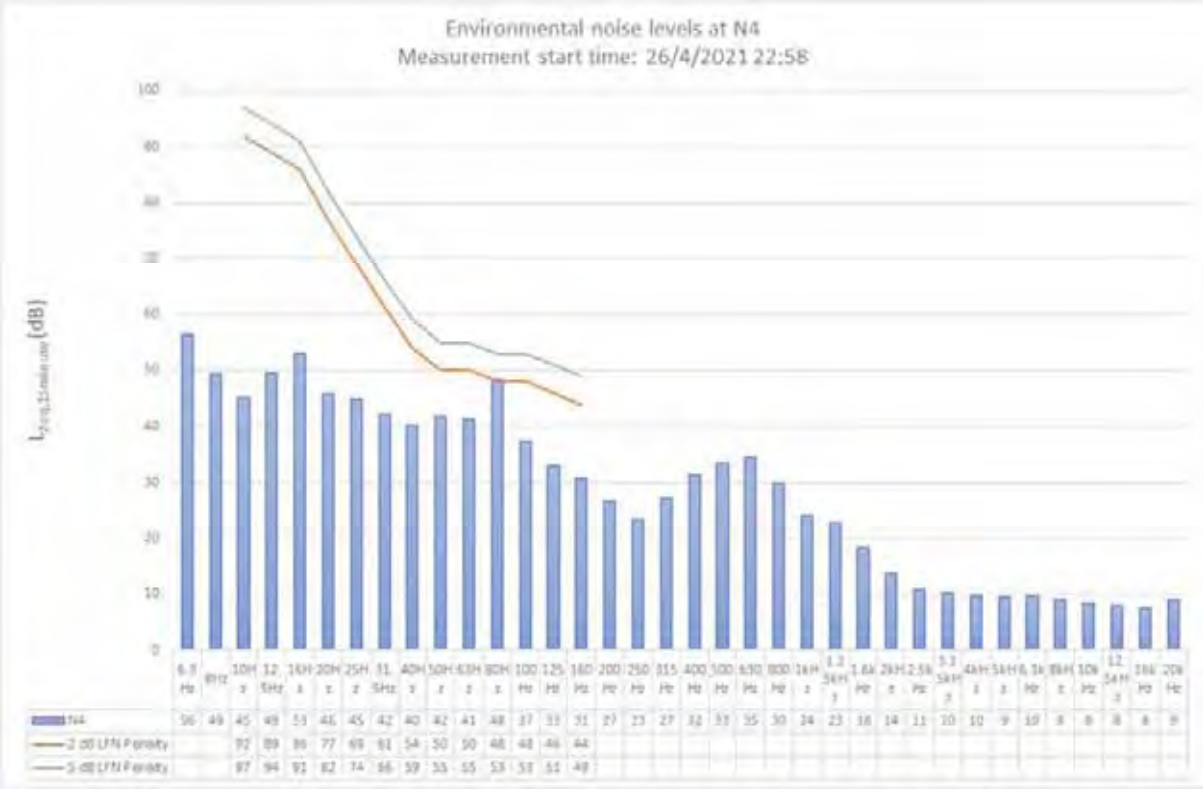

Figure 5.3 N4 total measured one-third octave band frequencies

Other 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 $L_{Aeq,night}$ <26 dB ($L_{Aeq,15\ minute}$ <29 dB - 3 dB as per NPfI methodology). This 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 26 April 2021.

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 not to be applicable during any of the three measurements due to the presence of an atmospheric stability Category G 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 DC and EPL.

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

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.

L3.2 The Licensee must not dispose of waste on the premises unless authorised by a condition of 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 12 and 32.

4 Operating Conditions

Appendix C

Calibration certificates

CERTIFICATE OF CALIBRATION

CERTIFICATE NO: C28769

EQUIPMENT TESTED: Sound Level Calibrator

Manufacturer: B & K
Type No: 4230 **Serial No:** 1276091
Owner: EMM Consulting
Level 3, 175 Scott 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	93.83	996.49	1.41
Level 2:	NA	N	NA	NA	NA
Uncertainty:			±0.11 dB	±0.05%	±0.20 %
Uncertainty (at 95% c.l.) k=2					

CONDITIONS OF TEST:

Ambient Pressure: 994 hPa ±1.5 hPa **Relative Humidity:** 59 % ±5%
Temperature: 23 °C ±2° C
Date of Calibration: 05/02/2021 **Issue Date:** 08/02/2021
Acu-Vib Test Procedure: AVP02 (Calibrators)
Test Method: AS IEC 60942 - 2017

CHECKED BY: ..... **AUTHORISED SIGNATURE:** .....
Hein Soe

.Accredited for compliance with ISO/IEC 17025 – Calibration
Results of the tests, calibration and/or measurements included in this document are traceable to SI units through reference equipment that has been calibrated by the Australian National Measurement Institute or other NATA accredited laboratories demonstrating traceability.

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

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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 26291 & FILT 5615

Equipment Description:	Sound Level Meter		
Manufacturer:	B & K		
Model No:	2250	**Serial No:**	2759405
Microphone Type:	4189	**Serial No:**	2888134
Preamplifier Type:	ZC0032	**Serial No:**	16037
Filter Type:	1/3 Octave	**Serial No:**	2759405
Comments:	All tests passed for class 1. (See over for details)		
Owner:	EMM Consulting Level 3, 175 Scott Street Newcastle, NSW 2300		
Ambient Pressure:	1007 hPa ±1.5 hPa		
Temperature:	24 °C ±2° C	**Relative Humidity:**	53% ±5%
Date of Calibration:	05/02/2020	**Issue Date:**	05/02/2020

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

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.

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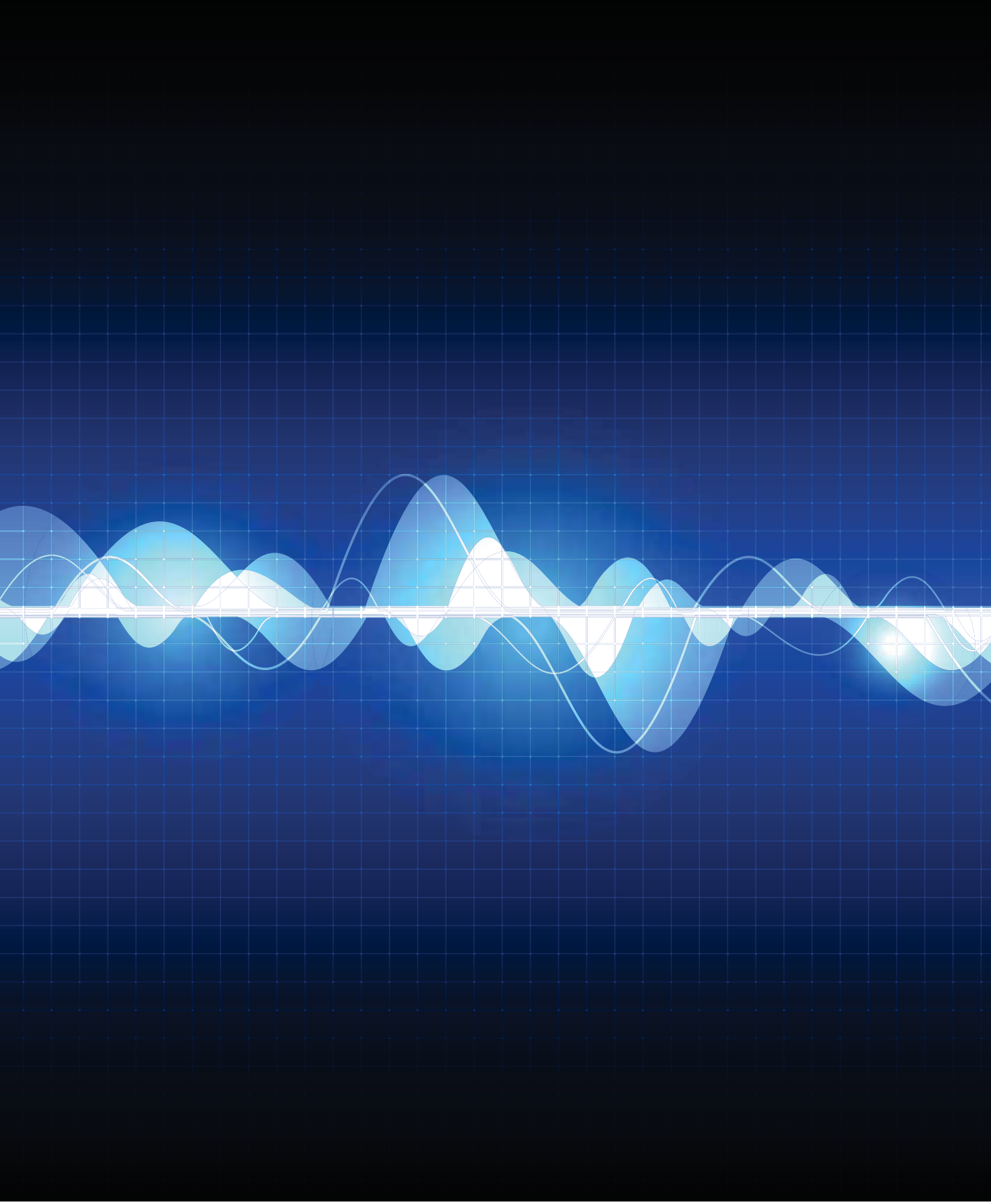


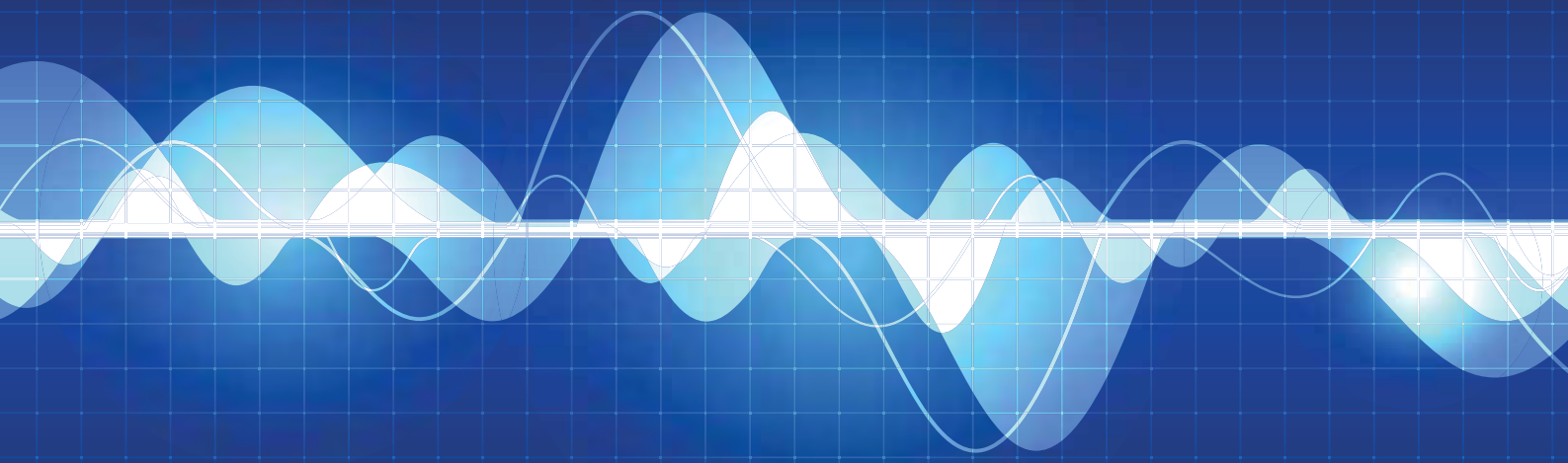
Appendix E

Monthly attended noise monitoring report - May 2021

Ashton Coal

Monthly attended noise monitoring
May 2021

Prepared for Ashton Coal Operations Pty Ltd
May 2021



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Prepared for Ashton Coal Operations Pty Ltd
May 2021

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Ashton Coal

Monthly attended noise monitoring - May 2021

Report Number

H200894 RP5

Client

Ashton Coal Operations Pty Ltd

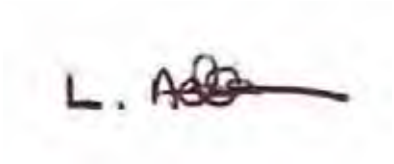
Date

28 May 2021

Version

v1-0 Final

Prepared by



Lucas Adamson
Senior Acoustic Consultant
28 May 2021

Approved by

Katie Teyhan
Associate
28 May 2021

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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 19 May 2021.

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 19 May 2021);
- Environment Protection Authority (EPA), Environment Protection License 11879, as varied on 3 February 2020 (current as of 19 May 2021);
- Ashton Coal Project Noise Management Plan (NMP), approved by DPIE on 23 September 2020 (current as of 19 May 2021);
- 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

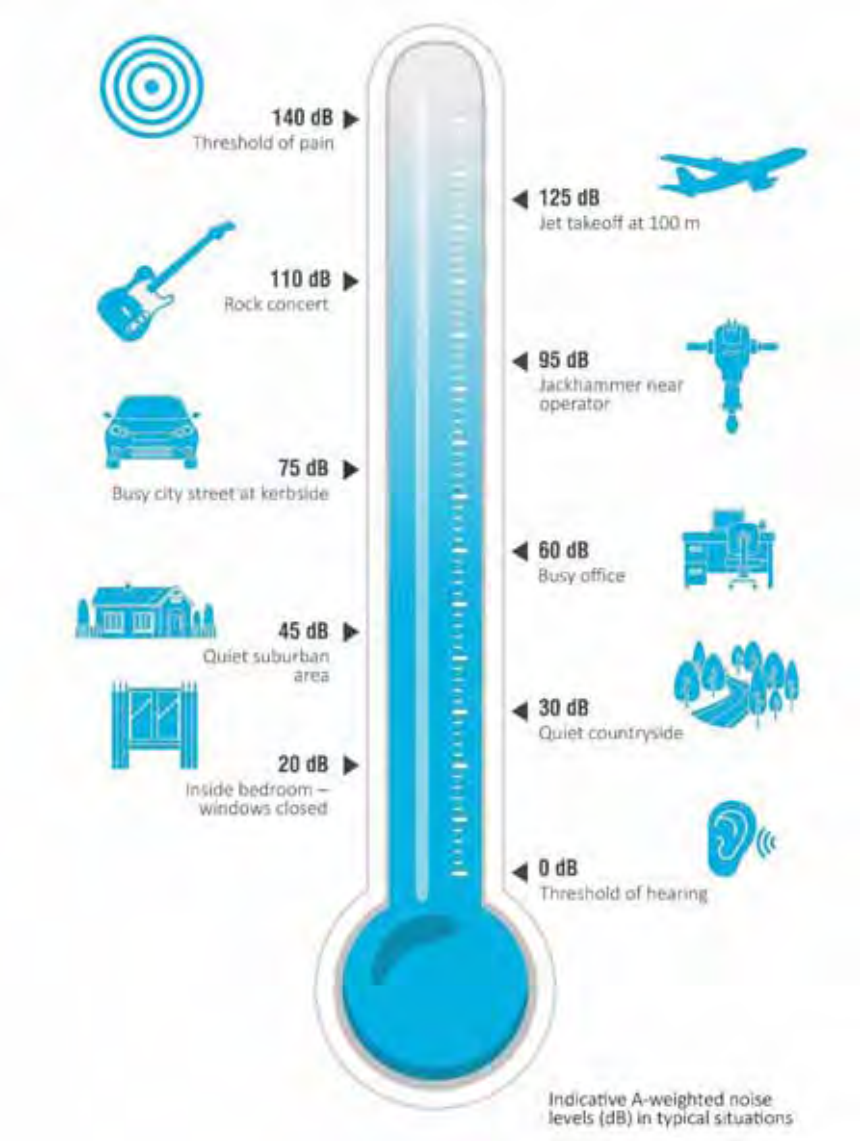

Figure 2.1 Common noise levels

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 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 completion of the noise monitoring 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 Svantek SV-36 calibrator (s/n 79952). 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

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

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

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 E1 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 Ashton Coal 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 19 May 2021. Noise from Ashton Coal operations was audible during two of the three operator-attended noise surveys; at N2 and N3.

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 not to be applicable during any of the three measurements due to the presence of an atmospheric stability Category G at the time of the measurements.

Low frequency noise is typically 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, where site is audible. Total measured noise levels exceeded the relevant LFN thresholds during all three measurements however, noise limits were not applicable during the times of these measurements due to a G class atmospheric stability category. Therefore, in accordance with the NPfI, LFN modifying factors were not applied to estimated site (or cumulative) noise levels at any of the locations.

Ashton Coal noise contributions and cumulative mine noise contributions were below (i.e. complied with) the relevant noise limits, had they applied, at all monitoring locations.

Table 5.1 Ashton Coal attended noise monitoring results – May 2021

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	19/5	22:00	36	39	46	49	53	65	60	Nil	<32	35	36	46	2.2 m/s @ 181° G class stability 5.5°C/100m VTG N	N/A	**Ashton Coal mine hum consistently audible with engine revs on occasion.** Other mines in the vicinity (<34 dB $L_{Aeq,15\ minute}$), insects, frogs, nearby roadworks (unrelated to Ashton Coal) and traffic on the New England Highway consistently audible. Resident noise and a train on the main line (unrelated to Ashton Coal) occasionally audible.
N3	19/5	22:17	35	39	46	49	56	68	60	Nil	<32	34	36	46	1.1 m/s @ 191° G class stability 4.8°C/100m VTG N	N/A	**Ashton Coal mine hum consistently audible with engine revs on occasion.** Other mines in the vicinity (<35 dB $L_{Aeq,15\ minute}$), insects, frogs, nearby roadworks (unrelated to Ashton Coal) and traffic on the New England Highway consistently audible. Livestock and a train on the main line (unrelated to Ashton Coal) occasionally audible.
N4	19/5	22:40	35	38	42	44	47	67	59	Nil	IA	IA	36	46	0.6 m/s @ 239° G class stability 5.8°C/100m VTG N	N/A	**Ashton Coal inaudible.** Other mines in the vicinity (<35 dB $L_{Aeq,15\ minute}$), nearby roadworks (unrelated to Ashton Coal) and traffic on the New England Highway 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 N2 - Camberwell Village (west)

Ashton Coal operations were consistently audible during the operator-attended noise survey including mine hum with engine revs on occasion. The Ashton Coal mine noise contribution was estimated at <32 dB $L_{Aeq,15\ minute}$. Engine revs from site generated an estimated 35 dB L_{Amax}. Ashton Coal noise contributions would have complied with the DC and EPL noise limits, had they applied. Other ambient noise sources included other mines in the vicinity, insects, frogs, traffic on the New England Highway, nearby roadworks (unrelated to Ashton Coal), resident noise and a train on the main line (unrelated to Ashton Coal). A graph of the total linear noise levels measured in each one-third octave frequency bands is shown in Figure 5.1.

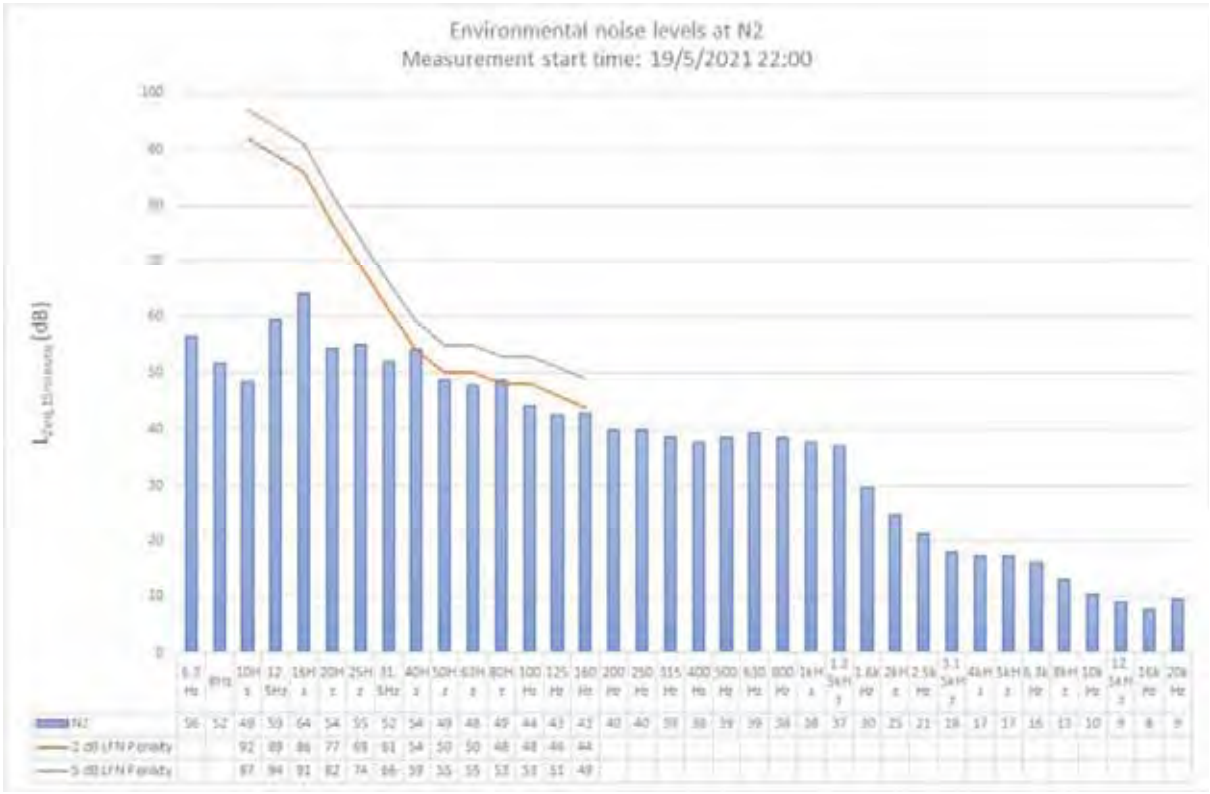

Figure 5.1 N2 total measured one-third octave band frequencies

Other 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 <33 dB $L_{Aeq,night}$ (i.e. Ashton Coal noise of <32 dB $L_{Aeq,15\ minute}$ + other mine noise of <34 dB $L_{Aeq,15\ minute}$ = total cumulative mine noise of <36 dB $L_{Aeq,15\ minute}$ - 3 dB as per NPfI methodology). This 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 mine hum with engine revs on occasion. The Ashton Coal mine noise contribution was estimated at <32 dB $L_{Aeq,15\ minute}$. Engine revs from site generated an estimated 34 dB L_{Amax}. Ashton Coal noise contributions would have complied with the DC and EPL noise limits, had they applied. Other ambient noise sources included other mines in the vicinity, insects, frogs, traffic on the New England Highway, nearby roadworks (unrelated to Ashton Coal), livestock and a train on the main line (unrelated to Ashton Coal). A graph of the total linear noise levels measured in the one-third octave frequency bands is shown in Figure 5.2.

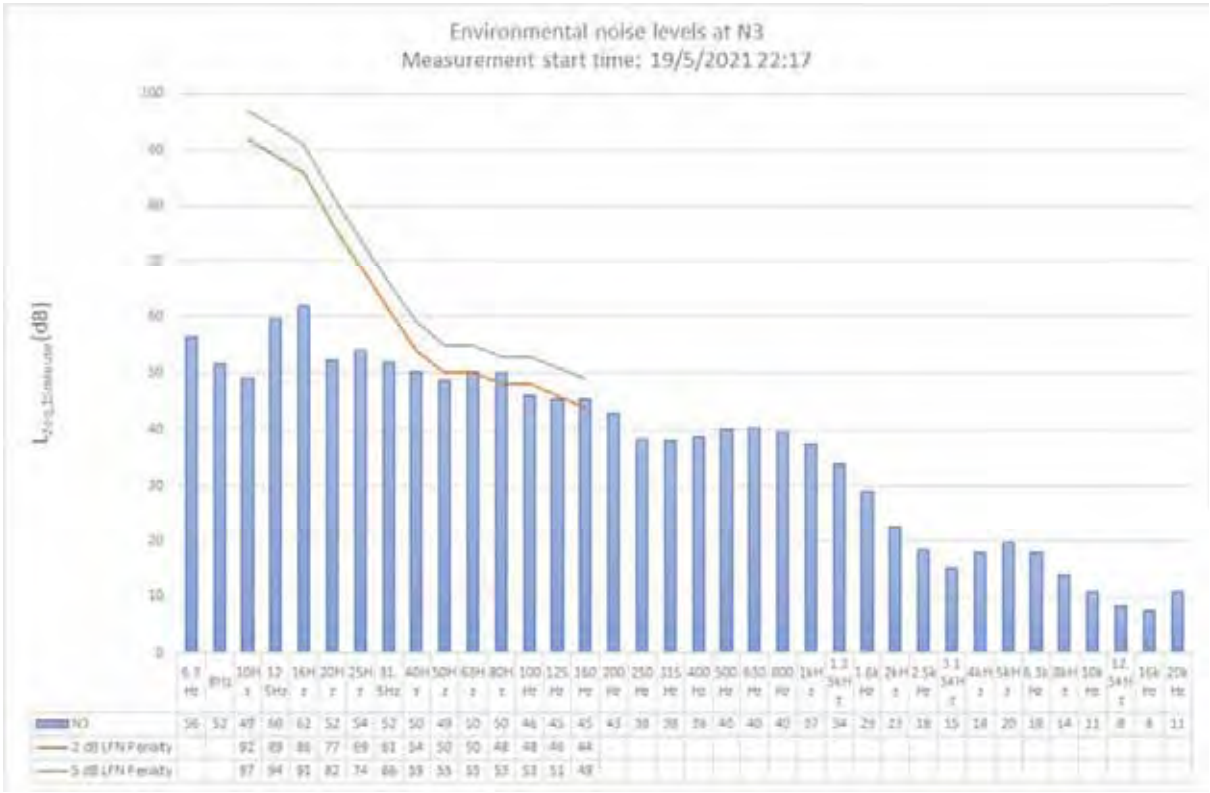

Figure 5.2 N3 total measured one-third octave band frequencies

Other 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 <33 dB $L_{Aeq,night}$ (i.e. Ashton Coal noise of <32 dB $L_{Aeq,15\ minute}$ + other mine noise of <35 dB $L_{Aeq,15\ minute}$ = total cumulative mine noise of <36 dB $L_{Aeq,15\ minute}$ - 3 dB as per NPfI methodology). This 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 entire operator-attended noise survey. Typically, when a particular source is not audible above local ambient noise levels, the likely contribution of that source is at least 10 dB below the measured background (L_{A90}) level. Given this and the measured background noise level of 38 dB L_{A90}, the Ashton Coal $L_{Aeq,15\ minute}$ mine noise contribution was estimated to be ≤28 dB $L_{Aeq,15\ minute}$ and therefore below the relevant noise limit. Ashton Coal noise contributions would have complied with the DC and EPL noise limits, had they applied. Other ambient noise sources included other mines in the vicinity, nearby roadworks (unrelated to Ashton Coal) and traffic on the New England Highway. A graph of the total linear noise levels measured in one-third octave frequency bands is shown below in Figure 5.3.

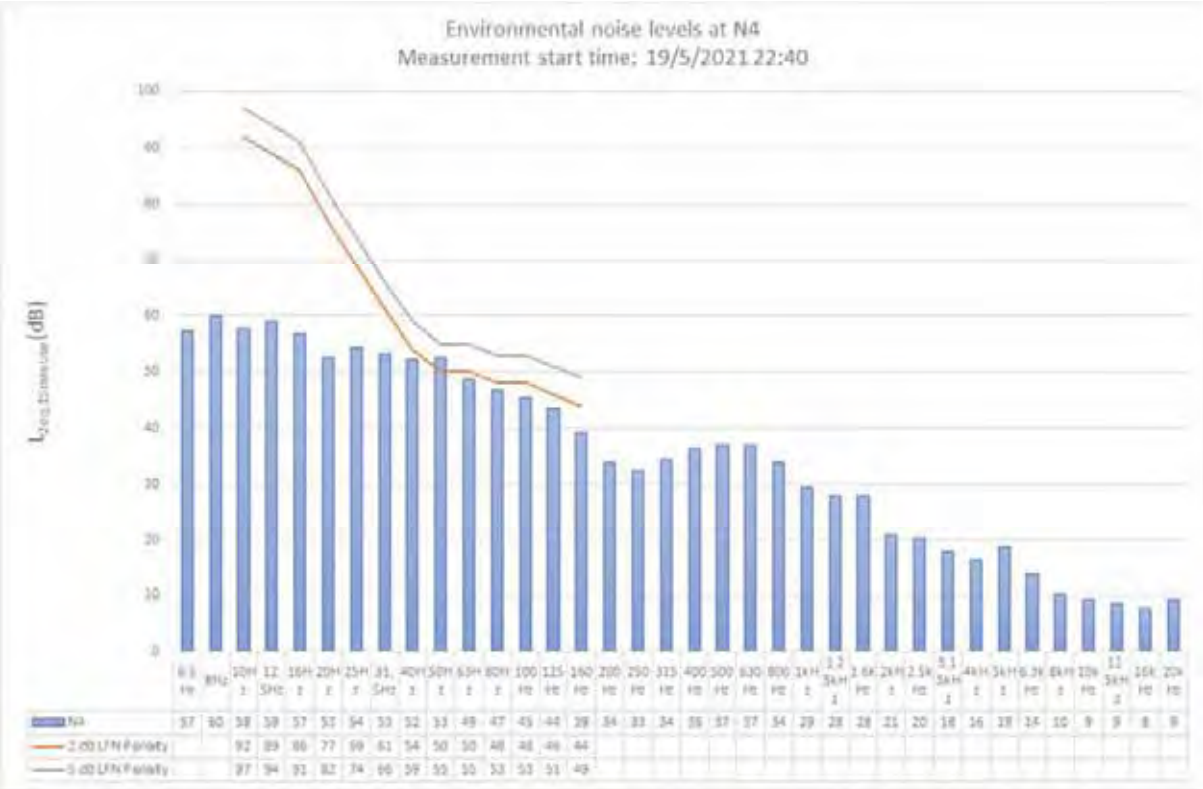

Figure 5.3 N4 total measured one-third octave band frequencies

Other 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 <32 dB $L_{Aeq,night}$ (i.e. Other mine noise of <35 dB $L_{Aeq,15\ minute}$ - 3 dB as per NPfI methodology). This 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 19 May 2021.

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 not to be applicable during any of the three measurements due to the presence of an atmospheric stability Category G 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 DC and EPL.

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

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.

L3.2 The Licensee must not dispose of waste on the premises unless authorised by a condition of 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 12 and 32.

4 Operating Conditions

Appendix C

Calibration certificates

CERTIFICATE OF CALIBRATION

CERTIFICATE NO: C28053

EQUIPMENT TESTED: Sound Level Calibrator

Manufacturer: Svantek
Type No: SV-36 **Serial No:** 79952
Owner: EMM Consulting Pty Ltd
L3, 175 Scott 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	94.13	1000.00	1.26
Level 2:	NA	N	114.04	1000.00	0.50
Uncertainty:			±0.11 dB	±0.05%	±0.20 %
Uncertainty (at 95% c.l.) k=2					

CONDITIONS OF TEST:

Ambient Pressure: 995 hPa ±1.5 hPa **Relative Humidity:** 57 % ±5%
Temperature: 24 °C ±2° C
Date of Calibration: 15/10/2020 **Issue Date:** 16/10/2020
Acu-Vib Test Procedure: AVP02 (Calibrators)
Test Method: AS IEC 60942 - 2017

CHECKED BY: ..... **AUTHORISED SIGNATURE:** .....
Hein Soe

Accredited for compliance with ISO/IEC 17025 – Calibration
Results of the tests, calibration and/or measurements included in this document are traceable to SI units through reference equipment that has been calibrated by the Australian National Measurement Institute or other NATA accredited laboratories demonstrating traceability.

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

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Mobile: 0413 809806
Web site: www.acu-vib.com.au

CERTIFICATE OF CALIBRATION

CERTIFICATE NO.: SLM 26291 & FILT 5615

Equipment Description:	Sound Level Meter		
Manufacturer:	B & K		
Model No:	2250	**Serial No:**	2759405
Microphone Type:	4189	**Serial No:**	2888134
Preamplifier Type:	ZC0032	**Serial No:**	16037
Filter Type:	1/3 Octave	**Serial No:**	2759405
Comments:	All tests passed for class 1. (See over for details)		
Owner:	EMM Consulting Level 3, 175 Scott Street Newcastle, NSW 2300		
Ambient Pressure:	1007 hPa ±1.5 hPa		
Temperature:	24 °C ±2° C	**Relative Humidity:**	53% ±5%
Date of Calibration:	05/02/2020	**Issue Date:**	05/02/2020

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

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.

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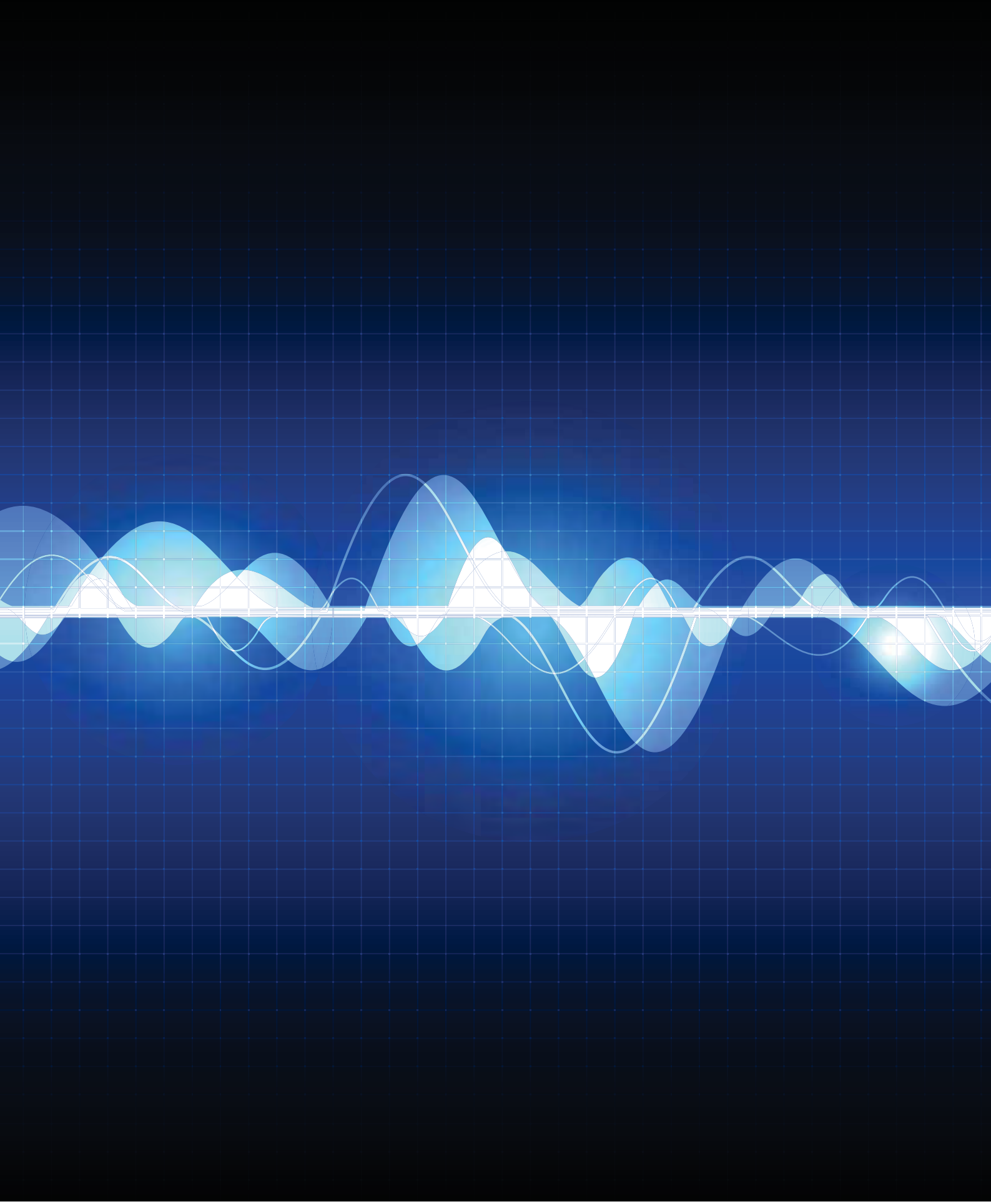


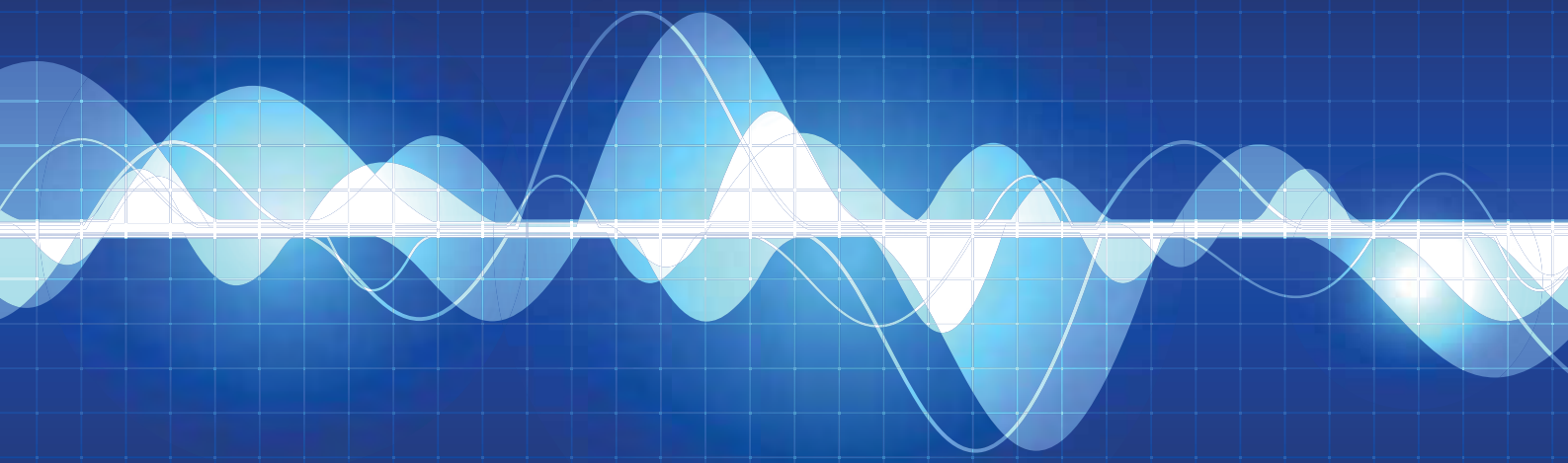
Appendix F

Monthly attended noise monitoring report - June 2021

Ashton Coal

Monthly attended noise monitoring
June 2021

Prepared for Ashton Coal Operations Pty Ltd
July 2021



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Prepared for Ashton Coal Operations Pty Ltd
July 2021

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www.emmconsulting.com.au

Ashton Coal

Monthly attended noise monitoring - June 2021

Report Number

H200894 RP6

Client

Ashton Coal Operations Pty Ltd

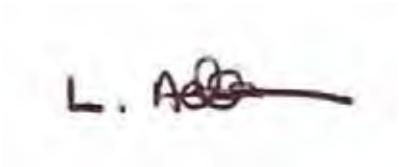
Date

12 July 2021

Version

v1-0 Final

Prepared by



Lucas Adamson
Senior Acoustic Consultant
12 July 2021

Approved by

Katie Teyhan
Associate
12 July 2021

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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 28 June 2021.

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 28 June 2021);
- Environment Protection Authority (EPA), Environment Protection License 11879, as varied on 3 February 2020 (current as of 28 June 2021);
- Ashton Coal Project Noise Management Plan (NMP), approved by DPIE on 23 September 2020 (current as of 28 June 2021);
- 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

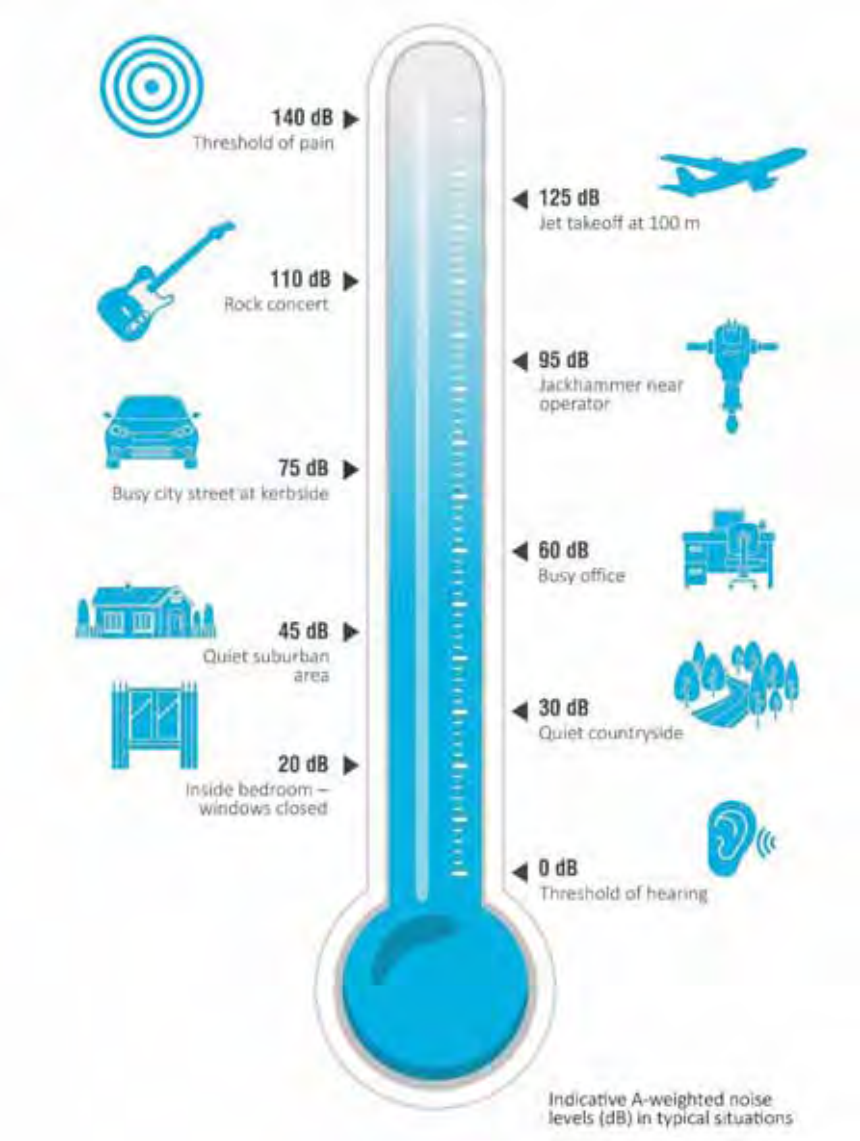

Figure 2.1 Common noise levels

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 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 completion of the noise monitoring 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 Svantek SV-36 calibrator (s/n 79952). 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

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

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

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 E1 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 Ashton Coal 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 28 June 2021. Noise from Ashton Coal operations was inaudible during all three operator-attended noise surveys.

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 not to be applicable during one of the three measurements due to the presence of temperature inversion conditions greater than 3°C/100m at the time of the measurement.

Low frequency noise is typically 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, where site is audible.

Given that Ashton Coal was not audible during any of the three measurements, LFN modifying factors were not applied to site noise levels at any of the locations. Notwithstanding the preceding, it is noted that total measured noise levels exceeded the relevant LFN thresholds during one of the three measurements (at N2). Therefore, in accordance with the NPfI, LFN modifying factors were applied to estimated cumulative noise levels at location N2..

Ashton Coal noise contributions and cumulative mine noise contributions were below (i.e. complied with) the relevant noise limits, had they applied, at all monitoring locations.

Table 5.1 Ashton Coal attended noise monitoring results – June 2021

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	28/6	22:03	32	35	44	48	53	55	57	Nil	IA	IA	36	46	0.6 m/s @ 111° F class stability 3.0°C/100m VTG Y	Nil	**Ashton Coal inaudible.** Other mines in the vicinity (<30 dB $L_{Aeq,15\ minute}$), insects, frogs, resident noise (music) and traffic on the New England Highway consistently audible. Train horns (unrelated to Ashton Coal) occasionally audible.
N3	28/6	22:20	28	31	35	37	43	49	53	Nil	IA	IA	36	46	0.5 m/s @ 88° F class stability 2.9°C/100m VTG Y	Nil	**Ashton Coal inaudible.** Other mines in the vicinity (<30 dB $L_{Aeq,15\ minute}$), insects and frogs consistently audible. Traffic on the New England Highway frequently audible. Distant dogs barking and nearby animals occasionally audible.
N4	28/6	22:41	27	32	38	41	47	56	53	Nil	IA	IA	36	46	0.5 m/s @ 65° F class stability 3.2°C/100m VTG N	N/A	**Ashton Coal inaudible.** Other mines in the vicinity (<30 dB $L_{Aeq,15\ minute}$), insects, frogs and traffic on the New England Highway 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 N2 - Camberwell Village (west)

Ashton Coal operations were inaudible during the entire operator-attended noise survey. Typically, when a particular source is not audible above local ambient noise levels, the likely contribution of that source is at least 10 dB below the measured background (L_{A90}) level. Given this and the measured background noise level of 35 dB L_{A90}, the Ashton Coal $L_{Aeq,15\ minute}$ mine noise contribution was estimated to be ≤25 dB $L_{Aeq,15\ minute}$ and therefore below the relevant noise limit. Ashton Coal noise contributions complied with the DC and EPL noise limits. Other ambient noise sources included other mines in the vicinity, insects, frogs, resident noise (music), train horns (unrelated to Ashton Coal) and traffic on the New England Highway. A graph of the total linear noise levels measured in each one-third octave frequency bands is shown in Figure 5.1.

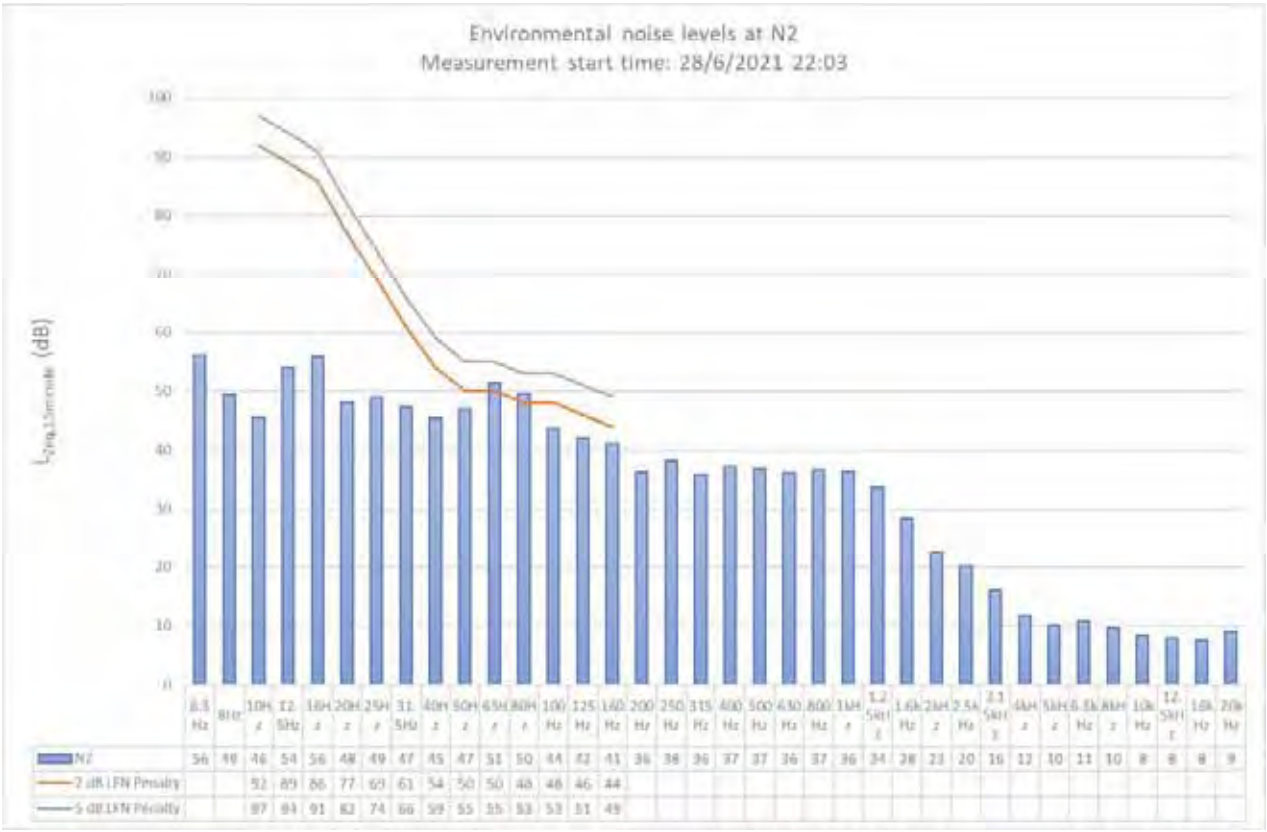

Figure 5.1 N2 total measured one-third octave band frequencies

Other 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 <29 dB $L_{Aeq,night}$ (i.e. Other mine noise of <30 dB $L_{Aeq,15\ minute}$ - 3 dB + 2 dB as per NPfI methodology), including a 2 dB positive adjustment for LFN. This 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 entire operator-attended noise survey. Typically, when a particular source is not audible above local ambient noise levels, the likely contribution of that source is at least 10 dB below the measured background (L_{A90}) level. Given this and the measured background noise level of 31 dB L_{A90}, the Ashton Coal $L_{Aeq,15\ minute}$ mine noise contribution was estimated to be ≤21 dB $L_{Aeq,15\ minute}$ and therefore below the relevant noise limit. Ashton Coal noise contributions complied with the DC and EPL noise limits. Other ambient noise sources included other mines in the vicinity, insects, frogs, distant dogs barking, nearby animals and traffic on the New England Highway. A graph of the total linear noise levels measured in the one-third octave frequency bands is shown in Figure 5.2.

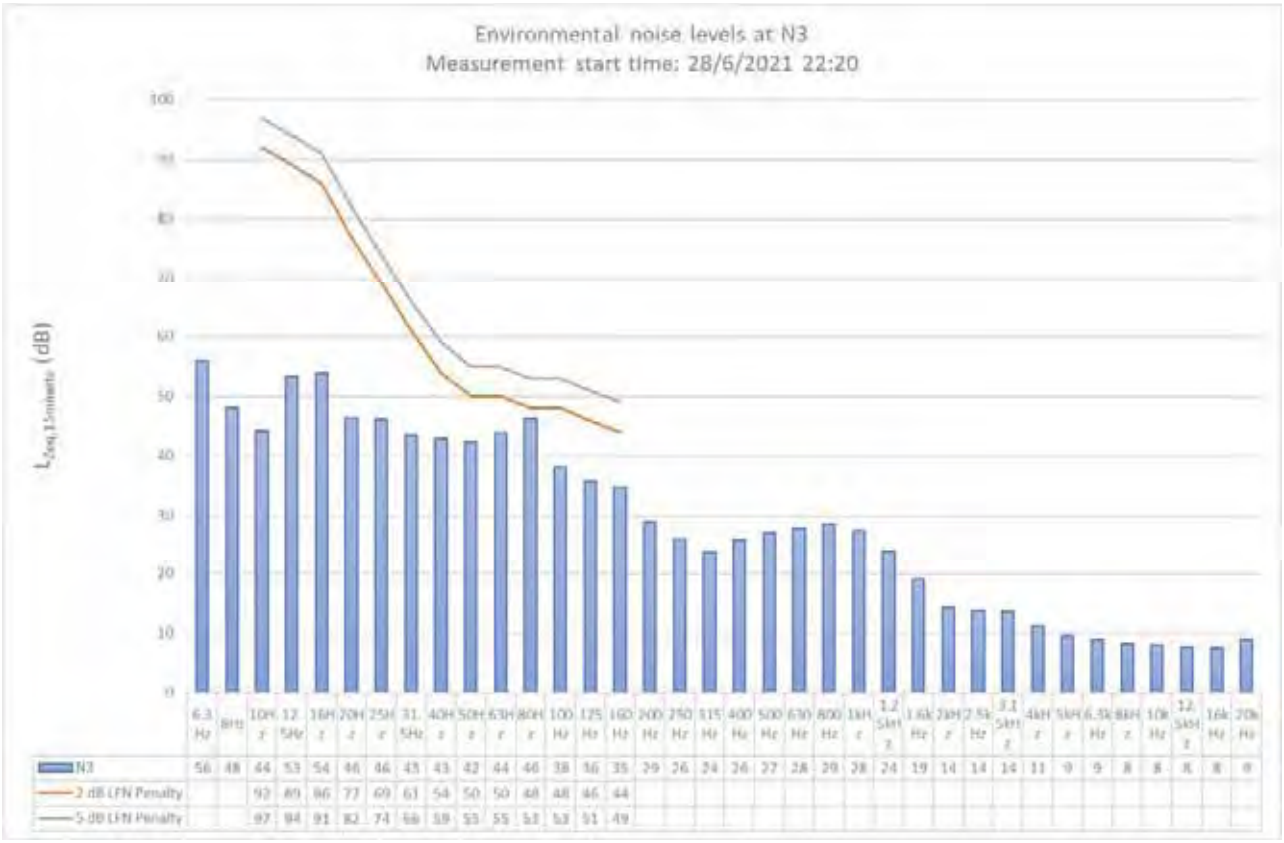

Figure 5.2 N3 total measured one-third octave band frequencies

Other 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 <27 dB $L_{Aeq,night}$ (i.e. Other mine noise of <30 dB $L_{Aeq,15\ minute}$ - 3 dB as per NPfI methodology). This 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 entire operator-attended noise survey. Typically, when a particular source is not audible above local ambient noise levels, the likely contribution of that source is at least 10 dB below the measured background (L_{A90}) level. Given this and the measured background noise level of 32 dB L_{A90}, the Ashton Coal $L_{Aeq,15\ minute}$ mine noise contribution was estimated to be ≤22 dB $L_{Aeq,15\ minute}$ and therefore below the relevant noise limit. Ashton Coal noise contributions would have complied with the DC and EPL noise limits, had they applied. Other ambient noise sources included other mines in the vicinity, insects, frogs and traffic on the New England Highway. A graph of the total linear noise levels measured in one-third octave frequency bands is shown below in Figure 5.3.

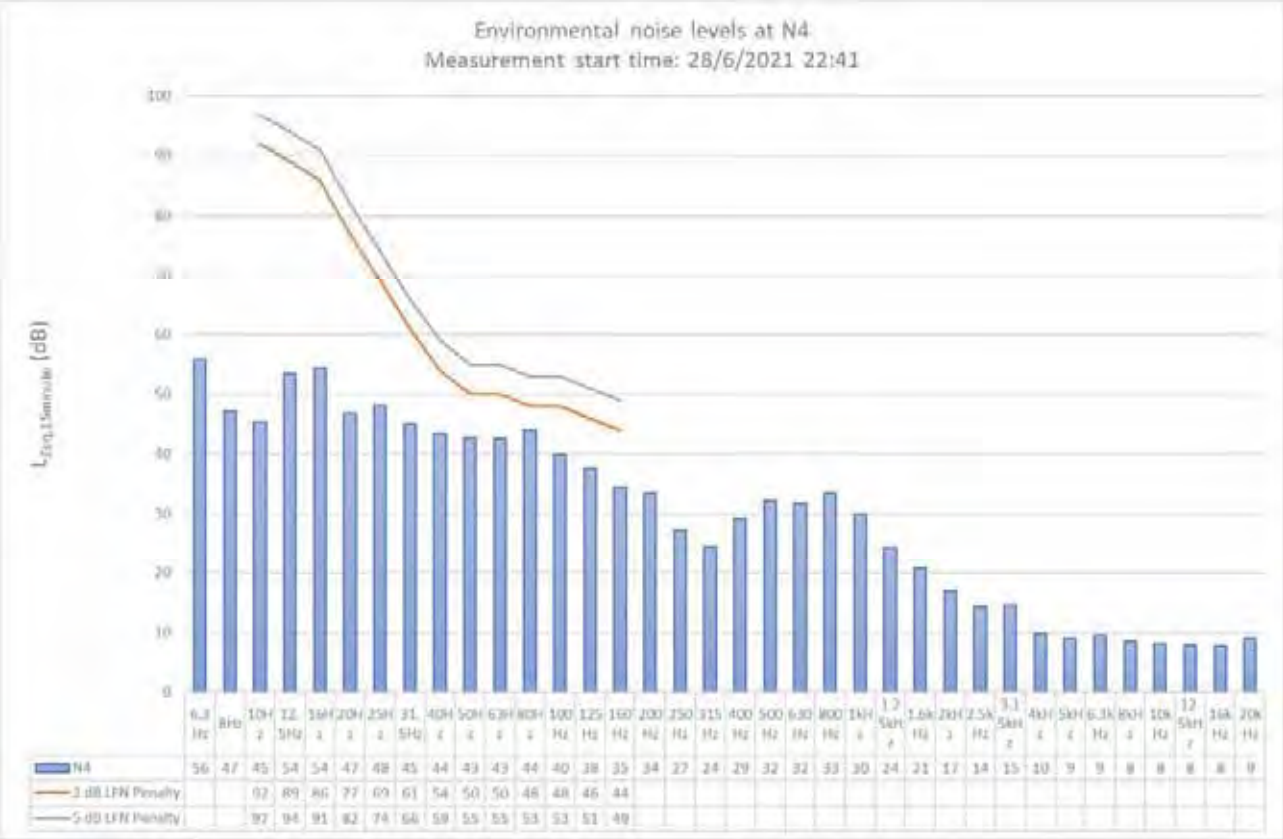

Figure 5.3 N4 total measured one-third octave band frequencies

Other 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 <27 dB $L_{Aeq,night}$ (i.e. Other mine noise of <30 dB $L_{Aeq,15\ minute}$ - 3 dB as per NPfI methodology). This 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 28 June 2021.

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 not to be applicable during one of the three measurements due to the presence of temperature inversion conditions greater than 3°C/100m 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 DC and EPL.

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

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.

L3.2 The Licensee must not dispose of waste on the premises unless authorised by a condition of 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 12 and 32.

4 Operating Conditions

Appendix C

Calibration certificates

CERTIFICATE OF CALIBRATION

CERTIFICATE NO: C28053

EQUIPMENT TESTED: Sound Level Calibrator

Manufacturer: Svantek
Type No: SV-36 **Serial No:** 79952
Owner: EMM Consulting Pty Ltd
L3, 175 Scott 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	94.13	1000.00	1.26
Level 2:	NA	N	114.04	1000.00	0.50
Uncertainty:			±0.11 dB	±0.05%	±0.20 %
Uncertainty (at 95% c.l.) k=2					

CONDITIONS OF TEST:

Ambient Pressure: 995 hPa ±1.5 hPa **Relative Humidity:** 57 % ±5%
Temperature: 24 °C ±2° C
Date of Calibration: 15/10/2020 **Issue Date:** 16/10/2020
Acu-Vib Test Procedure: AVP02 (Calibrators)
Test Method: AS IEC 60942 - 2017

CHECKED BY: ..... **AUTHORISED SIGNATURE:** .....
Hein Soe

Accredited for compliance with ISO/IEC 17025 – Calibration
Results of the tests, calibration and/or measurements included in this document are traceable to SI units through reference equipment that has been calibrated by the Australian National Measurement Institute or other NATA accredited laboratories demonstrating traceability.

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
WORLD RECOGNISED 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 26291 & FILT 5615

Equipment Description:	Sound Level Meter		
Manufacturer:	B & K		
Model No:	2250	**Serial No:**	2759405
Microphone Type:	4189	**Serial No:**	2888134
Preamplifier Type:	ZC0032	**Serial No:**	16037
Filter Type:	1/3 Octave	**Serial No:**	2759405
Comments:	All tests passed for class 1. (See over for details)		
Owner:	EMM Consulting Level 3, 175 Scott Street Newcastle, NSW 2300		
Ambient Pressure:	1007 hPa ±1.5 hPa		
Temperature:	24 °C ±2° C	**Relative Humidity:**	53% ±5%
Date of Calibration:	05/02/2020	**Issue Date:**	05/02/2020

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

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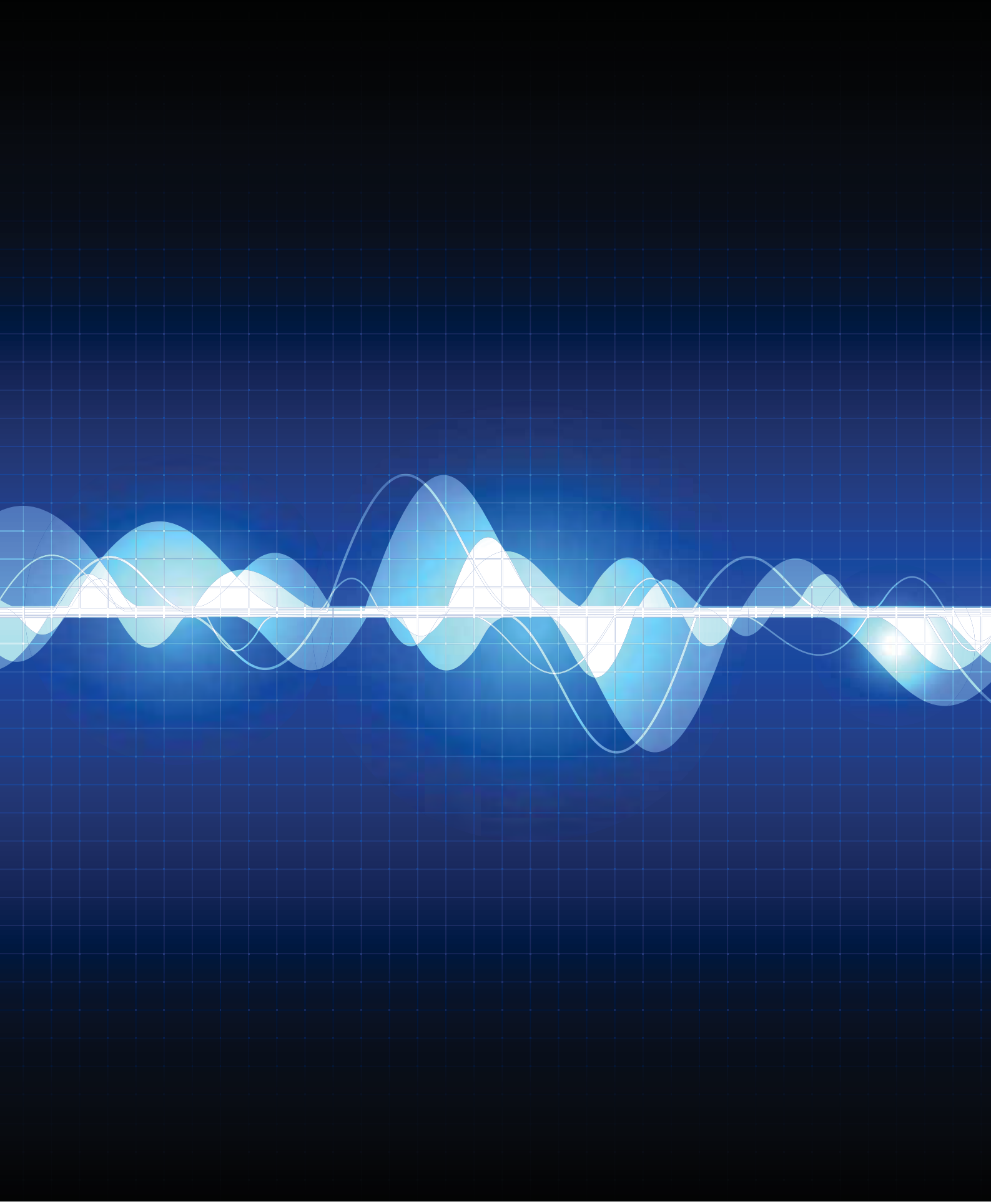


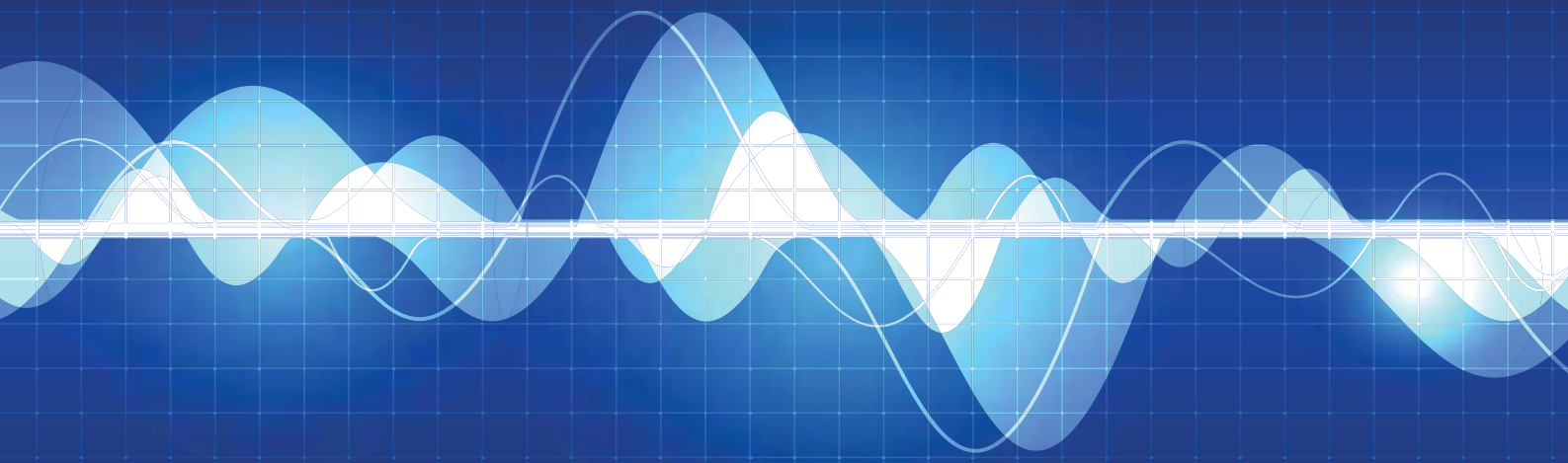
Appendix G

Monthly attended noise monitoring report - July 2021

Ashton Coal

Monthly attended noise monitoring
July 2021

Prepared for Ashton Coal Operations Pty Ltd
July 2021



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July 2021

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Ashton Coal

Monthly attended noise monitoring - July 2021

Report Number

H200894 RP7

Client

Ashton Coal Operations Pty Ltd

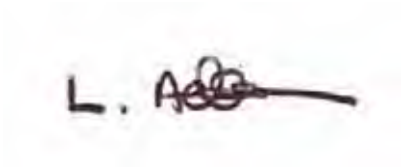
Date

30 July 2021

Version

v1-0 Final

Prepared by



Lucas Adamson
Senior Acoustic Consultant
30 July 2021

Approved by

Katie Teyhan
Associate
30 July 2021

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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 27 July 2021.

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 27 July 2021);
- Environment Protection Authority (EPA), Environment Protection License 11879, as varied on 3 February 2020 (current as of 27 July 2021);
- Ashton Coal Project Noise Management Plan (NMP), approved by DPIE on 23 September 2020 (current as of 27 July 2021);
- 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

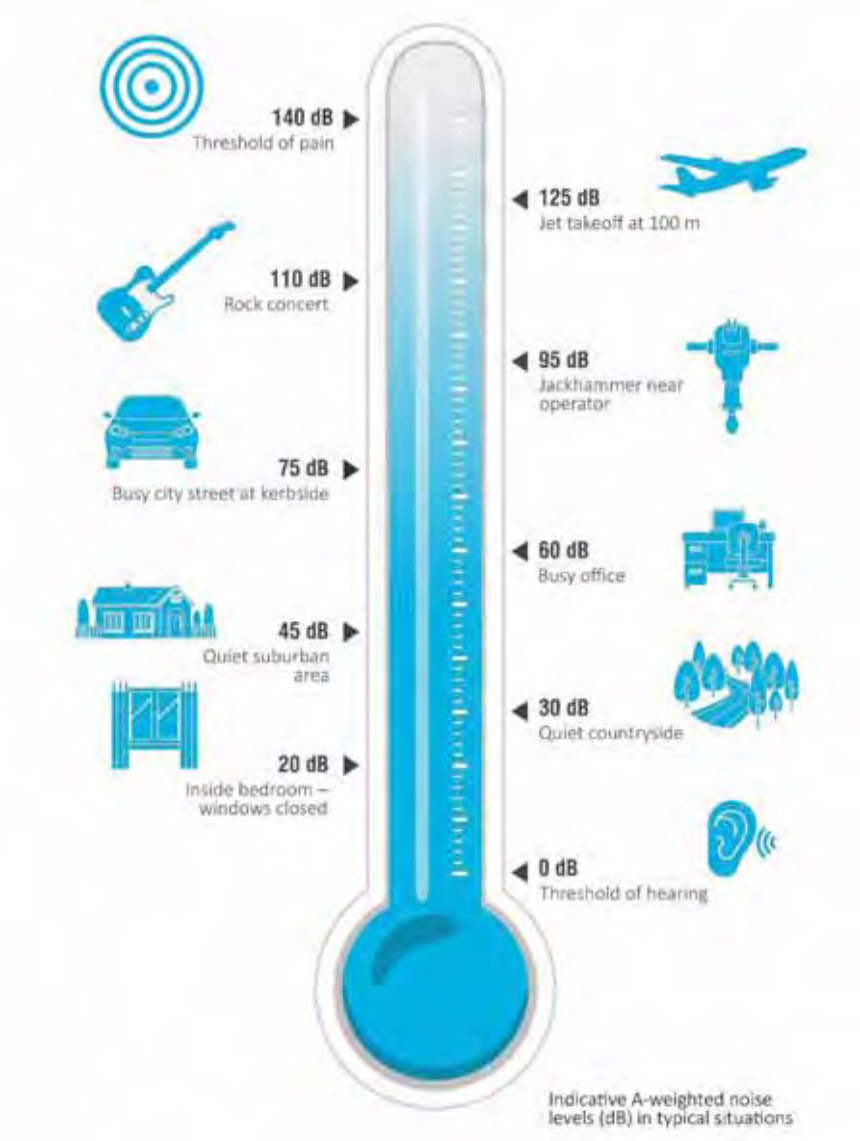

Figure 2.1 Common noise levels

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 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 completion of the noise monitoring 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 Svantek SV-36 calibrator (s/n 79952). 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

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

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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 E1 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 Ashton Coal 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 27 July 2021. Noise from Ashton Coal operations was audible during all three operator-attended noise surveys.

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 not to be applicable during all three measurements due to the presence of temperature inversion conditions greater than 3°C/100m at the time of the measurement.

Low frequency noise is typically 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, where site is audible.

Total measured noise levels exceeded the relevant LFN thresholds during two of the three measurements (at N2 and N3) however, noise limits were not applicable during the times of these measurements due to a G class atmospheric stability category. Therefore, in accordance with the NPfI, LFN modifying factors were not applied to estimated site (or cumulative) noise levels at any of the monitoring locations.

Ashton Coal noise contributions and cumulative mine noise contributions were below (i.e. complied with) the relevant noise limits, had they applied, at all monitoring locations.

Table 5.1 Ashton Coal attended noise monitoring results – July 2021

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	27/7	22:06	39	42	51	55	59	62	60	Nil	34	39	36	46	0.9 m/s @ 270° G class stability 7.7°C/100m VTG N	N/A	**Ashton Coal mine hum consistently audible, with engine revs on occasion.** Other mines in the vicinity (37 dB $L_{Aeq,15\ minute}$), insects, frogs, and traffic on the New England Highway consistently audible. Distant dogs barking, bird noise and a train on the main line (unrelated to Ashton Coal) occasionally audible.
N3	27/7	22:23	38	40	46	49	53	66	59	Nil	34	40	36	46	1.1 m/s @ 274° G class stability 7.9°C/100m VTG N	N/A	**Ashton Coal mine hum consistently audible, with engine revs on occasion.** Other mines in the vicinity (37 dB $L_{Aeq,15\ minute}$), insects, frogs, and traffic on the New England Highway consistently audible. Livestock frequently audible. Distant dogs barking, bird noise and train horns (unrelated to Ashton Coal) occasionally audible.
N4	27/7	22:44	33	35	40	43	47	63	56	Nil	32	32	36	46	1.4 m/s @287° G class stability 8.5°C/100m VTG N	N/A	**Ashton Coal mine hum consistently audible.** Other mines in the vicinity (36 dB $L_{Aeq,15\ minute}$), insects, frogs, and traffic on the New England Highway consistently audible. Train on the main line (unrelated to Ashton Coal) 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 hum and engine revs. The Ashton Coal mine noise contribution was estimated at up to 34 dB $L_{Aeq,15\ minute}$. Engine revs from site generated an estimated 39 dB L_{Amax}. Ashton Coal noise contributions would have complied with the DC and EPL noise limits, had they applied. Other ambient noise sources included other mines in the vicinity, insects, frogs, traffic on the New England Highway, bird noise, distant dogs barking and a train on the main line (unrelated to Ashton Coal). A graph of the total linear noise levels measured in each one-third octave frequency bands is shown in Figure 5.1.

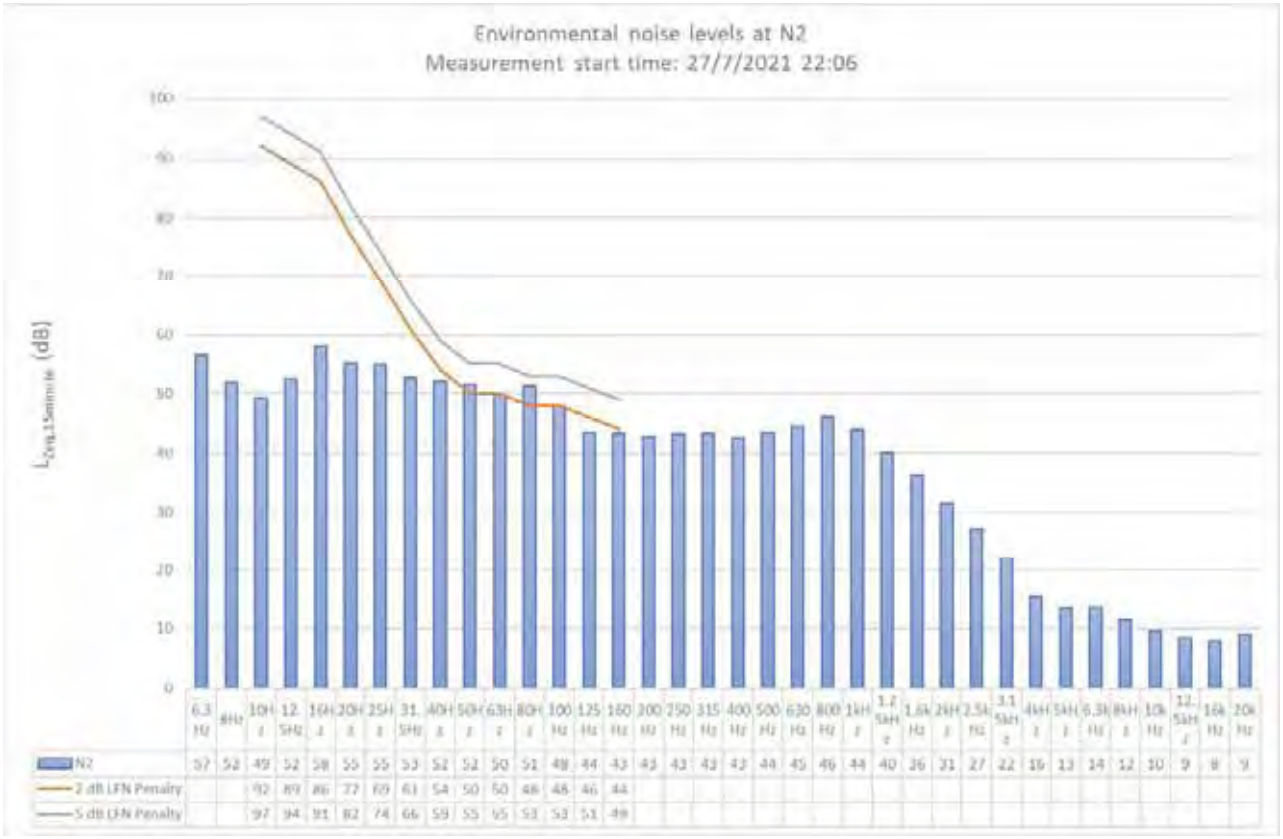

Figure 5.1 N2 total measured one-third octave band frequencies

Other 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 36 dB $L_{Aeq,night}$ (i.e. Ashton Coal mine noise of 34 dB $L_{Aeq,15\ minute}$ + Other mine noise of 37 dB $L_{Aeq,15\ minute}$ - 3 dB as per NPfI methodology),. This 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 hum and engine revs. The Ashton Coal mine noise contribution was estimated at up to 34 dB $L_{Aeq,15\ minute}$. Engine revs from site generated an estimated 40 dB L_{Amax}. Ashton Coal noise contributions would have complied with the DC and EPL noise limits, had they applied. Other ambient noise sources included other mines in the vicinity, insects, frogs, traffic on the New England Highway, livestock, bird noise, distant dogs barking and train horns (unrelated to Ashton Coal). A graph of the total linear noise levels measured in the one-third octave frequency bands is shown in Figure 5.2.

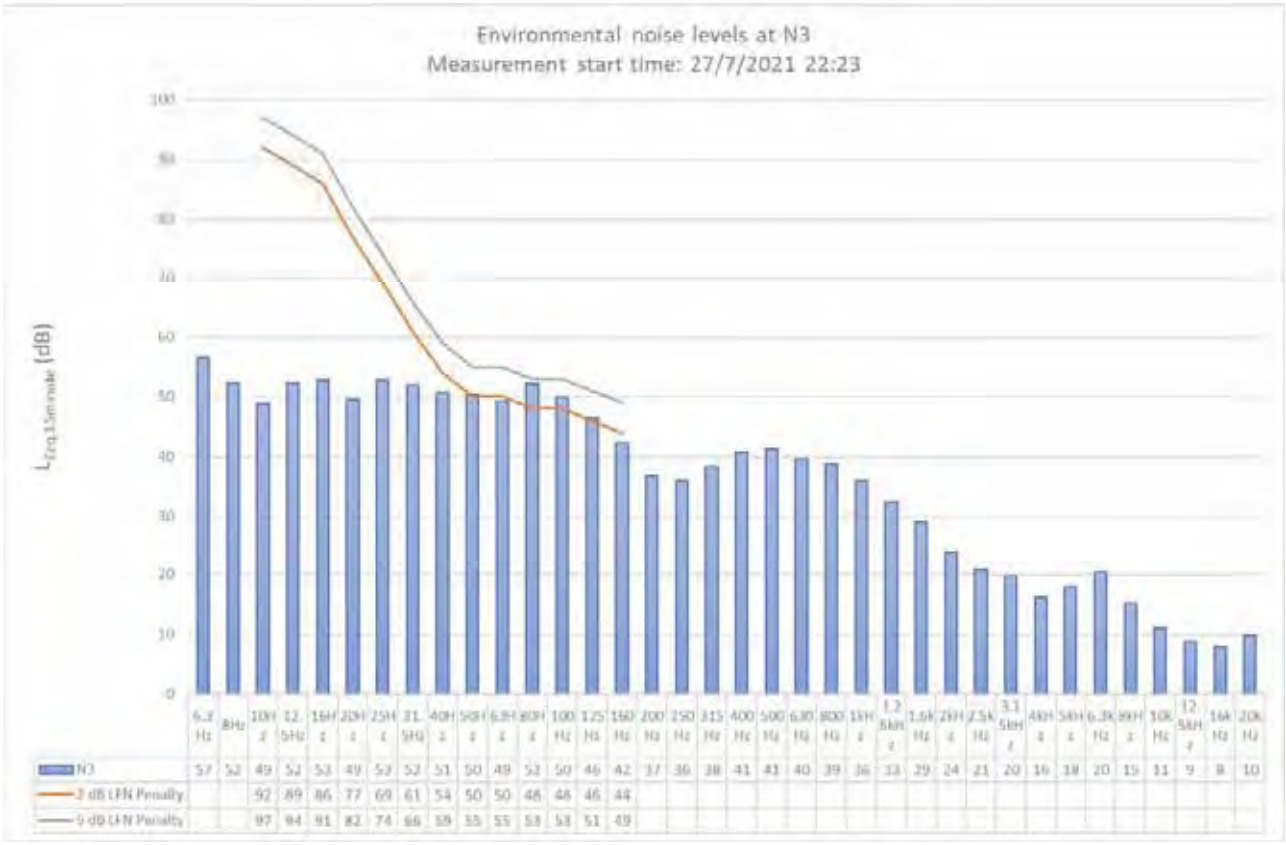

Figure 5.2 N3 total measured one-third octave band frequencies

Other 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 36 dB $L_{Aeq,night}$ (i.e. Ashton Coal mine noise of 34 dB $L_{Aeq,15\ minute}$ + Other mine noise of 37 dB $L_{Aeq,15\ minute}$ - 3 dB as per NPfI methodology). This 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 consistently audible during the operator-attended noise survey including conveyor hum and engine revs. The Ashton Coal mine noise contribution was estimated at up to 32 dB $L_{Aeq,15\ minute}$. Conveyor hum from site generated an estimated 32 dB L_{Amax}. Ashton Coal noise contributions would have complied with the DC and EPL noise limits, had they applied. Other ambient noise sources included other mines in the vicinity, insects, frogs, traffic on the New England Highway and a train on the main line (unrelated to Ashton Coal). A graph of the total linear noise levels measured in one-third octave frequency bands is shown below in Figure 5.3.

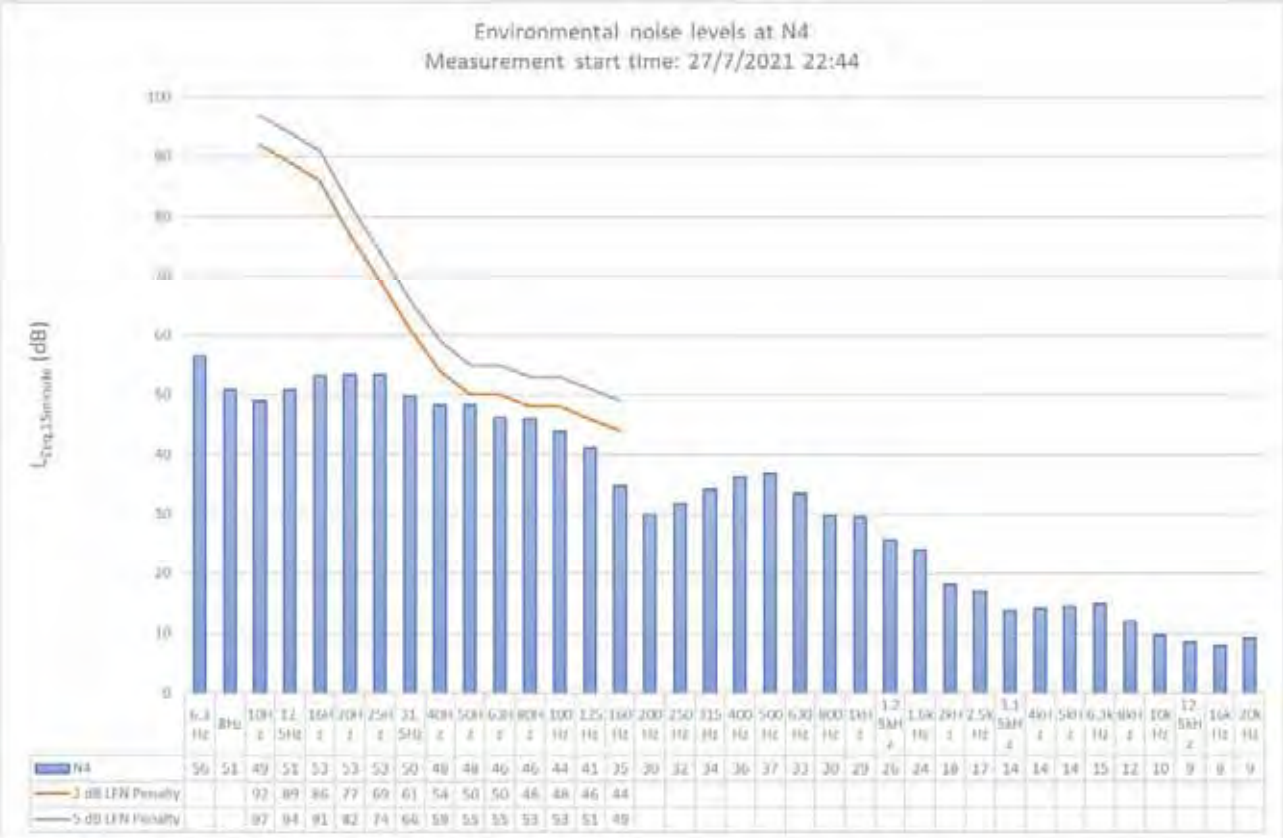

Figure 5.3 N4 total measured one-third octave band frequencies

Other 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 34 dB $L_{Aeq,night}$ (i.e. Ashton Coal mine noise of 36 dB $L_{Aeq,15\ minute}$ + Other mine noise of 32 dB $L_{Aeq,15\ minute}$ - 3 dB as per NPfI methodology. This 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 27 July 2021.

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 not to be applicable during all three measurements due to the presence of temperature inversion conditions greater than 3°C/100m 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 DC and EPL.

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

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.

L3.2 The Licensee must not dispose of waste on the premises unless authorised by a condition of 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 12 and 32.

4 Operating Conditions

Appendix C

Calibration certificates

CERTIFICATE OF CALIBRATION

CERTIFICATE NO: C28053

EQUIPMENT TESTED: Sound Level Calibrator

Manufacturer: Svantek
Type No: SV-36 **Serial No:** 79952
Owner: EMM Consulting Pty Ltd
L3, 175 Scott 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	94.13	1000.00	1.26
Level 2:	NA	N	114.04	1000.00	0.50
Uncertainty:			±0.11 dB	±0.05%	±0.20 %
Uncertainty (at 95% c.l.) k=2					

CONDITIONS OF TEST:

Ambient Pressure: 995 hPa ±1.5 hPa **Relative Humidity:** 57 % ±5%
Temperature: 24 °C ±2° C
Date of Calibration: 15/10/2020 **Issue Date:** 16/10/2020
Acu-Vib Test Procedure: AVP02 (Calibrators)
Test Method: AS IEC 60942 - 2017

CHECKED BY: ..... **AUTHORISED SIGNATURE:** .....
Hein Soe

Accredited for compliance with ISO/IEC 17025 – Calibration
Results of the tests, calibration and/or measurements included in this document are traceable to SI units through reference equipment that has been calibrated by the Australian National Measurement Institute or other NATA accredited laboratories demonstrating traceability.

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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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 26291 & FILT 5615

Equipment Description:	Sound Level Meter		
Manufacturer:	B & K		
Model No:	2250	**Serial No:**	2759405
Microphone Type:	4189	**Serial No:**	2888134
Preamplifier Type:	ZC0032	**Serial No:**	16037
Filter Type:	1/3 Octave	**Serial No:**	2759405
Comments:	All tests passed for class 1. (See over for details)		
Owner:	EMM Consulting Level 3, 175 Scott Street Newcastle, NSW 2300		
Ambient Pressure:	1007 hPa ±1.5 hPa		
Temperature:	24 °C ±2° C	**Relative Humidity:**	53% ±5%
Date of Calibration:	05/02/2020	**Issue Date:**	05/02/2020

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

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.

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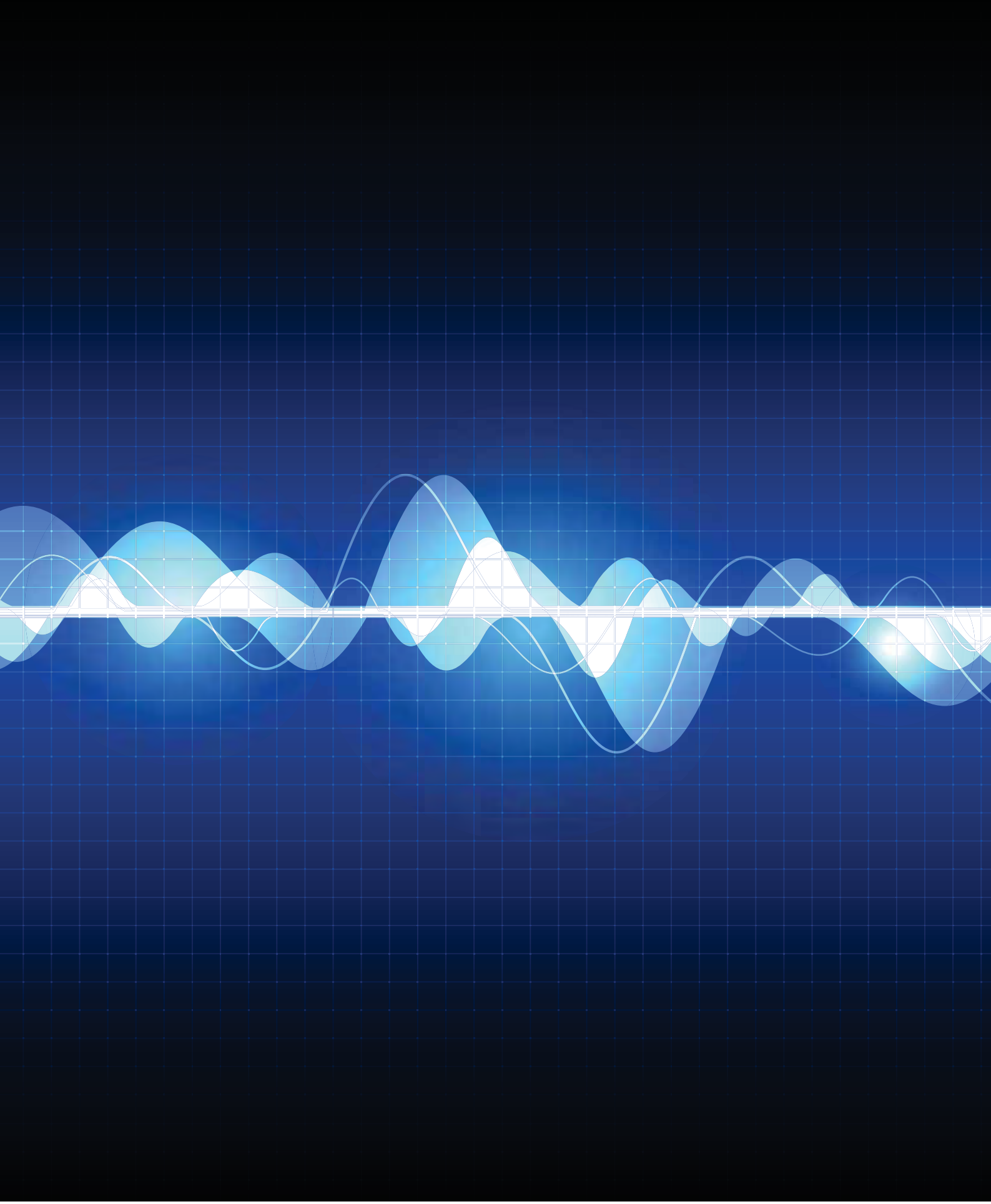
Acoustic and Vibration Measurements



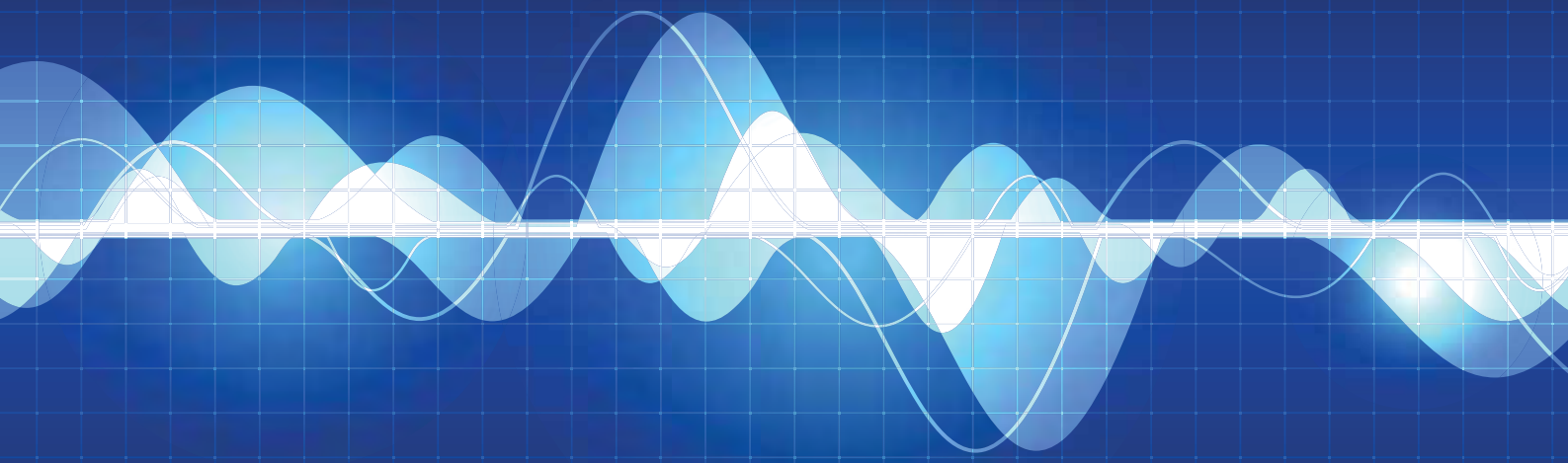
Appendix H

Monthly attended noise monitoring report - August 2021

Ashton Coal

Monthly attended noise monitoring
August 2021

Prepared for Ashton Coal Operations Pty Ltd
August 2021



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Prepared for Ashton Coal Operations Pty Ltd
August 2021

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Ashton Coal

Monthly attended noise monitoring - August 2021

Report Number

H200894 RP8

Client

Ashton Coal Operations Pty Ltd

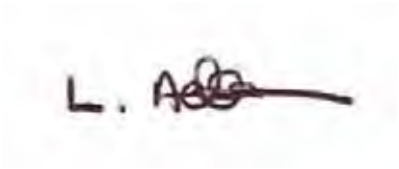
Date

12 August 2021

Version

v1-0 Final

Prepared by



Lucas Adamson
Senior Acoustic Consultant
12 August 2021

Approved by

Katie Teyhan
Associate
12 August 2021

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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 10 August 2021.

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 10 August 2021);
- Environment Protection Authority (EPA), Environment Protection License 11879, as varied on 3 February 2020 (current as of 10 August 2021);
- Ashton Coal Project Noise Management Plan (NMP), approved by DPIE on 23 September 2020 (current as of 10 August 2021);
- 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

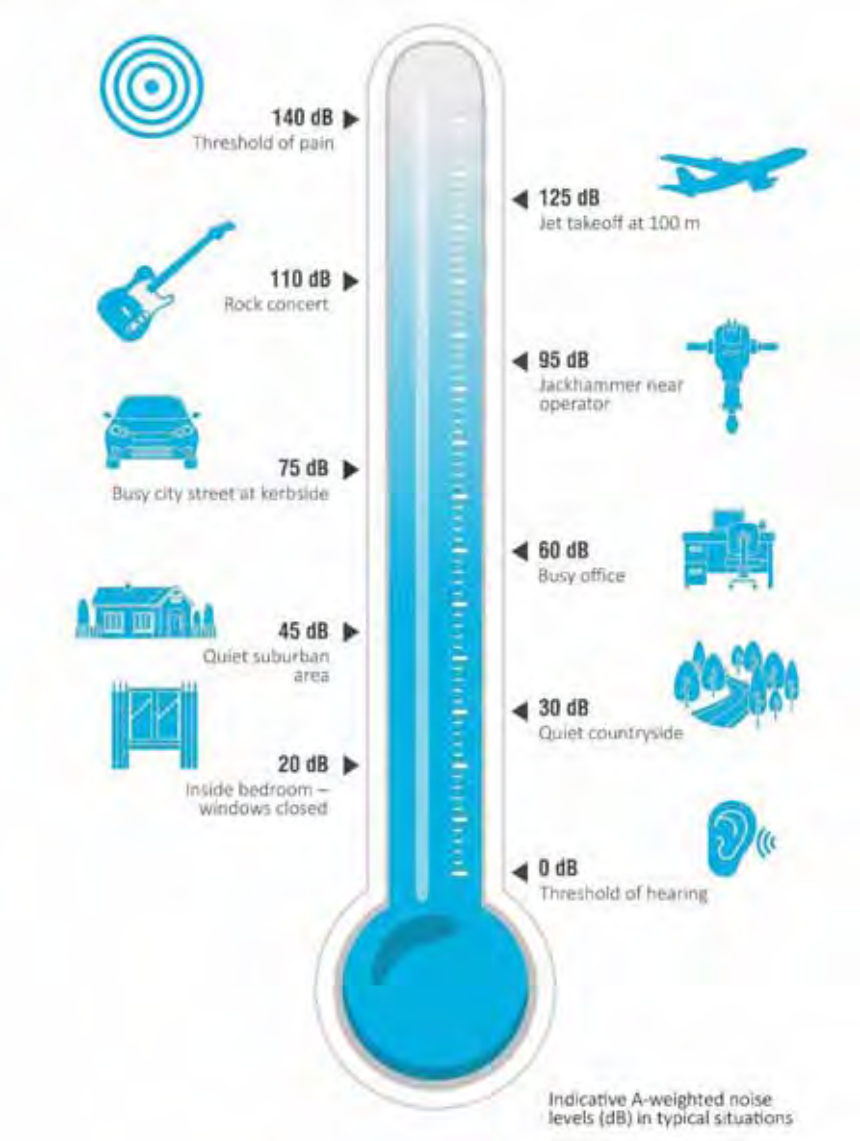

Figure 2.1 Common noise levels

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 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 completion of the noise monitoring 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 Svantek SV-36 calibrator (s/n 79952). 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

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

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

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 E1 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 Ashton Coal 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 10 August 2021. Noise from Ashton Coal operations was audible during all three operator-attended noise surveys.

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 not to be applicable during all three measurements due to the presence of temperature inversion conditions greater than 3°C/100m at the time of the measurement.

Low frequency noise is typically 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, where site is audible.

Total measured noise levels exceeded the relevant LFN thresholds during two of the three measurements (at N2 and N3) however, noise limits were not applicable during the times of these measurements due to a G class atmospheric stability category. Therefore, in accordance with the NPfI, LFN modifying factors were not applied to estimated site (or cumulative) noise levels at any of the monitoring locations.

Ashton Coal noise contributions and cumulative mine noise contributions were below (i.e. complied with) the relevant noise limits, had they applied, at all monitoring locations.

Table 5.1 Ashton Coal attended noise monitoring results – August 2021

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	10/8	22:02	38	41	50	54	61	64	62	Nil	34	39	36	46	0.6 m/s @ 355° G class stability 8.6°C/100m VTG N	N/A	**Ashton Coal mine hum consistently audible, with engine revs on occasion.** Other mines in the vicinity (37 dB $L_{Aeq,15\ minute}$), insects and frogs consistently audible. Traffic on the New England Highway frequently audible.
N3	10/8	22:20	37	41	44	46	52	63	59	Nil	33	39	36	46	1.0 m/s @ 8° G class stability 9.2°C/100m VTG N	N/A	**Ashton Coal mine hum consistently audible, with engine revs on occasion.** Other mines in the vicinity (38 dB $L_{Aeq,15\ minute}$), insects and frogs consistently audible. Traffic on the New England Highway frequently audible.
N4	10/8	22:41	35	38	42	45	48	59	57	Nil	<32	<32	36	46	1.0 m/s @ 31° G class stability 9.3°C/100m VTG N	N/A	**Ashton Coal mine hum consistently audible, with engine revs on occasion.** Other mines in the vicinity (37 dB $L_{Aeq,15\ minute}$), insects and frogs consistently audible. Traffic on the New England Highway 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 consistently audible during the operator-attended noise survey including conveyor hum and engine revs. The Ashton Coal mine noise contribution was estimated at up to 34 dB $L_{Aeq,15\ minute}$. Engine revs from site generated an estimated 39 dB L_{Amax}. Ashton Coal noise contributions would have complied with the DC and EPL noise limits, had they applied. Other ambient noise sources included other mines in the vicinity, insects, frogs and traffic on the New England Highway. A graph of the total linear noise levels measured in each one-third octave frequency bands is shown in Figure 5.1.

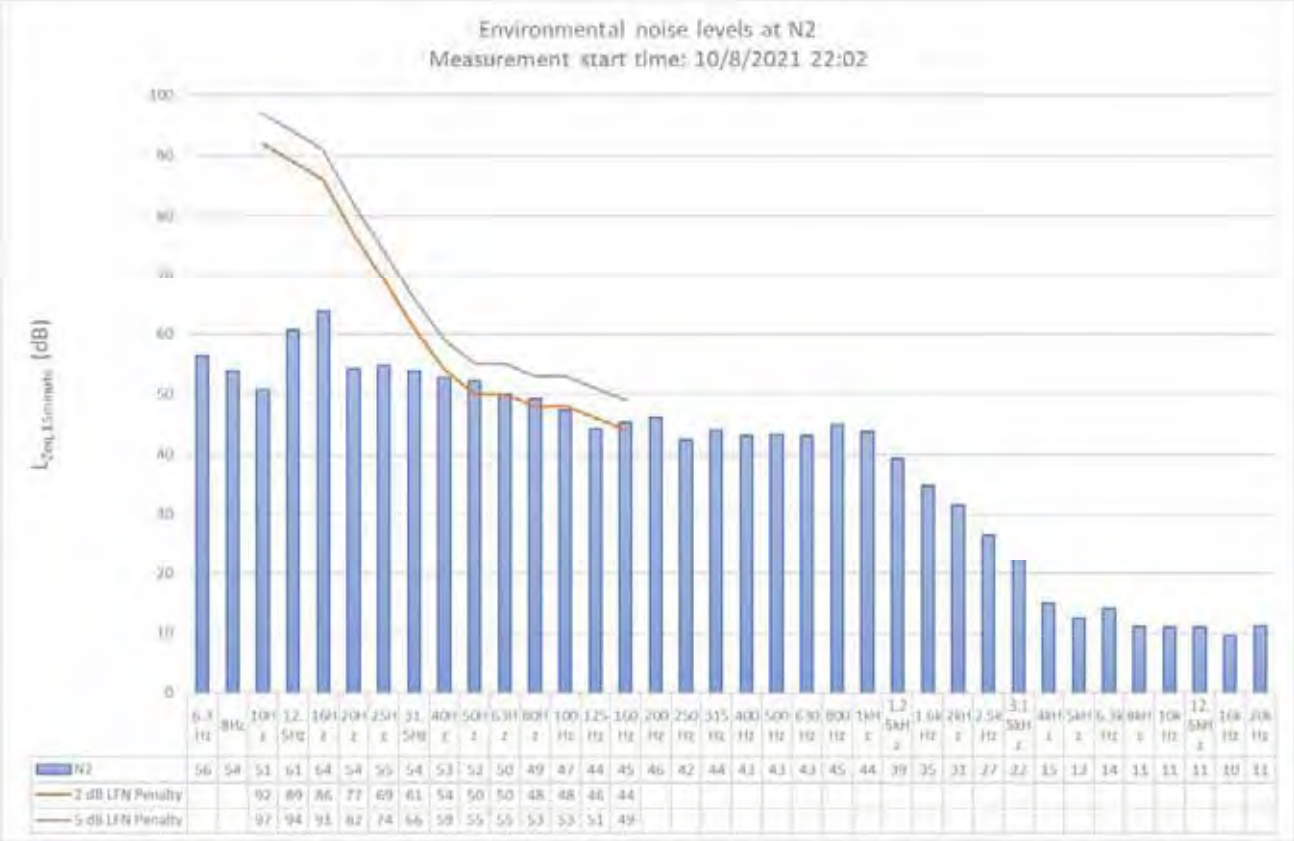

Figure 5.1 N2 total measured one-third octave band frequencies

Other 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 36 dB $L_{Aeq,night}$ (i.e. Ashton Coal mine noise of 34 dB $L_{Aeq,15\ minute}$ + Other mine noise of 37 dB $L_{Aeq,15\ minute}$ - 3 dB as per NPfI methodology). This 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 hum and engine revs. The Ashton Coal mine noise contribution was estimated at up to 33 dB $L_{Aeq,15\ minute}$. Engine revs from site generated an estimated 39 dB L_{Amax}. Ashton Coal noise contributions would have complied with the DC and EPL noise limits, had they applied. Other ambient noise sources included other mines in the vicinity, insects, frogs and traffic on the New England Highway. A graph of the total linear noise levels measured in the one-third octave frequency bands is shown in Figure 5.2.

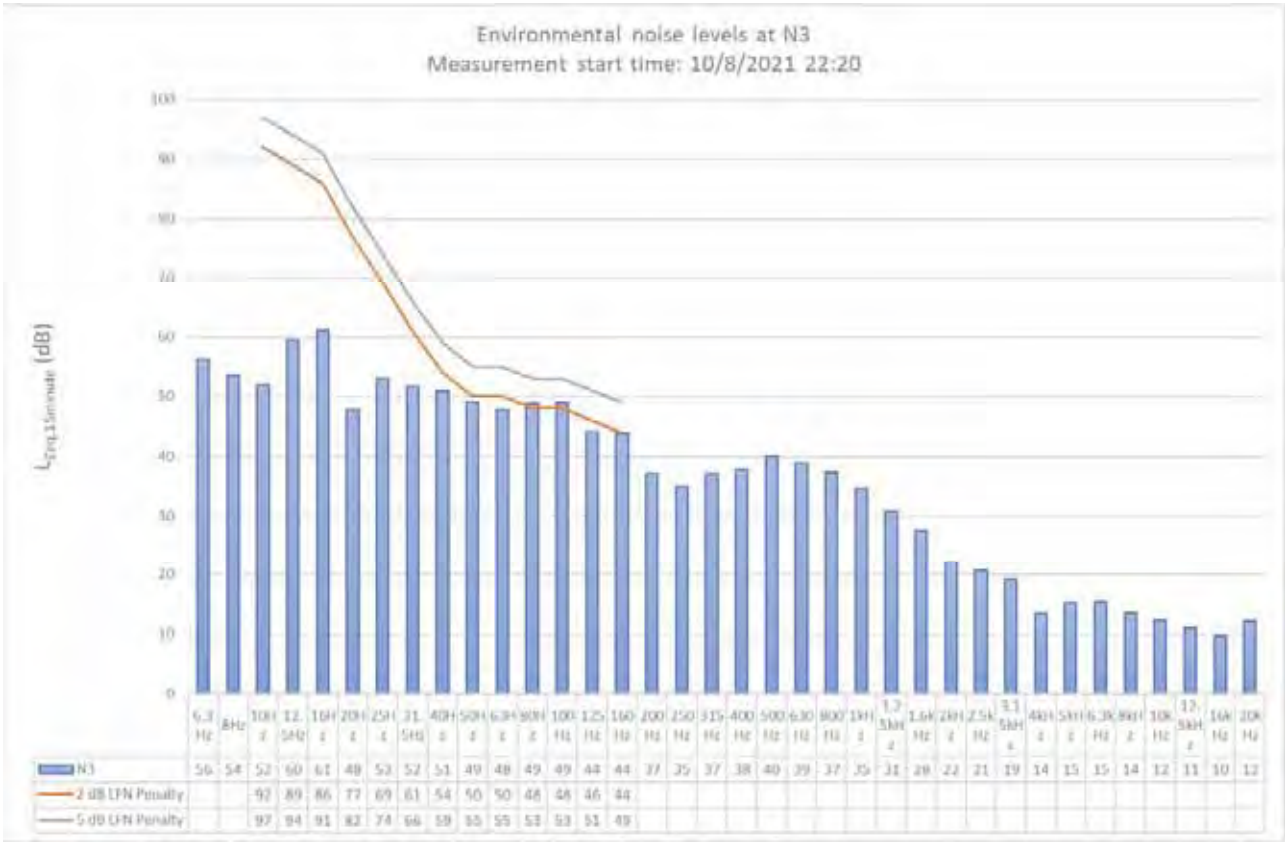

Figure 5.2 N3 total measured one-third octave band frequencies

Other 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 36 dB $L_{Aeq,night}$ (i.e. Ashton Coal mine noise of 33 dB $L_{Aeq,15\ minute}$ + Other mine noise of 38 dB $L_{Aeq,15\ minute}$ - 3 dB as per NPfI methodology). This 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 consistently audible during the operator-attended noise survey including conveyor hum and engine revs. The Ashton Coal mine noise contribution was estimated at up to <32 dB $L_{Aeq,15\ minute}$. Engine revs from site generated an estimated <32 dB L_{Amax}. Ashton Coal noise contributions would have complied with the DC and EPL noise limits, had they applied. Other ambient noise sources included other mines in the vicinity, insects, frogs and traffic on the New England Highway. A graph of the total linear noise levels measured in one-third octave frequency bands is shown below in Figure 5.3.

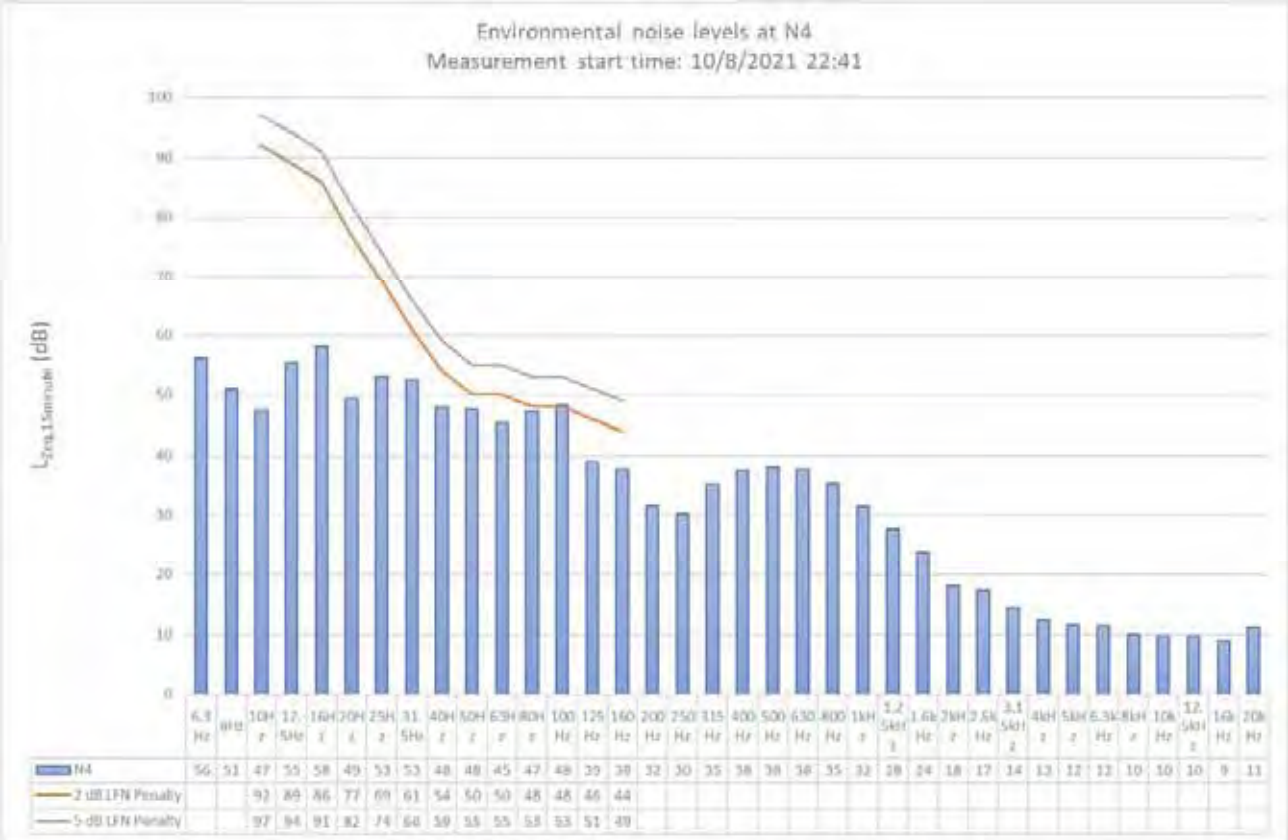

Figure 5.3 N4 total measured one-third octave band frequencies

Other 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 35 dB $L_{Aeq,night}$ (i.e. Ashton Coal mine noise of <32 dB $L_{Aeq,15\ minute}$ + Other mine noise of 37 dB $L_{Aeq,15\ minute}$ - 3 dB as per NPfI methodology. This 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 10 August 2021.

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 not to be applicable during all three measurements due to the presence of temperature inversion conditions greater than 3°C/100m 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 DC and EPL.

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

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.

L3.2 The Licensee must not dispose of waste on the premises unless authorised by a condition of 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 12 and 32.

4 Operating Conditions

Appendix C

Calibration certificates

CERTIFICATE OF CALIBRATION

CERTIFICATE NO: C28053

EQUIPMENT TESTED: Sound Level Calibrator

Manufacturer: Svantek
Type No: SV-36 **Serial No:** 79952
Owner: EMM Consulting Pty Ltd
L3, 175 Scott 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	94.13	1000.00	1.26
Level 2:	NA	N	114.04	1000.00	0.50
Uncertainty:			±0.11 dB	±0.05%	±0.20 %
Uncertainty (at 95% c.l.) k=2					

CONDITIONS OF TEST:

Ambient Pressure: 995 hPa ±1.5 hPa **Relative Humidity:** 57 % ±5%
Temperature: 24 °C ±2° C
Date of Calibration: 15/10/2020 **Issue Date:** 16/10/2020
Acu-Vib Test Procedure: AVP02 (Calibrators)
Test Method: AS IEC 60942 - 2017

CHECKED BY: ..... **AUTHORISED SIGNATURE:** .....
Hein Soe

Accredited for compliance with ISO/IEC 17025 – Calibration
Results of the tests, calibration and/or measurements included in this document are traceable to SI units through reference equipment that has been calibrated by the Australian National Measurement Institute or other NATA accredited laboratories demonstrating traceability.

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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Acoustic and Vibration Measurements

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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 26291 & FILT 5615

Equipment Description:	Sound Level Meter		
Manufacturer:	B & K		
Model No:	2250	**Serial No:**	2759405
Microphone Type:	4189	**Serial No:**	2888134
Preamplifier Type:	ZC0032	**Serial No:**	16037
Filter Type:	1/3 Octave	**Serial No:**	2759405
Comments:	All tests passed for class 1. (See over for details)		
Owner:	EMM Consulting Level 3, 175 Scott Street Newcastle, NSW 2300		
Ambient Pressure:	1007 hPa ±1.5 hPa		
Temperature:	24 °C ±2° C	**Relative Humidity:**	53% ±5%
Date of Calibration:	05/02/2020	**Issue Date:**	05/02/2020

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

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.

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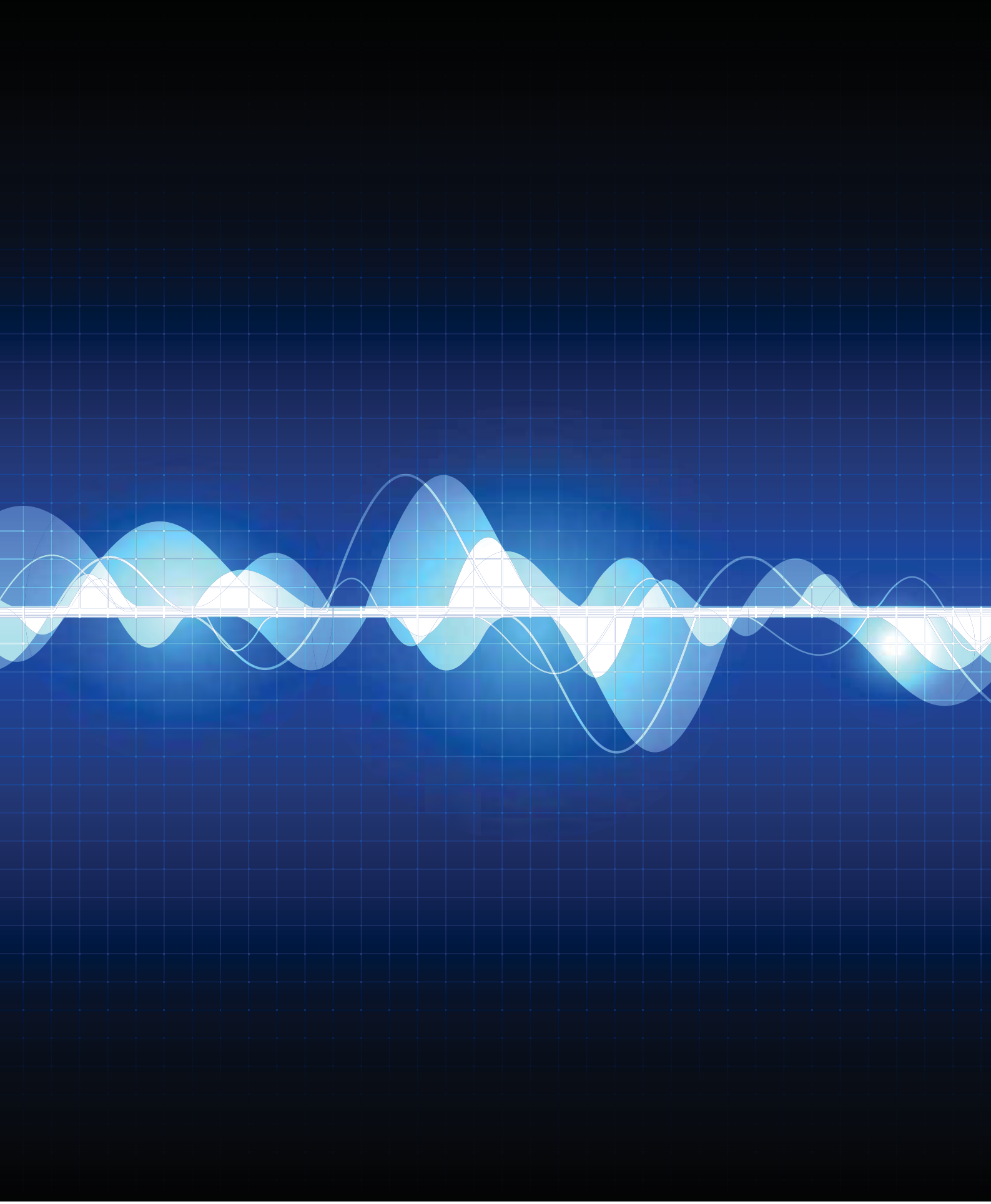


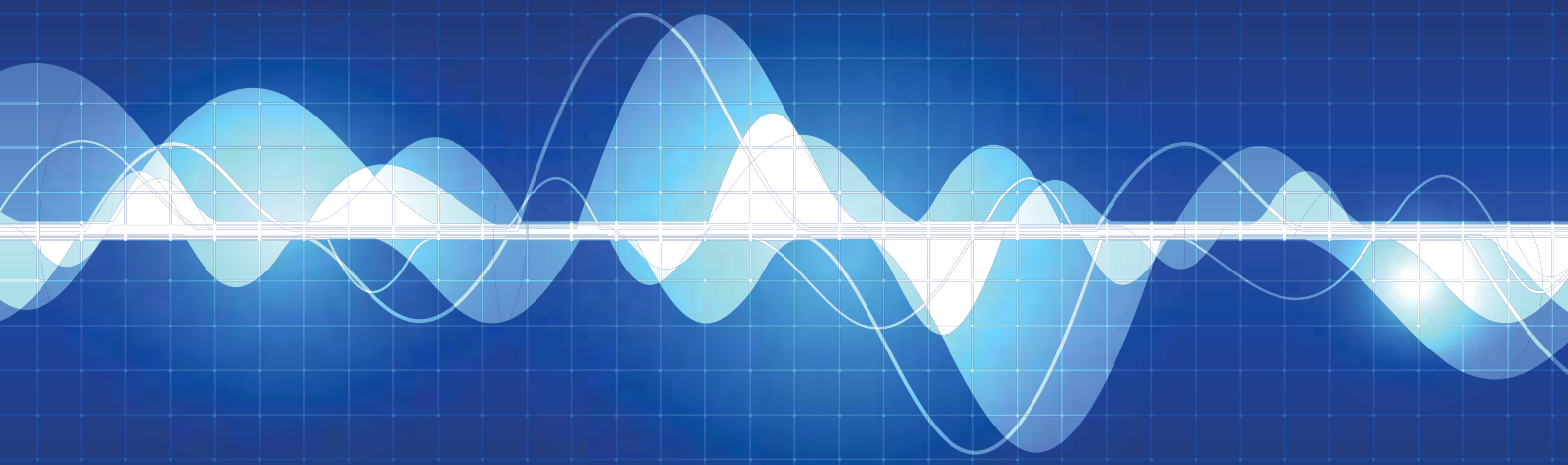
Appendix I

Monthly attended noise monitoring report - September 2021

Ashton Coal

Monthly attended noise monitoring
September 2021

Prepared for Ashton Coal Operations Pty Ltd
October 2021



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Monthly attended noise monitoring - September 2021

Prepared for Ashton Coal Operations Pty Ltd
October 2021

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Ashton Coal

Monthly attended noise monitoring - September 2021

Report Number

H200894 RP9

Client

Ashton Coal Operations Pty Ltd

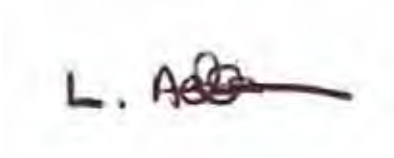
Date

13 October 2021

Version

v1-0 Final

Prepared by



Lucas Adamson
Senior Acoustic Consultant
13 October 2021

Approved by

Katie Teyhan
Associate
13 October 2021

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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 27 September 2021.

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 27 September 2021);
- Environment Protection Authority (EPA), Environment Protection License 11879, as varied on 3 February 2020 (current as of 27 September 2021);
- Ashton Coal Project Noise Management Plan (NMP), approved by DPIE on 23 September 2020 (current as of 27 September 2021);
- 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

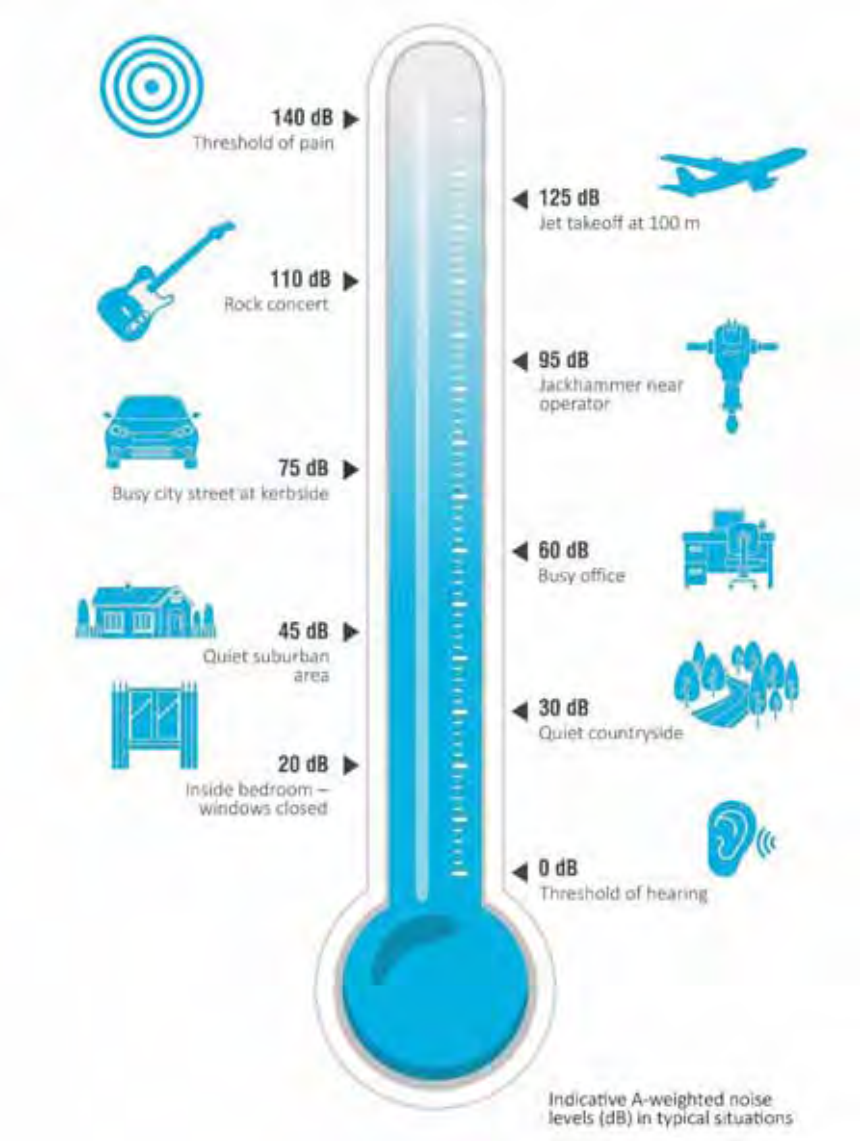

Figure 2.1 Common noise levels

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 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 completion of the noise monitoring 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 Svantek SV-36 calibrator (s/n 86311). 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

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

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

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 E1 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 Ashton Coal 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 27 September 2021. Noise from Ashton Coal operations was inaudible during all three operator-attended noise surveys.

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 is typically 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, where site is audible.

Given that Ashton Coal was not audible during any of the three measurements, LFN modifying factors were not applied to site noise levels at any of the locations. Notwithstanding the preceding, it is noted that total measured noise levels exceeded the relevant LFN thresholds during one of the three measurements (at N2). Therefore, in accordance with the NPfI, LFN modifying factors were applied to estimated cumulative noise levels at location N2.

Ashton Coal noise contributions and cumulative mine noise contributions were below (i.e. complied with) the relevant noise limits at all monitoring locations.

Table 5.1 Ashton Coal attended noise monitoring results – September 2021

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	27/9	22:00	29	34	47	51	58	68	58	Nil	IA	IA	36	46	2.4 m/s @ 168° F class stability 1.8°C/100m VTG Y	Nil	**Ashton Coal inaudible.** Other mines in the vicinity (32 dB $L_{Aeq,15\ minute}$), hum from the west (unrelated to Ashton Coal), insects and frogs consistently audible. Traffic on the New England Highway frequently audible. Bird noise, distant dogs barking, and resident noise occasionally audible.
N3	27/9	22:17	32	35	44	49	53	57	56	Nil	IA	IA	36	46	2.1 m/s @ 131° F class stability 1.8°C/100m VTG Y	Nil	**Ashton Coal inaudible.** Other mines in the vicinity (33 dB $L_{Aeq,15\ minute}$), hum from the west (unrelated to Ashton Coal), insects and frogs consistently audible. Traffic on the New England Highway frequently audible. Bird Noise, distant dogs barking and trains on the main line (unrelated to Ashton Coal) occasionally audible.
N4	27/9	22:41	31	34	42	42	47	65	56	Nil	IA	IA	36	46	2.5 m/s @ 143° F class stability 2.9°C/100m VTG Y	Nil	**Ashton Coal inaudible.** Other mines in the vicinity (32 dB $L_{Aeq,15\ minute}$), insects, frogs and power line hum consistently audible. Traffic on the New England Highway frequently audible. Nearby 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.

5.2 N2 - Camberwell Village (west)

Ashton Coal operations were inaudible during the entire operator-attended noise survey. Typically, when a particular source is not audible above local ambient noise levels, the likely contribution of that source is at least 10 dB below the measured background (L_{A90}) level. Given this and the measured background noise level of 34 dB L_{A90}, the Ashton Coal $L_{Aeq,15\ minute}$ mine noise contribution was estimated to be ≤24 dB $L_{Aeq,15\ minute}$ and therefore below the relevant noise limit. Ashton Coal noise contributions complied with the DC and EPL noise limits. Other ambient noise sources included other mines in the vicinity, insects, frogs, a hum from the west (unrelated to Ashton Coal), traffic on the New England Highway, bird noise and distant dogs barking. A graph of the total linear noise levels measured in each one-third octave frequency bands is shown in Figure 5.1.

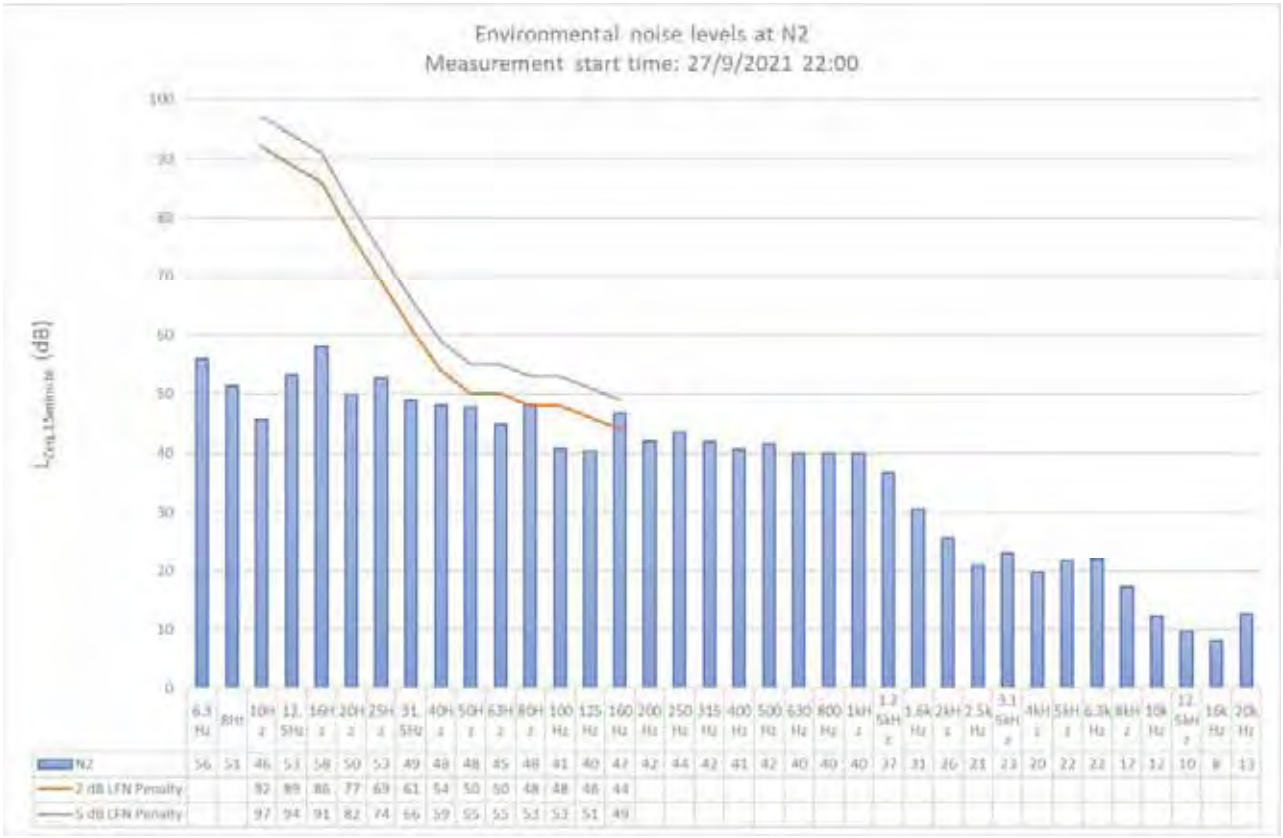

Figure 5.1 N2 total measured one-third octave band frequencies

Other 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 31 dB $L_{Aeq,night}$ (i.e. Other mine noise of 32 dB $L_{Aeq,15\ minute}$ - 3 dB + 2 dB as per NPfI methodology), including a 2 dB positive adjustment for LFN. This 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 entire operator-attended noise survey. Given this and the measured background noise level of 35 dB L_{A90}, the Ashton Coal $L_{Aeq,15\ minute}$ mine noise contribution was estimated to be ≤25 dB $L_{Aeq,15\ minute}$ and therefore below the relevant noise limit. Ashton Coal noise contributions complied with the DC and EPL noise limits. Other ambient noise sources included other mines in the vicinity, a hum from the west (unrelated to Ashton Coal), insects, frogs, traffic on the New England Highway, bird noise, distant dogs barking, and trains on the main line. A graph of the total linear noise levels measured in the one-third octave frequency bands is shown in Figure 5.2.

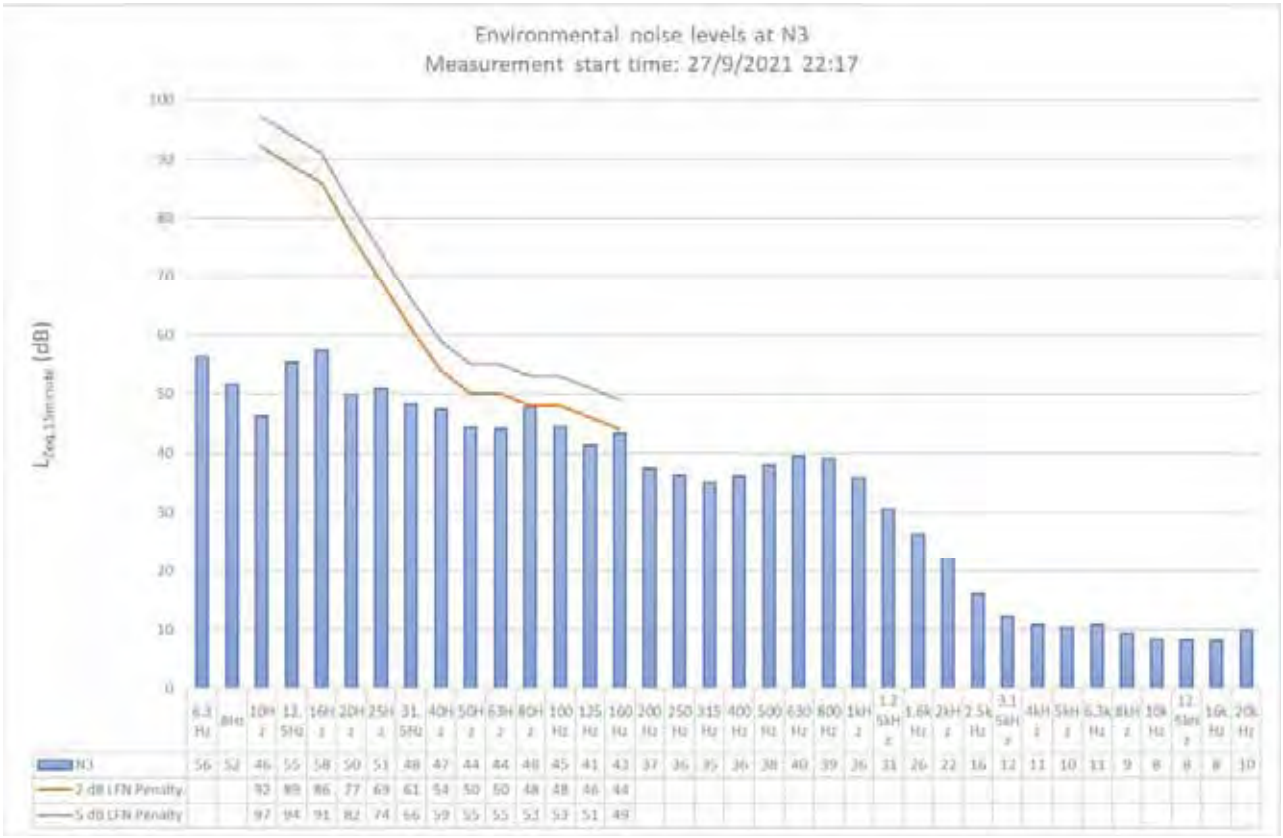

Figure 5.2 N3 total measured one-third octave band frequencies

Other 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 30 dB $L_{Aeq,night}$ (i.e. Other mine noise of 33 dB $L_{Aeq,15\ minute}$ - 3 dB as per NPfI methodology). This 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 entire operator-attended noise survey. Given this and the measured background noise level of 34 dB L_{A90}, the Ashton Coal $L_{Aeq,15\ minute}$ mine noise contribution was estimated to be ≤24 dB $L_{Aeq,15\ minute}$ and therefore below the relevant noise limit. Ashton Coal noise contributions complied with the DC and EPL noise limits. Other ambient noise sources included other mines in the vicinity, insects, frogs, the hum of a nearby power line, traffic on the New England Highway and nearby livestock. A graph of the total linear noise levels measured in one-third octave frequency bands is shown below in Figure 5.3.

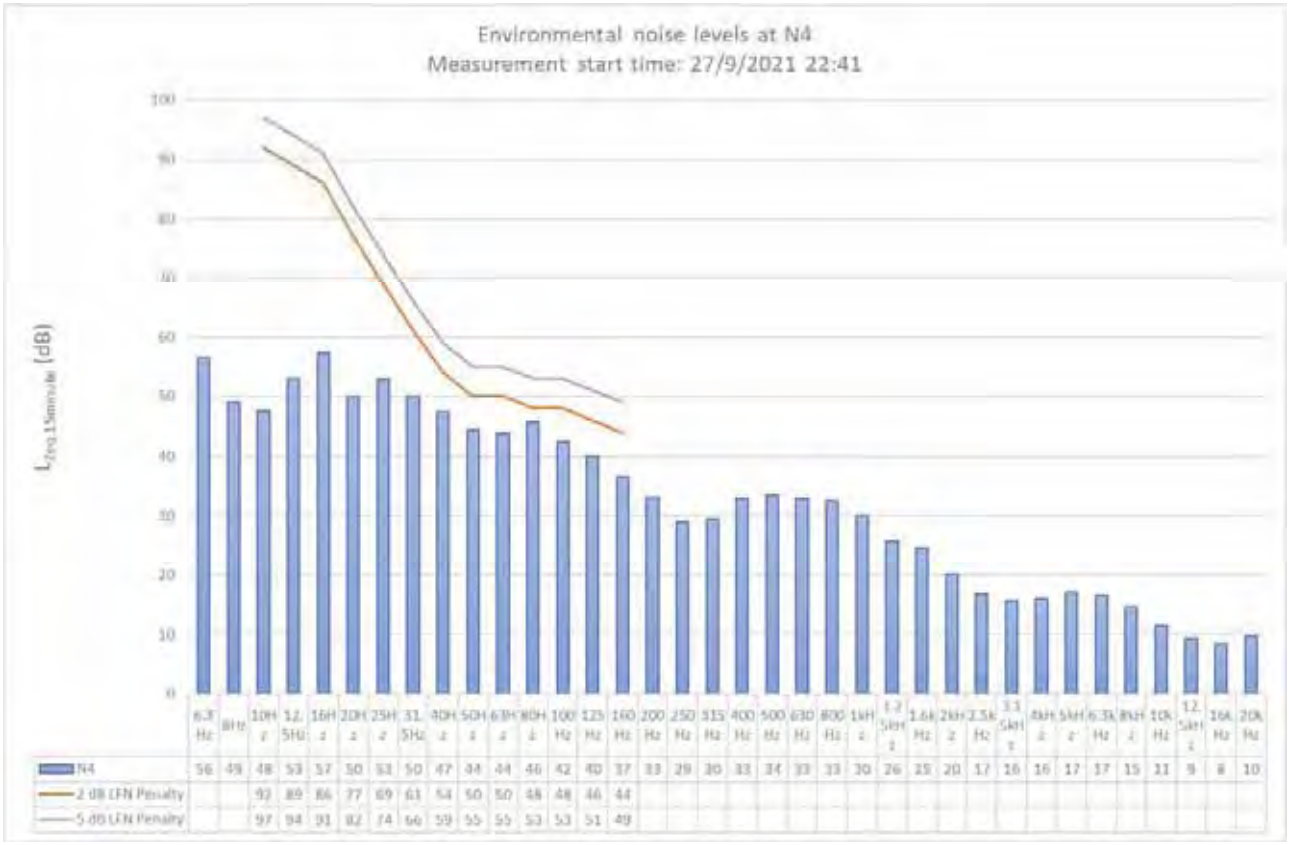

Figure 5.3 N4 total measured one-third octave band frequencies

Other 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 29 dB $L_{Aeq,night}$ (i.e. Other mine noise of 32 dB $L_{Aeq,15\ minute}$ - 3 dB as per NPfI methodology). This 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 27 September 2021.

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 DC and EPL.

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

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.

L3.2 The Licensee must not dispose of waste on the premises unless authorised by a condition of 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 12 and 32.

4 Operating Conditions

Appendix C

Calibration certificates

CERTIFICATE OF CALIBRATION

CERTIFICATE NO: C28079

EQUIPMENT TESTED: Sound Level Calibrator

Manufacturer: Svantek
Type No: SV-36 **Serial No:** 86311
Owner: EMM Consulting
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	94.06	999.99	0.89
Level 2:	NA	N	113.95	999.98	0.32
Uncertainty:			±0.11 dB	±0.05%	±0.20 %
Uncertainty (at 95% c.l.) k=2					

CONDITIONS OF TEST:

Ambient Pressure: 998 hPa ±1.5 hPa **Relative Humidity:** 56 % ±5%

Temperature: 22 °C ±2° C

Date of Calibration: 20/10/2020 **Issue Date:** 20/10/2020

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

Results of the tests, calibration and/or measurements included in this document are traceable to SI units through reference equipment that has been calibrated by the Australian National Measurement Institute or other NATA accredited laboratories demonstrating traceability

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

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Web site: www.acu-vib.com.au

CERTIFICATE OF CALIBRATION

CERTIFICATE NO.: SLM 26291 & FILT 5615

Equipment Description:	Sound Level Meter		
Manufacturer:	B & K		
Model No:	2250	**Serial No:**	2759405
Microphone Type:	4189	**Serial No:**	2888134
Preamplifier Type:	ZC0032	**Serial No:**	16037
Filter Type:	1/3 Octave	**Serial No:**	2759405
Comments:	All tests passed for class 1. (See over for details)		
Owner:	EMM Consulting Level 3, 175 Scott Street Newcastle, NSW 2300		
Ambient Pressure:	1007 hPa ±1.5 hPa		
Temperature:	24 °C ±2° C	**Relative Humidity:**	53% ±5%
Date of Calibration:	05/02/2020	**Issue Date:**	05/02/2020

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

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.

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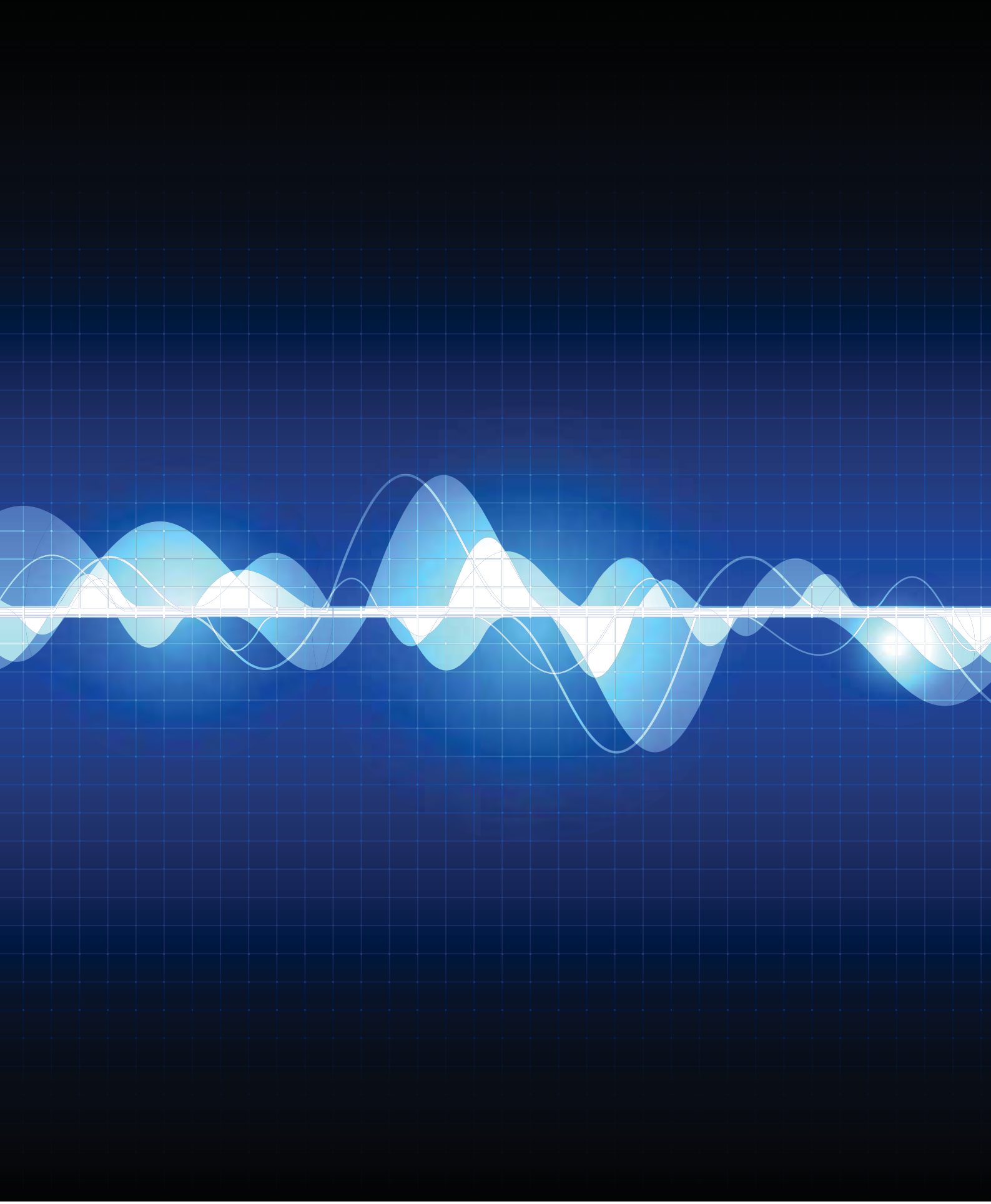


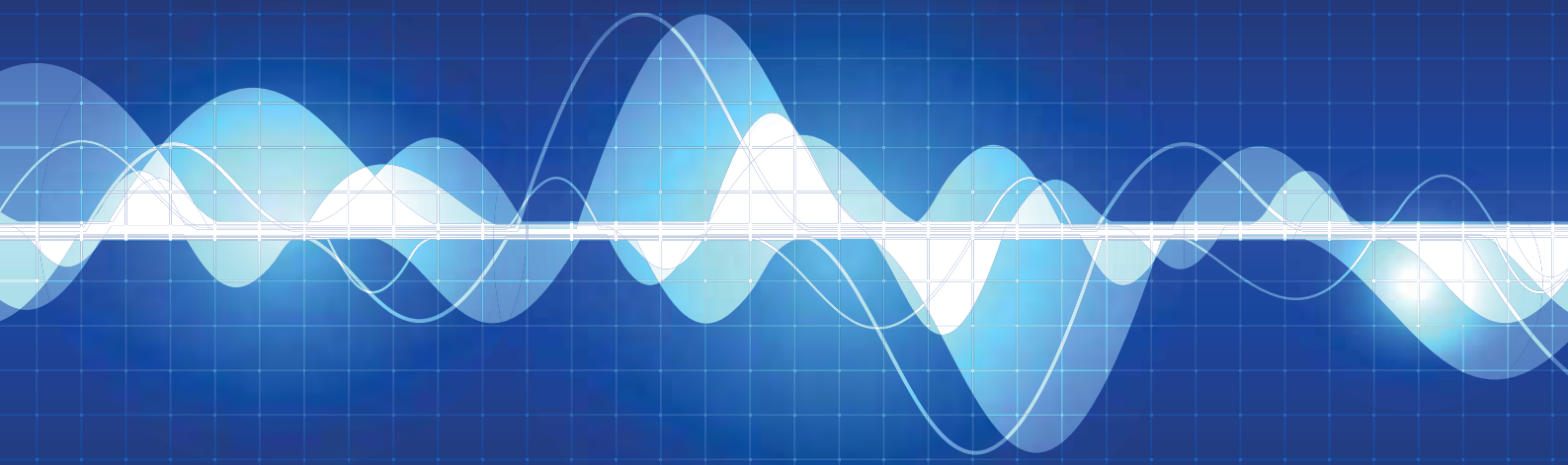
Appendix J

Monthly attended noise monitoring report - October 2021

Ashton Coal

Monthly attended noise monitoring
October 2021

Prepared for Ashton Coal Operations Pty Ltd
November 2021



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Prepared for Ashton Coal Operations Pty Ltd
November 2021

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Ashton Coal

Monthly attended noise monitoring - October 2021

Report Number

H200894 RP10

Client

Ashton Coal Operations Pty Ltd

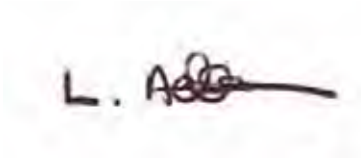
Date

8 November 2021

Version

v1-0 Final

Prepared by



Lucas Adamson
Senior Acoustic Consultant
8 November 2021

Approved by

Katie Teyhan
Associate
8 November 2021

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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 27 October 2021.

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 27 October 2021);
- Environment Protection Authority (EPA), Environment Protection License 11879, as varied on 3 February 2020 (current as of 27 October 2021);
- Ashton Coal Project Noise Management Plan (NMP), approved by DPIE on 23 September 2020 (current as of 27 October 2021);
- 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

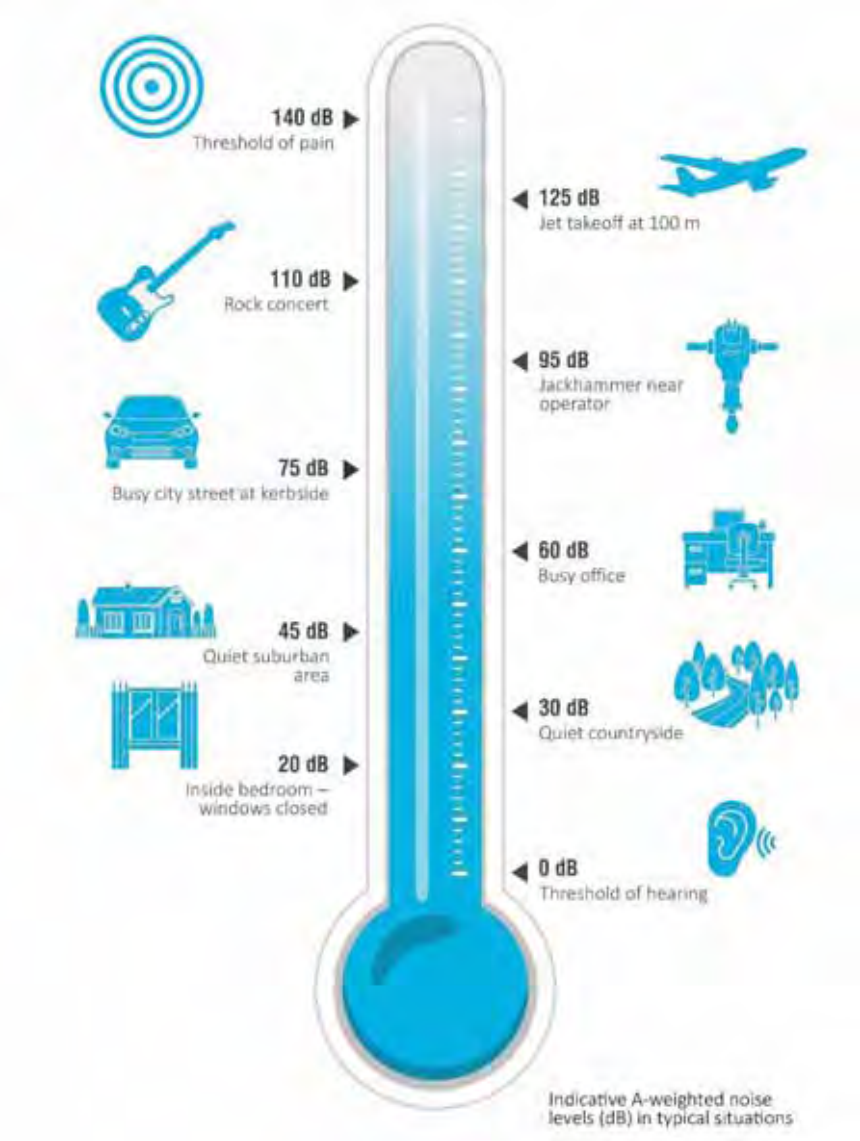

Figure 2.1 Common noise levels

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 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 completion of the noise monitoring 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 3029363) 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 Svantek SV-36 calibrator (s/n 79952). 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

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

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

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 E1 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 Ashton Coal 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 27 October 2021. Noise from Ashton Coal operations was audible during all three operator-attended noise surveys.

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 not to be applicable during all three measurements due to the presence of temperature inversion conditions greater than 3°C/100m at the time of the measurements.

Low frequency noise is typically 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, where site is audible.

Total measured noise levels exceeded the relevant LFN thresholds during two of the three measurements (at N2 and N3) however, noise limits were not applicable during the times of these measurements due to a G class atmospheric stability category. Therefore, in accordance with the NPfI, LFN modifying factors were not applied to estimated site (or cumulative) noise levels at any of the monitoring locations.

Ashton Coal noise contributions and cumulative mine noise contributions were below (i.e. complied with) the relevant noise limits, had they applied, at all monitoring locations.

Table 5.1 Ashton Coal attended noise monitoring results – October 2021

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	27/10	22:10	31	34	49	54	59	61	59	Nil	31	35	36	46	1.4 m/s @ 159° G class stability 4.9°C/100m VTG N	N/A	**Ashton Coal mine hum consistently audible, with dozer tracks on occasion.** Other mines in the vicinity (30 dB $L_{Aeq,15\ minute}$), insects and frogs consistently audible. Traffic on the New England Highway frequently audible. Dogs barking occasionally audible.
N3	27/10	22:34	34	38	48	53	57	61	60	Nil	31	36	36	46	2.5 m/s @ 166° F class stability 3.6°C/100m VTG N	N/A	**Ashton Coal mine hum consistently audible.** Other mines in the vicinity (35 dB $L_{Aeq,15\ minute}$), traffic on the New England Highway, insects and frogs consistently audible. Trains on the main line (unrelated to site) occasionally audible.
N4	27/10	22:59	32	35	42	46	51	57	58	Nil	<28	<28	36	46	2.6 m/s @ 141° F class stability 3.4°C/100m VTG N	N/A	**Ashton Coal mine hum consistently audible.** Other mines in the vicinity (33 dB $L_{Aeq,15\ minute}$) occasionally audible. Traffic on the New England Highway, insects and frogs 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 N2 - Camberwell Village (west)

Ashton Coal operations were consistently audible during the operator-attended noise survey including conveyor hum, with dozer tracks on occasion. The Ashton Coal mine noise contribution was estimated at up to 31 dB $L_{Aeq,15\ minute}$. Dozer tracks from site generated an estimated 35 dB L_{Amax}. Ashton Coal noise contributions would have complied with the DC and EPL noise limits, had they applied. Other ambient noise sources included other mines in the vicinity, insects, frogs, traffic on the New England Highway and dogs barking. A graph of the total linear noise levels measured in each one-third octave frequency bands is shown in Figure 5.1.

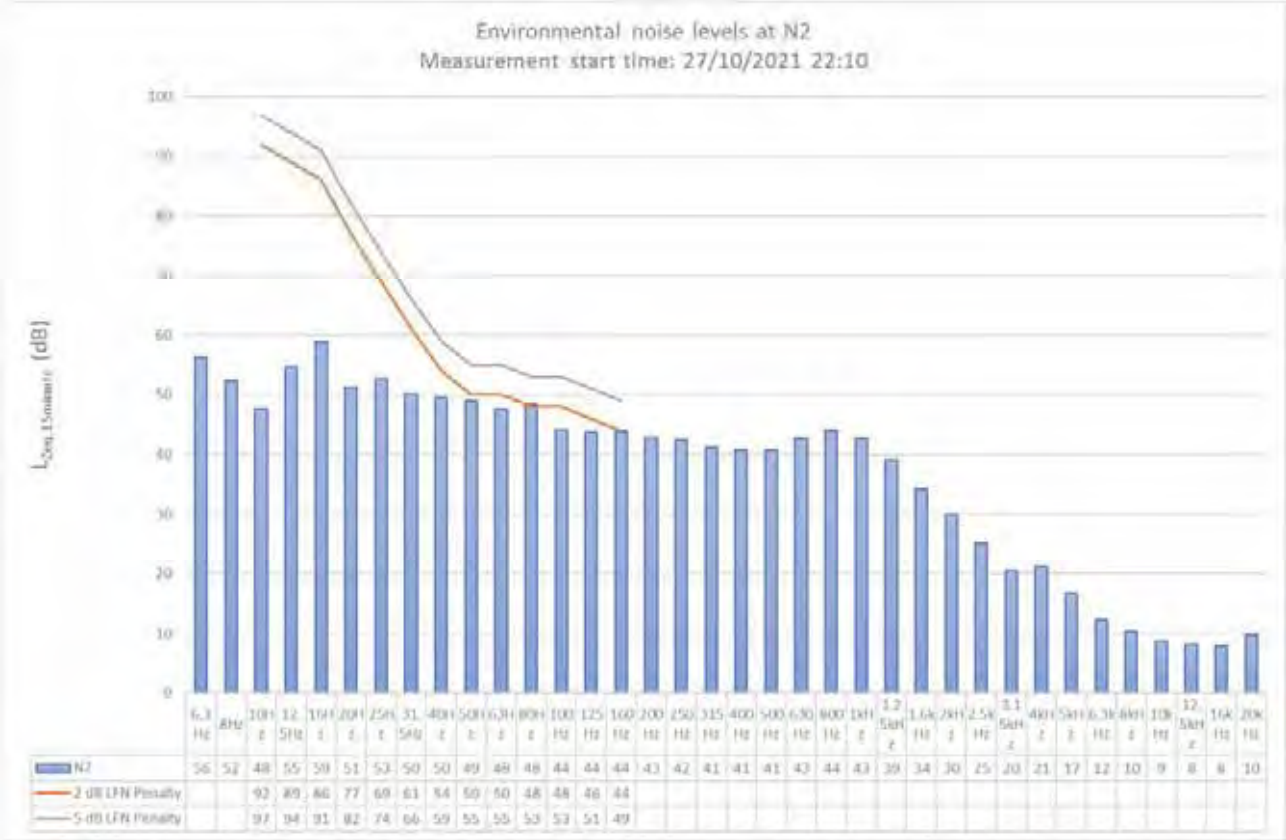

Figure 5.1 N2 total measured one-third octave band frequencies

Other 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 31 dB $L_{Aeq,night}$ (i.e. Ashton Coal mine noise of 31 dB $L_{Aeq,15\ minute}$ + Other mine noise of 30 dB $L_{Aeq,15\ minute}$ - 3 dB as per NPfI methodology). This 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 hum with dozer tracks on occasion. The Ashton Coal mine noise contribution was estimated at up to 31 dB $L_{Aeq,15\ minute}$. Dozer loading noise from site generated an estimated 36 dB L_{Amax}. Ashton Coal noise contributions would have complied with the DC and EPL noise limits, had they applied. Other ambient noise sources included other mines in the vicinity, insects, frogs, traffic on the New England Highway and trains on the main line (unrelated to Ashton Coal). A graph of the total linear noise levels measured in the one-third octave frequency bands is shown in Figure 5.2.

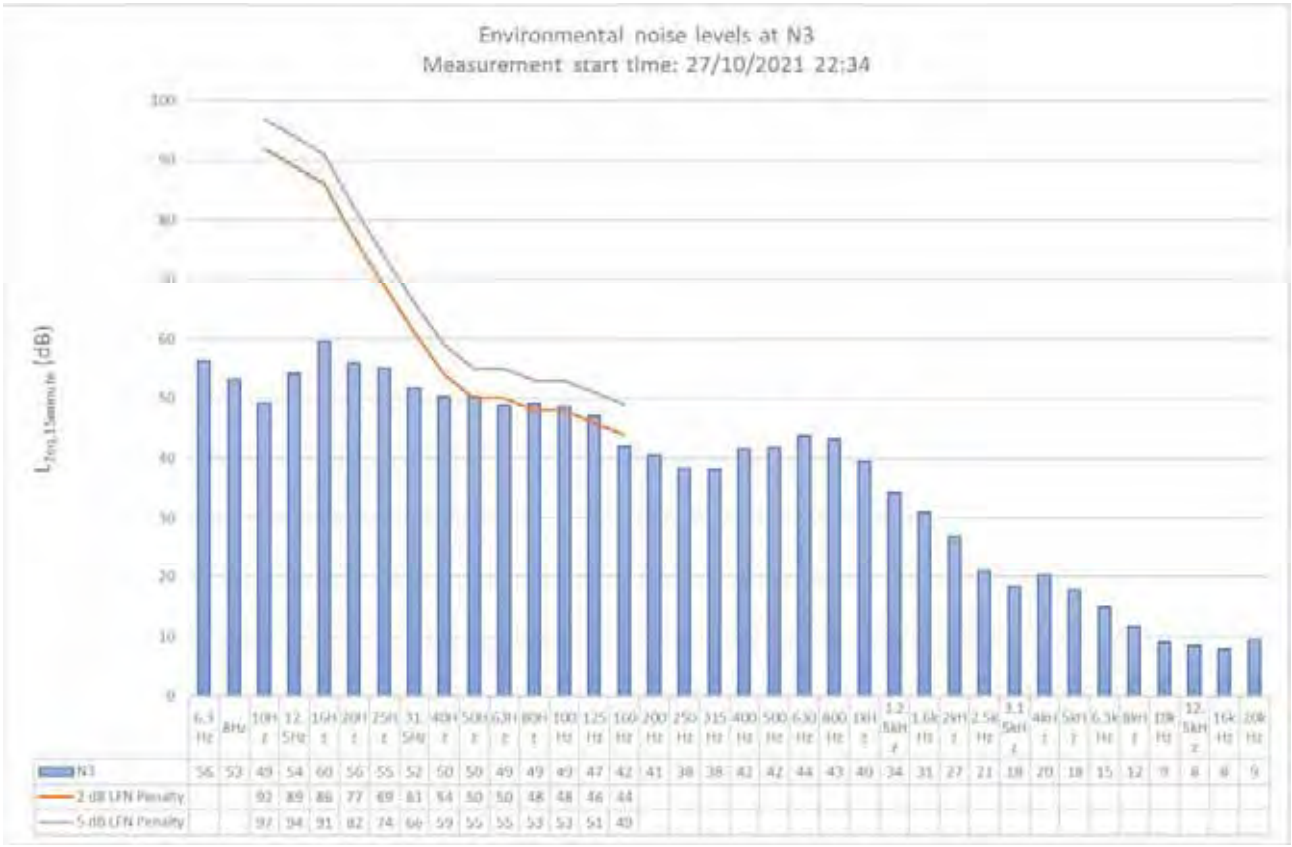

Figure 5.2 N3 total measured one-third octave band frequencies

Other 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 33 dB $L_{Aeq,night}$ (i.e. Ashton Coal mine noise of 31 dB $L_{Aeq,15\ minute}$ + Other mine noise of 35 dB $L_{Aeq,15\ minute}$ - 3 dB as per NPfI methodology). This 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 consistently audible during the operator-attended noise survey including conveyor hum. The Ashton Coal mine noise contribution was estimated at up to <28 dB $L_{Aeq,15\ minute}$. Conveyor hum from site generated an estimated <28 dB L_{Amax}. Ashton Coal noise contributions would have complied with the DC and EPL noise limits, had they applied. Other ambient noise sources included other mines in the vicinity, insects, frogs and traffic on the New England Highway. A graph of the total linear noise levels measured in one-third octave frequency bands is shown below in Figure 5.3.

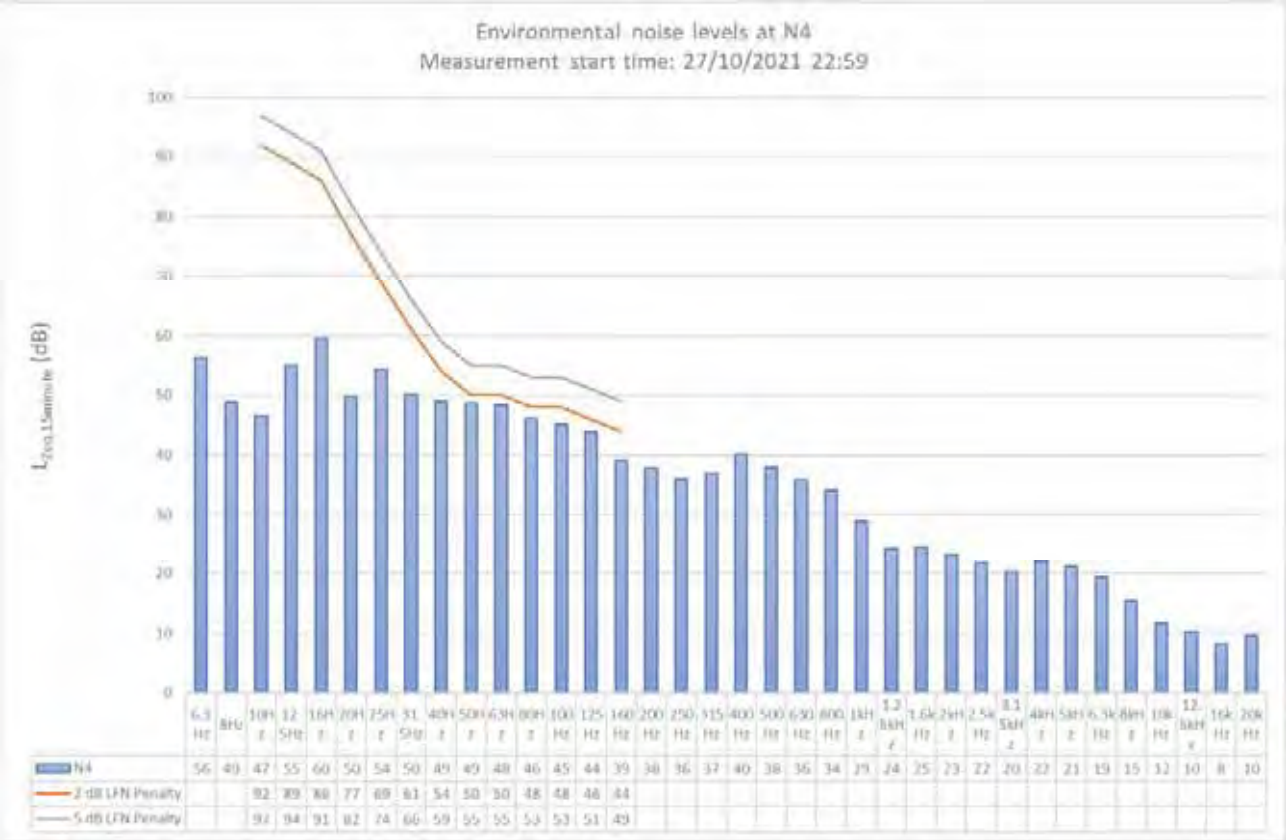

Figure 5.3 N4 total measured one-third octave band frequencies

Other 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 31 dB $L_{Aeq,night}$ (i.e. Ashton Coal mine noise of <28 dB $L_{Aeq,15\ minute}$ + Other mine noise of 33 dB $L_{Aeq,15\ minute}$ - 3 dB as per NPfI methodology). This 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 27 October 2021.

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 not to be applicable during all three measurements due to the presence of temperature inversion conditions greater than 3°C/100m 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 DC and EPL.

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

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.

L3.2 The Licensee must not dispose of waste on the premises unless authorised by a condition of 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 12 and 32.

4 Operating Conditions

Appendix C

Calibration certificates

CERTIFICATE OF CALIBRATION

CERTIFICATE NO: C30591

EQUIPMENT TESTED : Sound Level Calibrator

Manufacturer: Svantek
Type No: SV-36 **Serial No:** 79952
Owner: EMM Consulting Pty Ltd
L3, 175 Scott Street
Newcastle, NSW 2300
Tests Performed: Measured Output Pressure level, Frequency & Distortion
Comments: See Details overleaf. All Test Passed.

Parameter	Pre-Adj	Adj Y/N	Output: (dB re 20 µPa)	Frequency (Hz)	THD&N (%)
Level1	NA	N	94.12 dB	999.99 Hz	1.58 %
Level2:	NA	N	114.05 dB	999.99 Hz	1.12 %
Uncertainty			±0.11 dB	±0.05%	±0.20 %
Uncertainty (at 95% c.l.) k=2					

CONDITION OF TEST:

Ambient Pressure	1007	hPa ±1 hPa	**Date of Receipt :**	16/09/2021
Temperature	21	°C ±1° C	**Date of Calibration :**	16/09/2021
Relative Humidity	43	% ±5%	**Date of Issue :**	16/09/2021

Acu-Vib Test Procedure: AVP02 (Calibrators)
Test Method: AS IEC 60942 - 2017

CHECKED BY: ..... **AUTHORISED SIGNATURE:** .....
Alan Sng

Accredited for compliance with ISO/IEC 17025 - Calibration
Results of the tests, calibration and/or measurements included in this document are traceable to SI units through reference equipment that has been calibrated by the Australian National Measurement Institute or other NATA accredited laboratories demonstrating traceability.

This report applies only to the item identified in the report and may not be reproduced in part.

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

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CAL Reg.No. 307
Member of EA MLA

CERTIFICATE OF CALIBRATION

No: CDK2007931

CALIBRATION OF

Sound Level Meter:	Brüel & Kjær Type 2250	No: 3029363	Id: -
Microphone:	Brüel & Kjær Type 4189	No: 3260501	
PreAmplifier:	Brüel & Kjær Type ZC-0032	No: 30109	
Supplied Calibrator:	None		
Software version:	BZ7222 Version 4.7.6	Pattern Approval:	-
Instruction manual:	BE1712-22		

CUSTOMER

EMM Consulting
Ground Floor, Suite 1
20 Chandos Street
2065 St Leonards
New South Wales, Australia

CALIBRATION CONDITIONS

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

Environment conditions: *See actual values in sections.*

SPECIFICATIONS

The Sound Level Meter Brüel & Kjær Type 2250 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 8.2 - DB: 8.20) by using procedure B&K proc 2250, 4189 (IEC 61672:2013).

RESULTS

Calibration Mode: **Calibration as received.**

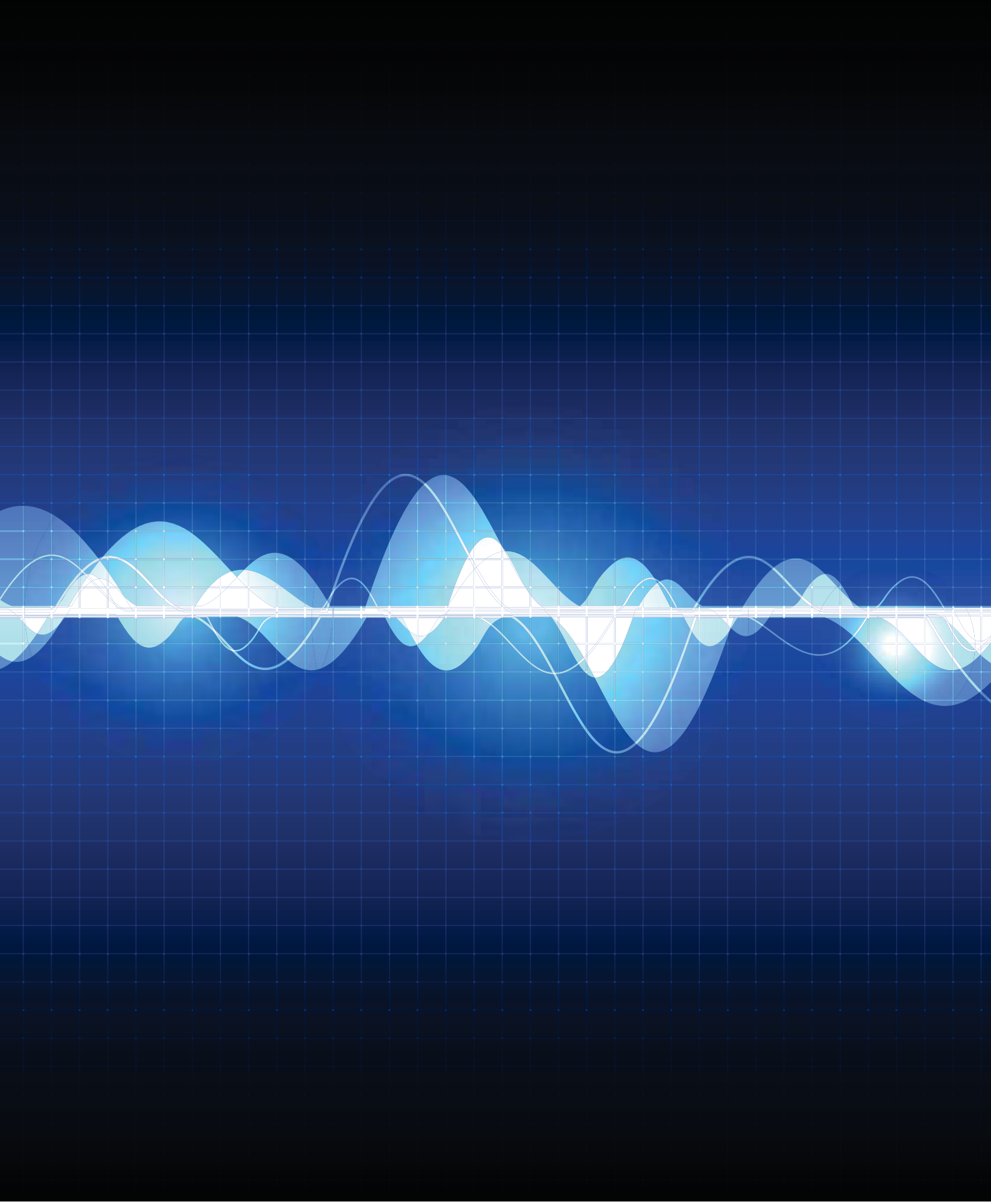
The reported expanded uncertainty is based on the standard uncertainty multiplied by a coverage factor $k = 2$ providing a level of confidence of approximately 95 %. The uncertainty evaluation has been carried out in accordance with EA-4/02 from elements originating from the standards, calibration method,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

Date of calibration: 2020-11-26

Date of issue: 2020-11-26

Lene Petersen
Calibration Technician

Erik Bruus
Approved Signatory



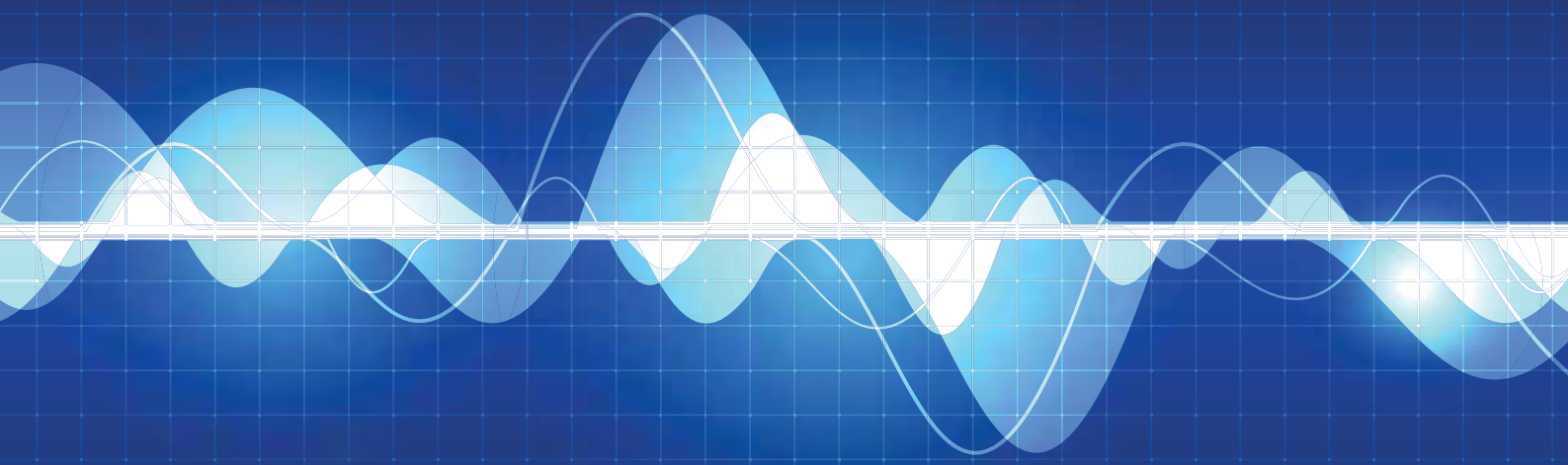
Appendix K

Monthly attended noise monitoring report - November 2021

Ashton Coal

Monthly attended noise monitoring
November 2021

Prepared for Ashton Coal Operations Pty Ltd
December 2021



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December 2021

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Ashton Coal

Monthly attended noise monitoring - November 2021

Report Number

H200894 RP11

Client

Ashton Coal Operations Pty Ltd

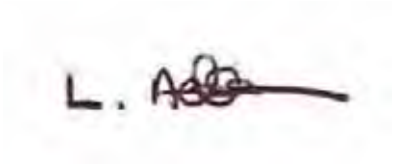
Date

6 December 2021

Version

v1-0 Final

Prepared by



Lucas Adamson
Senior Acoustic Consultant
6 December 2021

Approved by

Katie Teyhan
Associate
6 December 2021

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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 24 November 2021.

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 24 November 2021);
- Environment Protection Authority (EPA), Environment Protection License 11879, as varied on 3 February 2020 (current as of 24 November 2021);
- Ashton Coal Project Noise Management Plan (NMP), approved by DPIE on 23 September 2020 (current as of 24 November 2021);
- 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

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 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 completion of the noise monitoring 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 3029363) 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 Svantek SV-36 calibrator (s/n 79952). 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

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

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

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 E1 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 Ashton Coal 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 24 November 2021. Noise from Ashton Coal operations was audible during all three operator-attended noise surveys.

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 is typically 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, where site is audible.

Low frequency noise was initially 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. Total measured LFN thresholds were exceeded during the measurement at N2 and therefore a more detailed analysis of overall mining noise contributions was conducted. The surveys were reviewed for periods with low levels of extraneous noise (such as traffic and other mines in the area) as to determine and assess the Ashton Coal low-frequency noise contributions to the total LFN levels. It was determined that the relevant LFN thresholds would not have been exceeded solely by noise emissions from Ashton Coal due to the following:

- the relative contribution of Ashton Coal;
- the relative contribution of other mines in the area;
- the relative contribution from traffic on the New England Highway; and
- onsite operations were relatively consistent during the measurement (ie fixed and mobile plant activities).

Therefore, in accordance with the NPfI, an LFN modifying factor was not applied to estimated site noise levels at N2.

Notwithstanding the preceding, it is noted that total measured noise levels exceeded the relevant LFN thresholds during the measurement at N2 and therefore, in accordance with the NPfI, an LFN modifying factor was applied to the estimated cumulative mine noise level at location N2.

Ashton Coal noise contributions and cumulative mine noise contributions were below (i.e. complied with) the relevant noise limits at all monitoring locations.

Table 5.1 Ashton Coal attended noise monitoring results – November 2021

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	24/11	22:00	36	39	45	49	54	58	59	Nil	31	35	36	46	0.6 m/s @ 202° E class stability 0.5°C/100m VTG Y	Nil	**Ashton Coal mine hum consistently audible, with engine revs on occasion.** Other mines in the vicinity (34 dB $L_{Aeq,15\ minute}$), traffic on the New England Highway, insects and frogs consistently audible. Bird noise occasionally audible.
N3	24/11	22:17	35	38	42	45	50	61	58	Nil	32	35	36	46	1.4 m/s @ 140° E class stability 0.5°C/100m VTG Y	Nil	**Ashton Coal mine hum consistently audible, with engine revs on occasion.** Other mines in the vicinity (35 dB $L_{Aeq,15\ minute}$), traffic on the New England Highway, insects and frogs consistently audible. Bird noise and aircraft noise occasionally audible.
N4	24/11	22:40	38	41	43	45	47	54	57	Nil	IA	IA	36	46	1.8 m/s @ 81° E class stability 0.4°C/100m VTG Y	Nil	**Ashton Coal inaudible.** Other mines in the vicinity (33 dB $L_{Aeq,15\ minute}$), traffic on the New England Highway, insects and frogs 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 N2 - Camberwell Village (west)

Ashton Coal operations were consistently audible during the operator-attended noise survey including conveyor hum, with engine revs on occasion. The Ashton Coal mine noise contribution was estimated at up to 31 dB $L_{Aeq,15\ minute}$. Engine revs from site generated an estimated 35 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, insects, frogs, traffic on the New England Highway and bird noise. A graph of the total linear noise levels measured in each one-third octave frequency bands is shown in Figure 5.1.

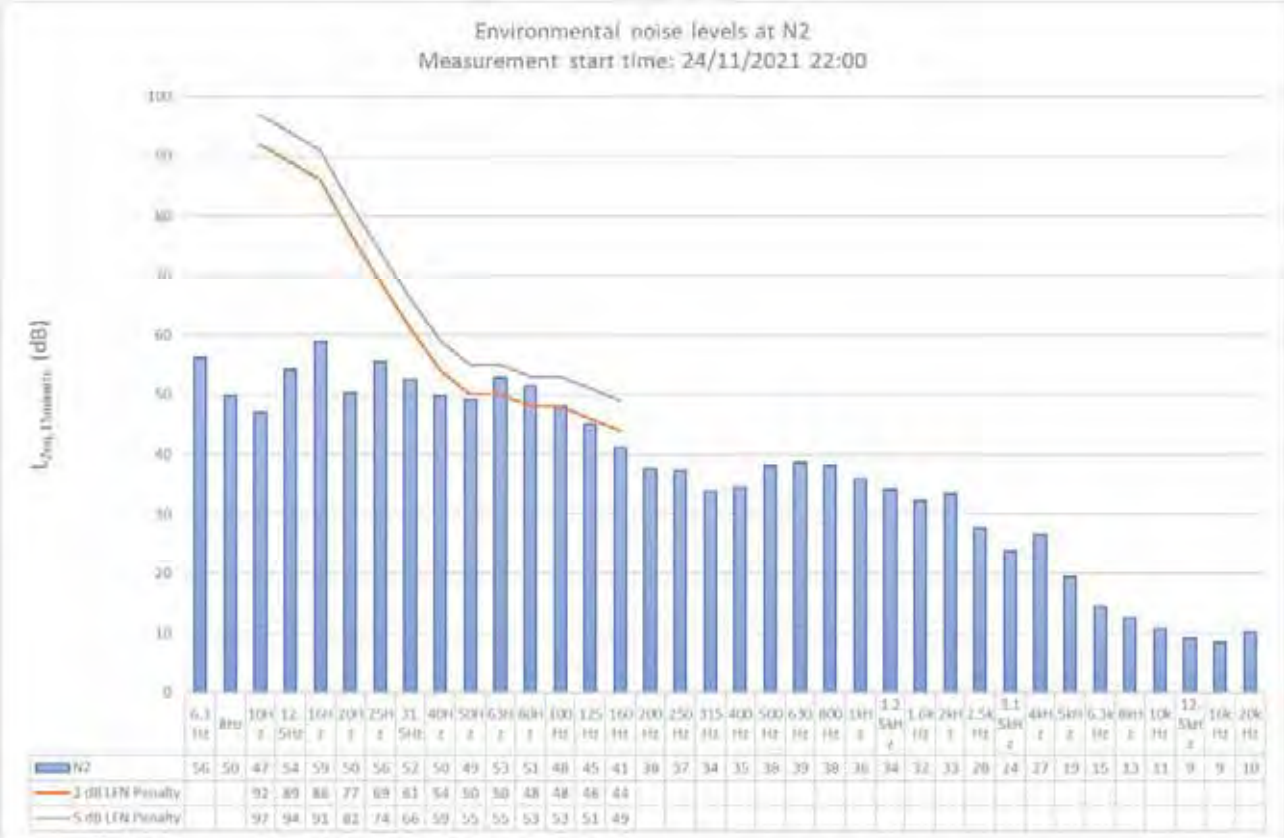

Figure 5.1 N2 total measured one-third octave band frequencies

Other 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 35 dB $L_{Aeq,night}$ (i.e. Ashton Coal mine noise of 31 dB $L_{Aeq,15\ minute}$ + Other mine noise of 34 dB $L_{Aeq,15\ minute}$ +2 dB - 3 dB as per NPfI methodology), including a 2 dB positive adjustment for LFN. This 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 hum with engine revs on occasion. The Ashton Coal mine noise contribution was estimated at up to 32 dB $L_{Aeq,15\ minute}$. Engine revs from site generated an estimated 35 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, insects, frogs, traffic on the New England Highway, bird noise and aircraft noise. A graph of the total linear noise levels measured in the one-third octave frequency bands is shown in Figure 5.2.

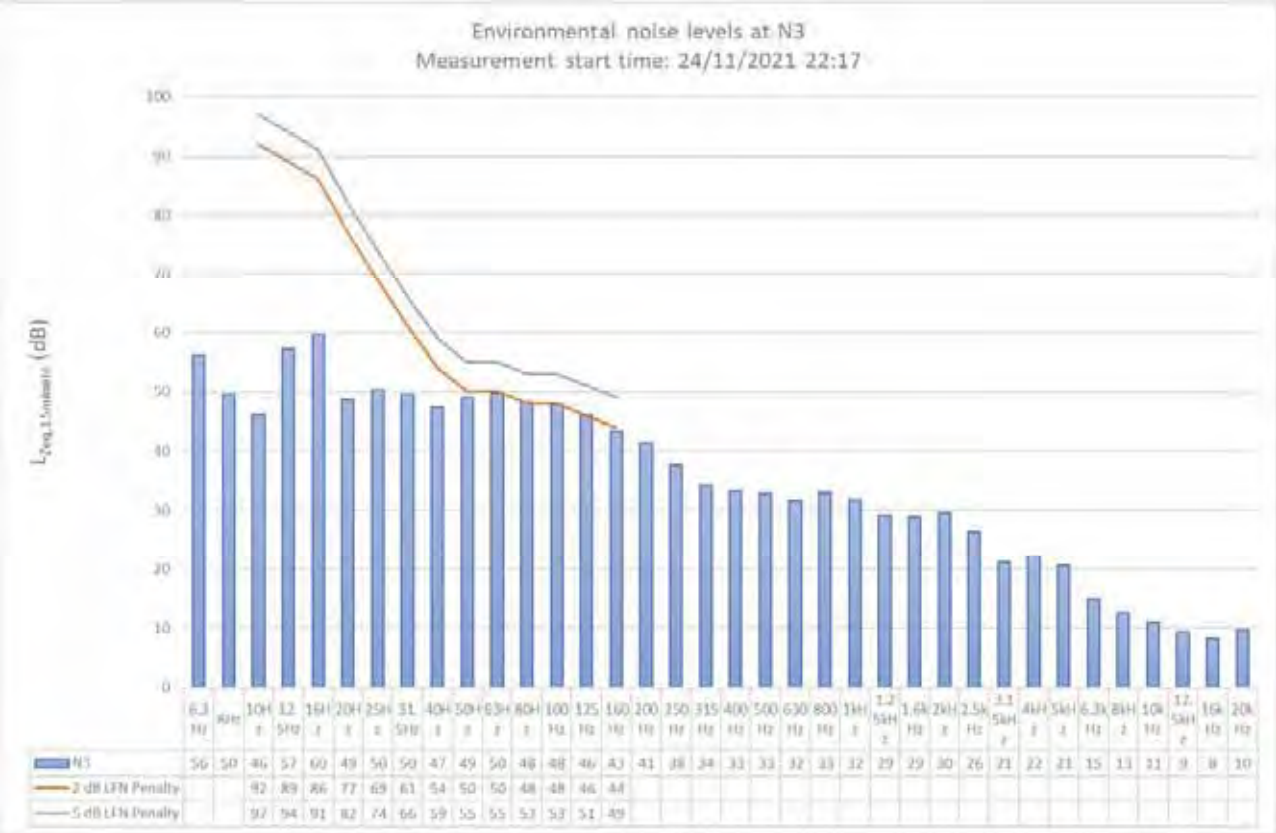

Figure 5.2 N3 total measured one-third octave band frequencies

Other 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 34 dB $L_{Aeq,night}$ (i.e. Ashton Coal mine noise of 32 dB $L_{Aeq,15\ minute}$ + Other mine noise of 35 dB $L_{Aeq,15\ minute}$ - 3 dB as per NPfI methodology). This 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 entire operator-attended noise survey. Given this and the measured background noise level of 41 dB L_{A90}, the Ashton Coal $L_{Aeq,15\ minute}$ mine noise contribution was estimated to be ≤31 dB $L_{Aeq,15\ minute}$ and therefore below the relevant noise limit. Ashton Coal noise contributions complied with the DC and EPL noise limits. Other ambient noise sources included other mines in the vicinity, insects, frogs, and traffic on the New England Highway. A graph of the total linear noise levels measured in one-third octave frequency bands is shown below in Figure 5.3.

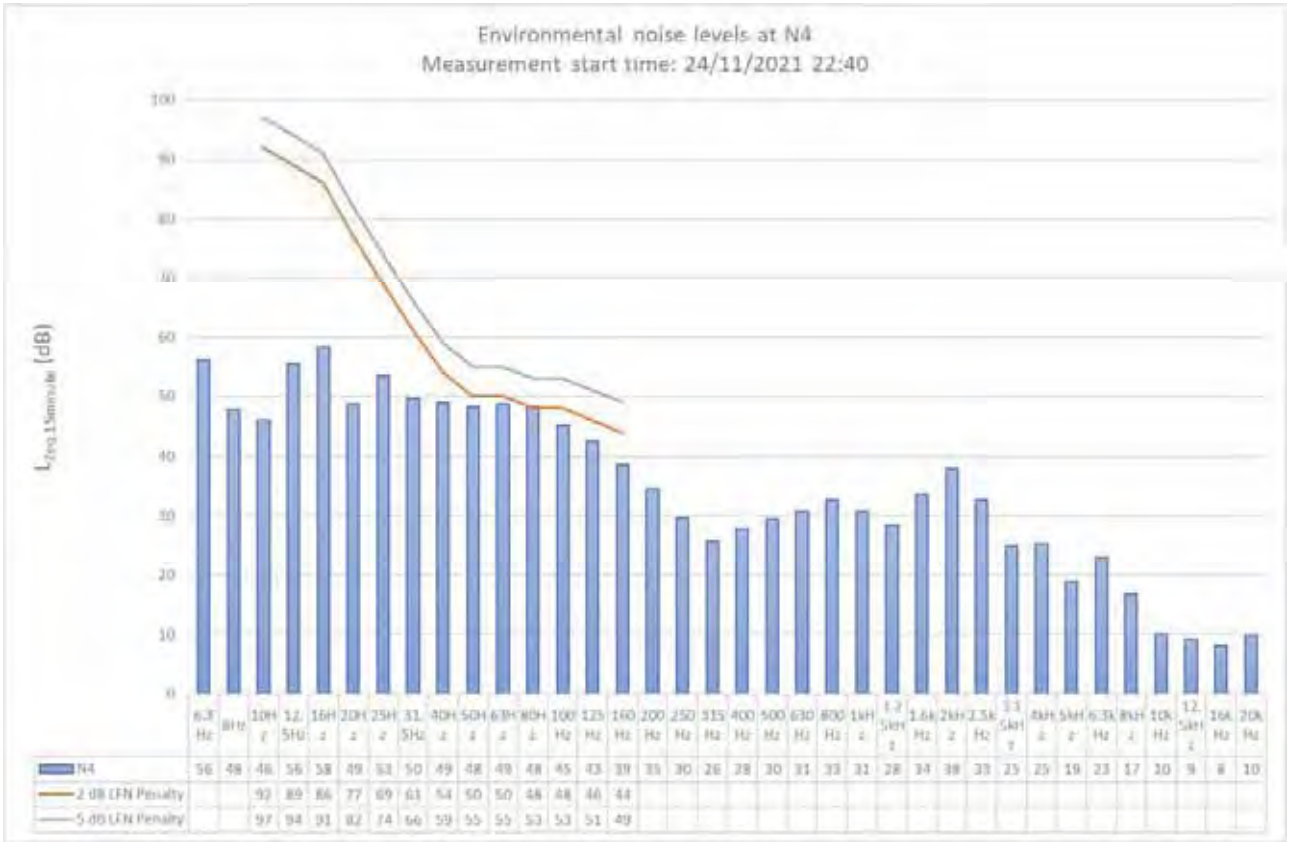

Figure 5.3 N4 total measured one-third octave band frequencies

Other 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 30 dB $L_{Aeq,night}$ (i.e. Other mine noise of 33 dB $L_{Aeq,15\ minute}$ - 3 dB as per NPfI methodology). This 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 24 November 2021.

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 DC and EPL.

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

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.

L3.2 The Licensee must not dispose of waste on the premises unless authorised by a condition of 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 12 and 32.

4 Operating Conditions

Appendix C

Calibration certificates

CERTIFICATE OF CALIBRATION

CERTIFICATE NO: C30591

EQUIPMENT TESTED : Sound Level Calibrator

Manufacturer: Svantek
Type No: SV-36 **Serial No:** 79952
Owner: EMM Consulting Pty Ltd
L3, 175 Scott Street
Newcastle, NSW 2300
Tests Performed: Measured Output Pressure level, Frequency & Distortion
Comments: See Details overleaf. All Test Passed.

Parameter	Pre-Adj	Adj Y/N	Output: (dB re 20 µPa)	Frequency (Hz)	THD&N (%)
Level1	NA	N	94.12 dB	999.99 Hz	1.58 %
Level2:	NA	N	114.05 dB	999.99 Hz	1.12 %
Uncertainty			±0.11 dB	±0.05%	±0.20 %
Uncertainty (at 95% c.l.) k=2					

CONDITION OF TEST:

Ambient Pressure	1007	hPa ±1 hPa	**Date of Receipt :**	16/09/2021
Temperature	21	°C ±1° C	**Date of Calibration :**	16/09/2021
Relative Humidity	43	% ±5%	**Date of Issue :**	16/09/2021

Acu-Vib Test Procedure: AVP02 (Calibrators)
Test Method: AS IEC 60942 - 2017

CHECKED BY: ..... **AUTHORISED SIGNATURE:** .....
Alan Sng

Accredited for compliance with ISO/IEC 17025 - Calibration
Results of the tests, calibration and/or measurements included in this document are traceable to SI units through reference equipment that has been calibrated by the Australian National Measurement Institute or other NATA accredited laboratories demonstrating traceability.

This report applies only to the item identified in the report and may not be reproduced in part.

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

ilac-MRA DANAK
CAL Reg.No. 307
Member of EA MLA

CERTIFICATE OF CALIBRATION

No: CDK2007931

CALIBRATION OF

Sound Level Meter:	Brüel & Kjær Type 2250	No: 3029363	Id: -
Microphone:	Brüel & Kjær Type 4189	No: 3260501	
PreAmplifier:	Brüel & Kjær Type ZC-0032	No: 30109	
Supplied Calibrator:	None		
Software version:	BZ7222 Version 4.7.6	Pattern Approval:	-
Instruction manual:	BE1712-22		

CUSTOMER

EMM Consulting
Ground Floor, Suite 1
20 Chandos Street
2065 St Leonards
New South Wales, Australia

CALIBRATION CONDITIONS

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

Environment conditions: *See actual values in sections.*

SPECIFICATIONS

The Sound Level Meter Brüel & Kjær Type 2250 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 8.2 - DB: 8.20) by using procedure B&K proc 2250, 4189 (IEC 61672:2013).

RESULTS

Calibration Mode: **Calibration as received.**

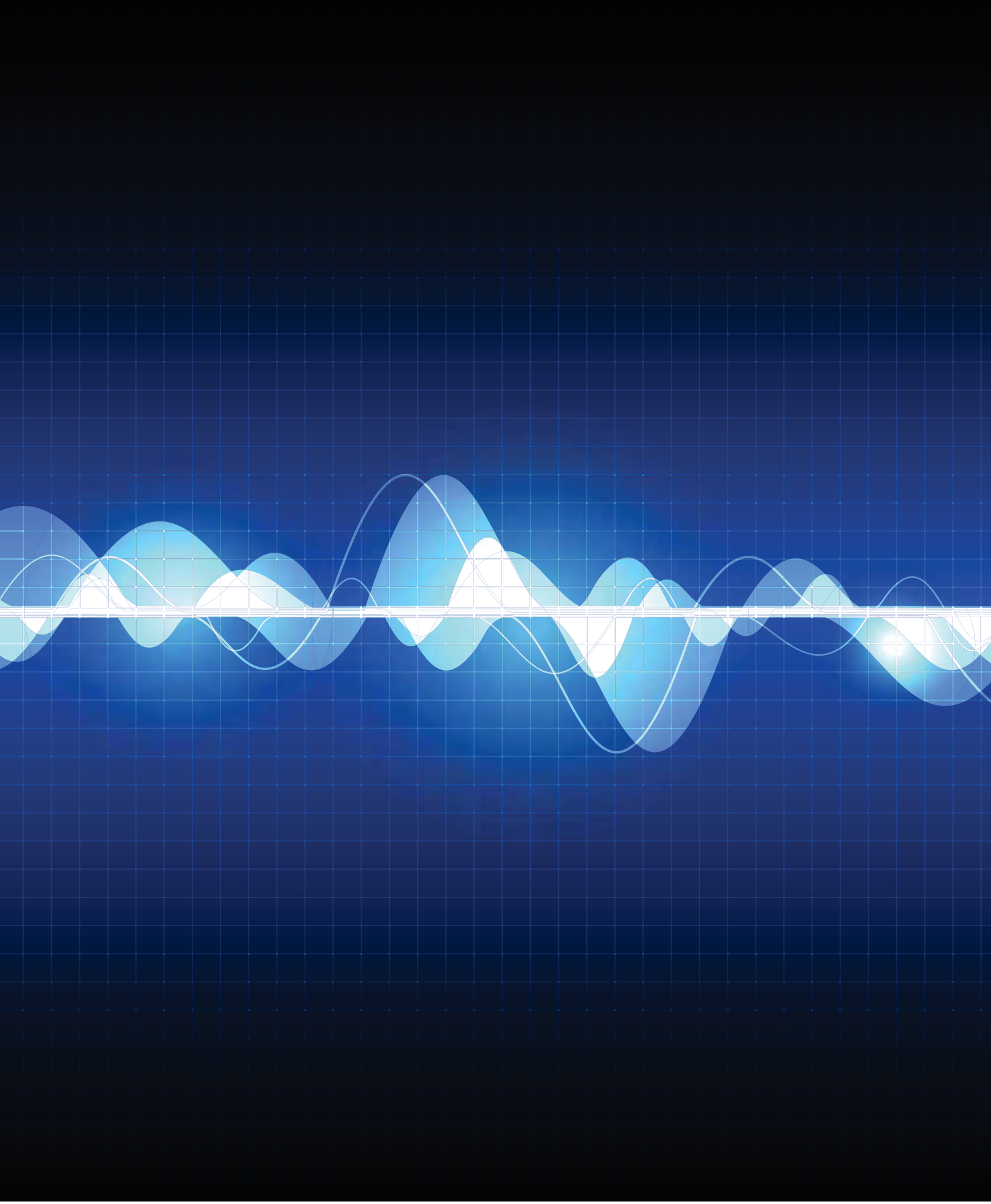
The reported expanded uncertainty is based on the standard uncertainty multiplied by a coverage factor $k = 2$ providing a level of confidence of approximately 95 %. The uncertainty evaluation has been carried out in accordance with EA-4/02 from elements originating from the standards, calibration method,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

Date of calibration: 2020-11-26

Date of issue: 2020-11-26

Lene Petersen
Calibration Technician

Erik Bruus
Approved Signatory



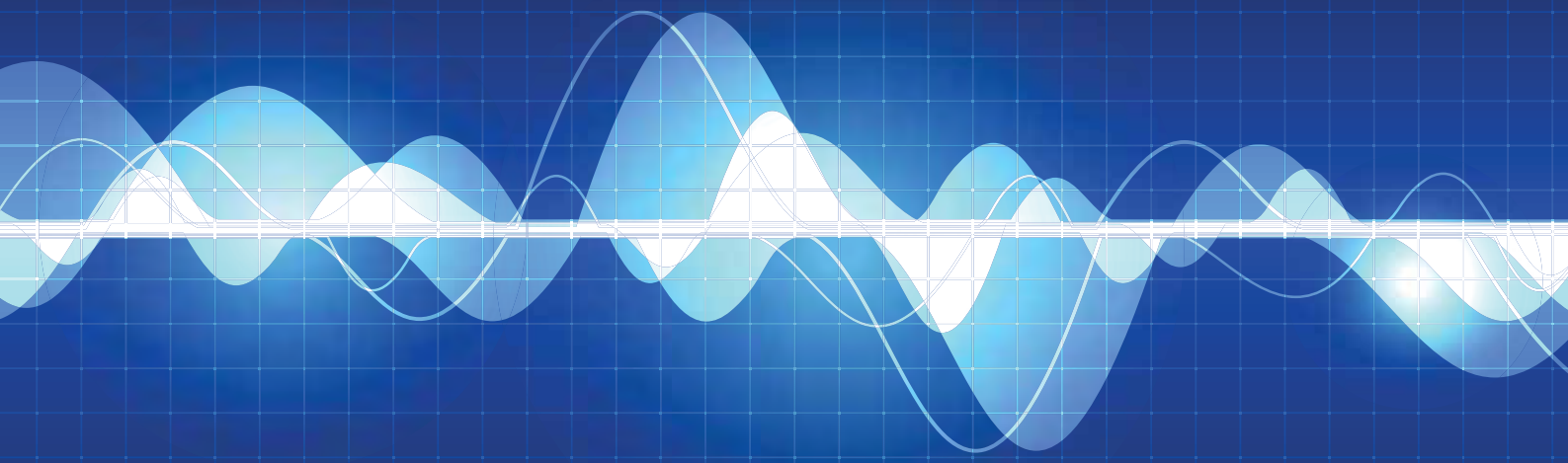
Appendix L

Monthly attended noise monitoring report - December 2021

Ashton Coal

Monthly attended noise monitoring
December 2021

Prepared for Ashton Coal Operations Pty Ltd
January 2022



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Ashton Coal

Monthly attended noise monitoring - December 2021

Report Number

H200894 RP12

Client

Ashton Coal Operations Pty Ltd

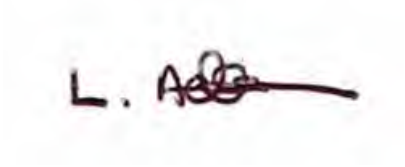
Date

4 January 2022

Version

v2 Final

Prepared by



Lucas Adamson
Senior Acoustic Consultant
4 January 2022

Approved by

Alex Dundon
Associate
4 January 2022

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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 20 December 2021.

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 20 December 2021);
- Environment Protection Authority (EPA), Environment Protection License 11879, as varied on 3 February 2020 (current as of 20 December 2021);
- Ashton Coal Project Noise Management Plan (NMP), approved by DPIE on 23 September 2020 (current as of 27 October 2021);
- 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

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 metres per second (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 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 completion of the noise monitoring 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 (eg low pass filtering).

4.2 Instrumentation

A Brüel & Kjær 2250 Type 1 sound analyser (s/n 3008201) 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 Svantek SV-36 calibrator (s/n 79952). 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

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

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

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 E1 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 Ashton Coal 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 (eg removing higher frequencies that are not mine related, ie above 630 Hz). Attended monitoring was completed on 20 December 2021. Noise from Ashton Coal operations was audible during all three operator-attended noise surveys.

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 initially 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. Total measured LFN thresholds were exceeded during the measurement at N2 and therefore a more detailed analysis of overall mining noise contributions was conducted. The surveys were reviewed for periods with low levels of extraneous noise (such as traffic and other mines in the area) as to determine and assess the Ashton Coal low-frequency noise contributions to the total LFN levels. It was determined that the relevant LFN thresholds would not have been exceeded solely by noise emissions from Ashton Coal due to the following:

- the relative contribution of Ashton Coal (31 dB $L_{Aeq,15\ minute}$);
- the relative contribution of other mines in the area (35 dB $L_{Aeq,15\ minute}$);
- the relative contribution from traffic on the New England Highway (consistent and dominant at times);
- the level/nature of the exceedance of the relevant LFN threshold (2 dB exceedance at 500 Hz); and
- onsite operations were relatively consistent during the measurement (ie fixed and mobile plant activities).

Therefore, in accordance with the NPfI, an LFN modifying factor was not applied to estimated Ashton Coal noise levels at N2.

Notwithstanding the preceding, it is noted that total measured noise levels exceeded the relevant LFN thresholds during the measurement at N2 and therefore, in accordance with the NPfI, an LFN modifying factor was applied to the estimated cumulative mine noise level at location N2.

Ashton Coal noise contributions and cumulative mine noise contributions were below (ie complied with) the relevant noise limits at all monitoring locations.

Table 5.1 Ashton Coal attended noise monitoring results – December 2021

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	20/12	22:08	36	38	45	49	53	59	60	Nil	31	32	36	46	1.5 m/s @ 173° E class stability 0.7°C/100m VTG Y	Nil	Ashton Coal mine hum consistently audible. Other mines in the vicinity (35 dB $L_{Aeq,15\ minute}$), insects, frogs and traffic on the New England Highway consistently audible. Bird noise, livestock and resident noise occasionally audible.
N3	20/12	22:27	34	36	41	44	50	53	58	Nil	29	31	36	46	1.8 m/s @ 157° E class stability 1.1°C/100m VTG Y	Nil	Ashton Coal mine hum consistently audible. Other mines in the vicinity (35 dB $L_{Aeq,15\ minute}$), traffic on the New England Highway, insects and frogs consistently audible. Dogs barking occasionally audible.
N4	20/12	22:50	31	33	36	39	43	47	57	Nil	IA	IA	36	46	1.4 m/s @ 145° F class stability 1.6°C/100m VTG Y	Nil	Ashton Coal inaudible. Other mines in the vicinity (31 dB $L_{Aeq,15\ minute}$) occasionally audible. Traffic on the New England Highway, insects and frogs 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 N2 - Camberwell Village (west)

Ashton Coal operations were consistently audible during the operator-attended noise survey including conveyor hum. The Ashton Coal mine noise contribution was estimated at up to 31 dB $L_{Aeq,15\ minute}$. Conveyor hum from site generated an estimated 32 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, insects, frogs, traffic on the New England Highway, bird noise, livestock and resident noise. A graph of the total linear noise levels measured in each one-third octave frequency bands is shown in Figure 5.1.

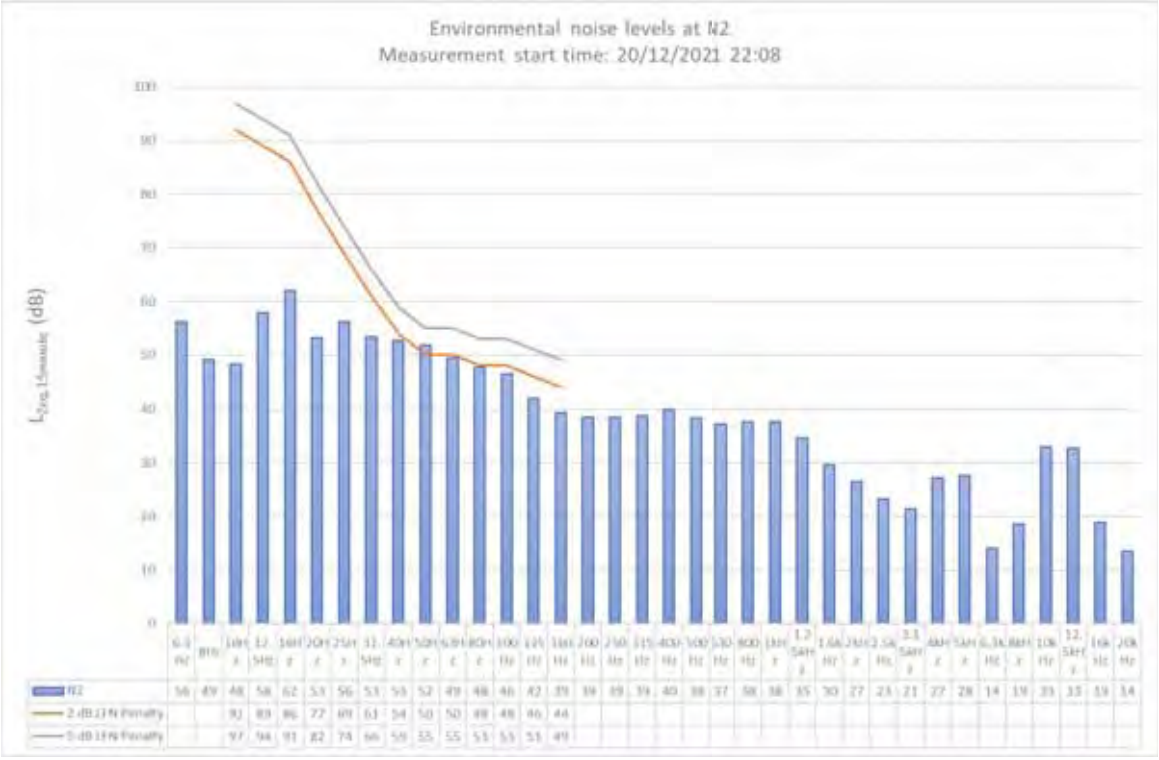

Figure 5.1 N2 total measured one-third octave band frequencies

Other 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 35 dB $L_{Aeq,night}$ (ie Ashton Coal mine noise of 31 dB $L_{Aeq,15\ minute}$ + Other mine noise of 35 dB $L_{Aeq,15\ minute}$ - 3 dB + 2 dB as per NPfI methodology), including a 2 dB positive adjustment for LFN. This is below the cumulative mine noise night-time criterion (ie $L_{Aeq,night}$ 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 hum. The Ashton Coal mine noise contribution was estimated at up to 29 dB $L_{Aeq,15\ minute}$. Conveyor hum from site generated an estimated 31 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, insects, frogs, traffic on the New England Highway and dogs barking. A graph of the total linear noise levels measured in the one-third octave frequency bands is shown in Figure 5.2.

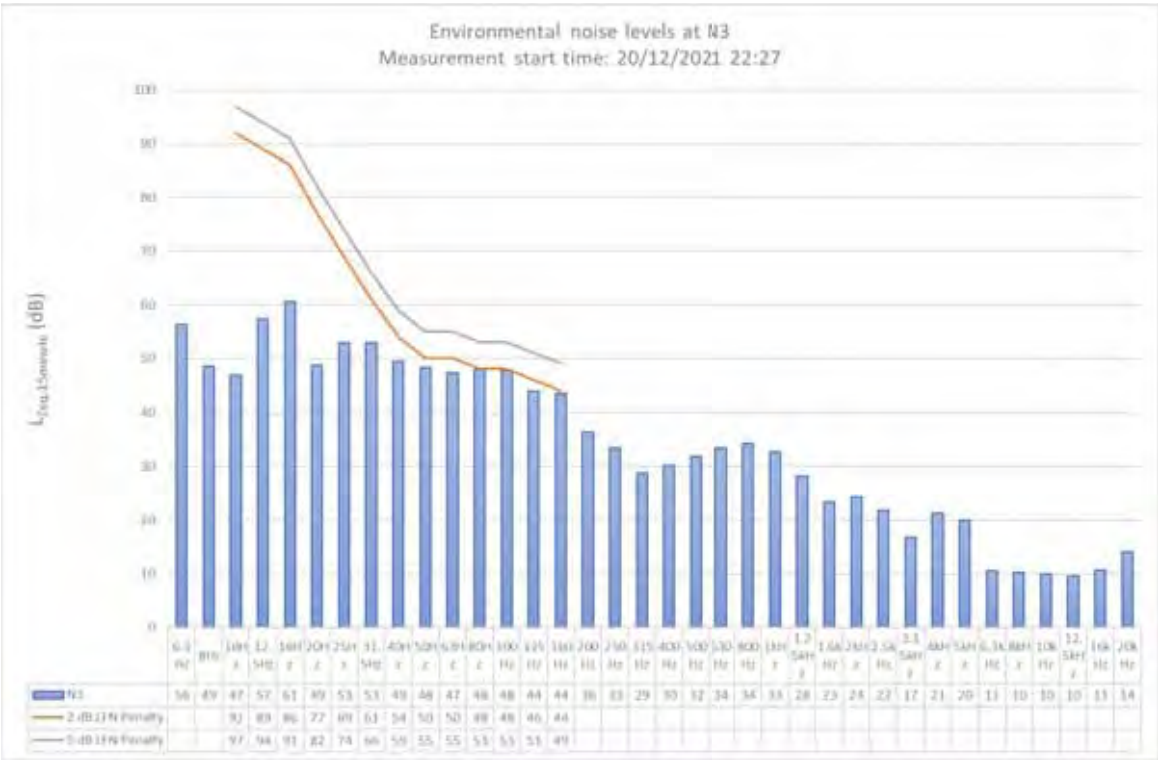

Figure 5.2 N3 total measured one-third octave band frequencies

Other 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 33 dB $L_{Aeq,night}$ (ie Ashton Coal mine noise of 29 dB $L_{Aeq,15\ minute}$ + Other mine noise of 35 dB $L_{Aeq,15\ minute}$ - 3 dB as per NPfI methodology). This is below the cumulative mine noise night-time criterion (ie $L_{Aeq,night}$ 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 entire operator-attended noise survey. Given this and the measured background noise level of 33 dB L_{A90}, the Ashton Coal $L_{Aeq,15\ minute}$ mine noise contribution was estimated to be ≤23 dB $L_{Aeq,15\ minute}$ and therefore below the relevant noise limit. Ashton Coal noise contributions would have complied with the DC and EPL noise limits. Other ambient noise sources included other mines in the vicinity, insects, frogs and traffic on the New England Highway. A graph of the total linear noise levels measured in one-third octave frequency bands is shown below in Figure 5.3.

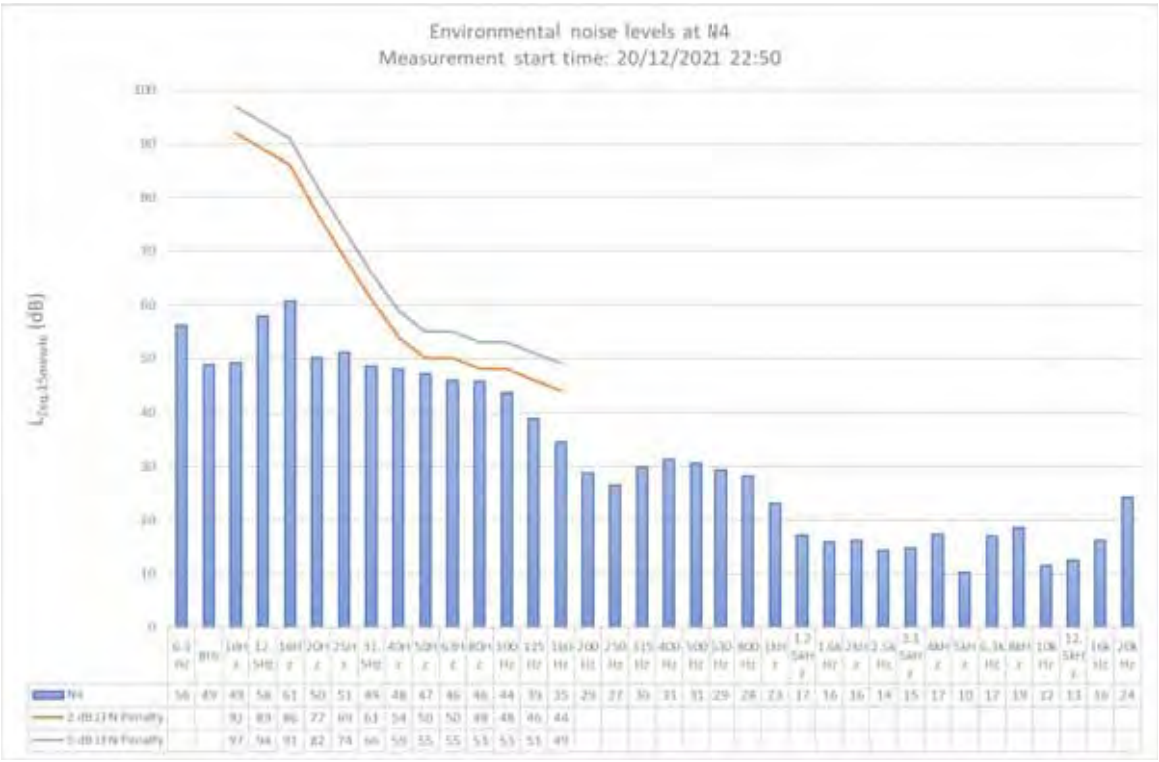

Figure 5.3 N4 total measured one-third octave band frequencies

Other 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 28 dB $L_{Aeq,night}$ (ie other mine noise of 31 dB $L_{Aeq,15\ minute}$ - 3 dB as per NPfI methodology). This is below the cumulative mine noise night-time criterion (ie $L_{Aeq,night}$ 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 20 December 2021.

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 DC and EPL.

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

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.

L3.2 The Licensee must not dispose of waste on the premises unless authorised by a condition of 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 12 and 32.

4 Operating Conditions

Appendix C

Calibration certificates

CERTIFICATE OF CALIBRATION

CERTIFICATE NO.: SLM 26291 & FILT 5615

Equipment Description:	Sound Level Meter		
Manufacturer:	B & K		
Model No:	2250	**Serial No:**	2759405
Microphone Type:	4189	**Serial No:**	2888134
Preamplifier Type:	ZC0032	**Serial No:**	16037
Filter Type:	1/3 Octave	**Serial No:**	2759405
Comments:	All tests passed for class 1. (See over for details)		
Owner:	EMM Consulting Level 3, 175 Scott Street Newcastle, NSW 2300		
Ambient Pressure:	1007 hPa ±1.5 hPa		
Temperature:	24 °C ±2° C	**Relative Humidity:**	53% ±5%
Date of Calibration:	05/02/2020	**Issue Date:**	05/02/2020

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

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

Accredited for compliance with ISO/IEC 17025 - Calibration
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Tel: (02) 96808133 Fax: (02)96808233
Mobile: 0413 809806
web site: www.acu-vib.com.au

Accredited Lab. No. 9262
Acoustic and Vibration Measurements

CERTIFICATE OF CALIBRATION

CERTIFICATE NO.: **SLM 25410 & FILT 5368**

Equipment Description:	Sound Level Meter		
Manufacturer:	B & K		
Model No:	2250	**Serial No:**	3008201
Microphone Type:	B&K 4189	**Serial No:**	2983733
Preamplifier Type:	B&K ZC0032	**Serial No:**	22666
Filter Type:	1/3 Octave	**Serial No:**	3008201
Comments:	All tests passed for class 1. (See over for details)		
Owner:	EMM Consulting Ground Floor, Suite 01, 20 Chandos St St Leonards NSW 2065		
Ambient Pressure:	1002 hPa ±1.5 hPa		
Temperature:	23 °C ±2° C	**Relative Humidity:**	29% ±5%
Date of Calibration:	21/08/2019	**Issue Date:**	21/08/2019
Acu-Vib Test Procedure:	AVP10 (SLM) & AVP06 (Filters)		

CHECKED BY: IRB **AUTHORISED SIGNATURE:** ..... Heiy Soe

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Acoustic and Vibration Measurements

CERTIFICATE NO.: SLM 25410 & FILT 5368

The performance characteristics listed below were tested. The tests are based on the relevant clauses of IEC 61672-3:2013

Tests Performed:	*Clause*	*Result*
Absolute Calibration	10	Pass
Acoustical Frequency Weighting	12	Pass
Self Generated Noise	11.1	Entered
Electrical Noise	11.2	Entered
Long Term Stability	15	Pass
Electrical Frequency Weightings	13	Pass
Frequency and Time Weightings	14	Pass
Reference Level Linearity	16	Pass
Range Level Linearity	17	NA
Toneburst	18	Pass
Peak C Sound Level	19	Pass
Overload Indicator	20	Pass
High Level Stability	21	Pass

Statement of Compliance: The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent organization responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2013, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2013, the sound level meter submitted for testing conforms to the class 1 requirements of IEC61672-1:2013.
A full technical report is available if required.

This Sound Level Meter included an Octave Filter Set. Tests were based on IEC 1260: 1995 and AS/NZS 4476 - 1997 and were conducted to test the following performance characteristics:

1. Relative attenuation clause 5.3

Date of Calibration: 21/08/2019 **Issue Date:** 21/08/2019

Checked by:

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CERTIFICATE OF CALIBRATION

CERTIFICATE NO: C28769

EQUIPMENT TESTED: Sound Level Calibrator

Manufacturer: B & K
Type No: 4230 **Serial No:** 1276091
Owner: EMM Consulting
Level 3, 175 Scott 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	93.83	996.49	1.41
Level 2:	NA	N	NA	NA	NA
Uncertainty:			±0.11 dB	±0.05%	±0.20 %
Uncertainty (at 95% c.l.) k=2					

CONDITIONS OF TEST:

Ambient Pressure: 994 hPa ±1.5 hPa **Relative Humidity:** 59 % ±5%
Temperature: 23 °C ±2° C
Date of Calibration: 05/02/2021 **Issue Date:** 08/02/2021
Acu-Vib Test Procedure: AVP02 (Calibrators)
Test Method: AS IEC 60942 - 2017

CHECKED BY: ..... **AUTHORISED SIGNATURE:** .....
Hein Soe

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CERTIFICATE OF CALIBRATION

CERTIFICATE NO: C30591

EQUIPMENT TESTED : Sound Level Calibrator

Manufacturer: Svantek
Type No: SV-36 **Serial No:** 79952
Owner: EMM Consulting Pty Ltd
L3, 175 Scott Street
Newcastle, NSW 2300
Tests Performed: Measured Output Pressure level, Frequency & Distortion
Comments: See Details overleaf. All Test Passed.

Parameter	Pre-Adj	Adj Y/N	Output: (dB re 20 µPa)	Frequency (Hz)	THD&N (%)
Level1	NA	N	94.12 dB	999.99 Hz	1.58 %
Level2:	NA	N	114.05 dB	999.99 Hz	1.12 %
Uncertainty			±0.11 dB	±0.05%	±0.20 %
Uncertainty (at 95% c.l.) k=2					

CONDITION OF TEST:

Ambient Pressure	1007	hPa ±1 hPa	**Date of Receipt :**	16/09/2021
Temperature	21	°C ±1° C	**Date of Calibration :**	16/09/2021
Relative Humidity	43	% ±5%	**Date of Issue :**	16/09/2021

Acu-Vib Test Procedure: AVP02 (Calibrators)
Test Method: AS IEC 60942 - 2017

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Acu-Vib Electronics
CALIBRATIONS SALES RENTALS REPAIRS

Head Office & Calibration Laboratory

CERTIFICATE OF CALIBRATION

CERTIFICATE NO: C30881

EQUIPMENT TESTED : Sound Level Calibrator

Manufacturer: Svantek
Type No: SV-36 **Serial No:** 86311
Owner: EMM Consulting
Suite 01, 20 Chandos St
St Leonards NSW 2065
Tests Performed: Measured Output Pressure level, Frequency & Distortion
Comments: See Details overleaf. All Test Passed.

Parameter	Pre-Adj	Adj Y/N	Output: (dB re 20 µPa)	Frequency (Hz)	THD&N (%)
Level1:	NA	N	94.05 dB	999.99 Hz	1.00 %
Level2:	NA	N	114.05 dB	999.99 Hz	1.00 %
Uncertainty			±0.11 dB	±0.05%	±0.20 %
Uncertainty (at 95% c.l.) k=2					

CONDITION OF TEST:

Ambient Pressure	1002	hPa ±1 hPa	**Date of Receipt :**	20/10/2021
Temperature	23	°C ±1° C	**Date of Calibration :**	20/10/2021
Relative Humidity	41	% ±5%	**Date of Issue :**	20/10/2021

Acu-Vib Test Procedure: AVP02 (Calibrators)
Test Method: AS IEC 60942 - 2017

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

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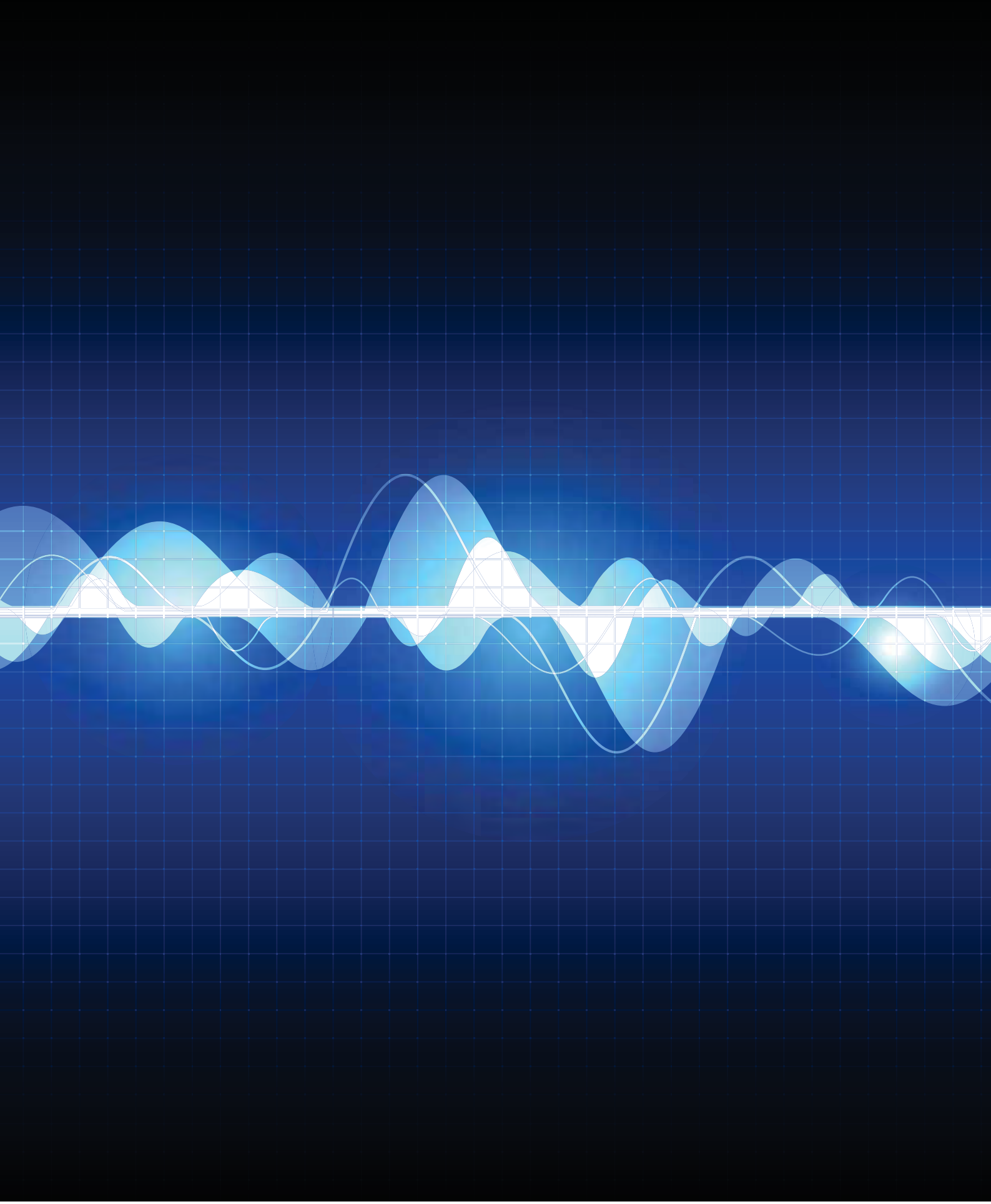

Appendix 2

Annual Groundwater Monitoring Review 2021

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Australasian Groundwater & Environmental Consultants

Report on

Yancoal – Ashton Coal Annual Groundwater Monitoring Review 2021

Prepared for
Yancoal Australia Limited

Project No. G1922P
March 2022

ageconsultants.com.au

ABN 64 080 238 642

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Yancoal – Ashton Coal
Annual Groundwater Monitoring Review 2021

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 LW204 within the ULLD extracted coal between August 2020 and April 2021. Works on longwall panel LW205 within the ULLD began in June 2021 and were completed in December 2021.

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

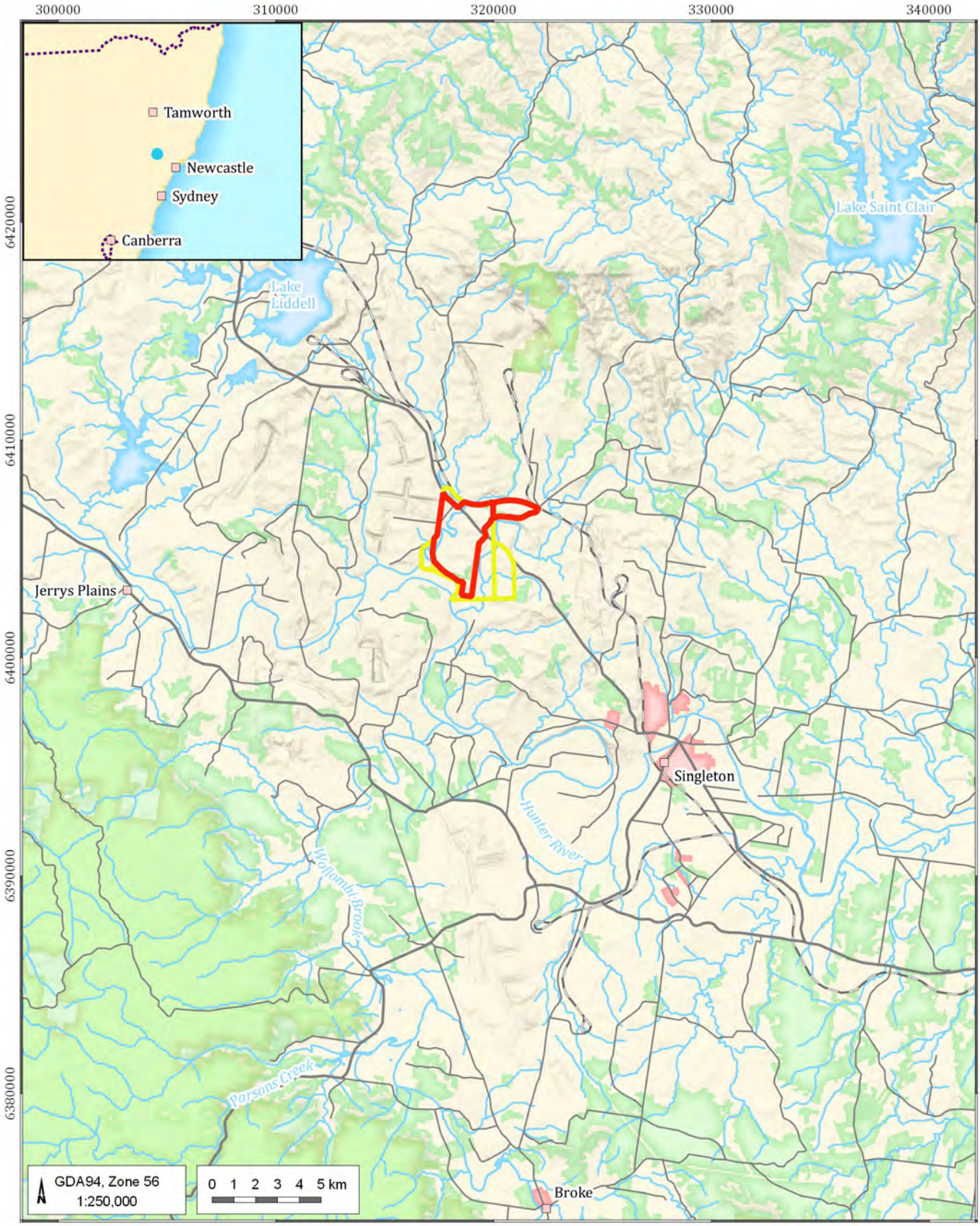
The ACOL development consent (DA 309-11-2001-i – 11 February 2002; last modified June 2016), requires that groundwater be monitored for potential impacts from mining. In 2020, the Department of Planning and Environment (DPE) approved the current water management plan (WMP; Ashton document HSEC Management System Plan Doc. No. 3.4.1.8 version 11, dated 15 September 2020). 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 2021 to December 2021. The aim of this report is to provide a consolidated summary of groundwater conditions at ACP throughout 2021.

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 2021 (G1922P)

Study area location

AGE

DATE 20/01/2022

FIGURE No: **1.1**

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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 equipment is being relocated to LW206 of the ULLD seam (LW201 to LW208). Mining in LW206 will begin extracting coal in early January 2021. LW206 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 LW206, 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. The Ashton Weather station has 16 years of rainfall data for the period 1 July 2005 to present, while the Bulga (South Wambo) station has 63 years of rainfall data dating from 1959 to present. A summary of average monthly rainfall from the Bulga (South Wambo) station and the Ashton Weather station for 2021 is presented in Table 2.1. Rainfall at Ashton increased significantly in 2021 compared to the previous year with above average rainfall between January to March, May, August and October to December. The data presented in Table 2.1 shows that rainfall at Ashton in 2021 was below average for four months (April, June, July and September). Rainfall at the Bulga (South Wambo) station was below average for three months of 2021 (April, May and September).

Table 2.1 Average Monthly Rainfall 2021 – 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	78.4	124%	132.4	164%
Feb	149.8	179%	96.4	108%
Mar	272.4	275%	256.3	272%
Apr	27.6	49%	19.8	42%
May	37.8	114%	5.5	23%
Jun	66.0	96%	67.6	101%
Jul	24.6	84%	30.8	112%
Aug	34.0	108%	46.0	153%
Sep	38.0	93%	24.8	59%
Oct	79.0	160%	78.5	158%
Nov	296.0	347%	229	282%
Dec	114.6	169%	96.2	121%

An evapotranspiration (ET) rate of 765 mm/year was sourced from the Bureau of Meteorology (BOM)[1] database for the Camberwell area.

1 Bureau of Meteorology (2016). Average annual & monthly evapotranspiration.
Available at: http://www.bom.gov.au/jsp/ncc/climate_averages/evapotranspiration/index.jsp

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 above average rainfall for 2021, as represented by an increasing CRD.

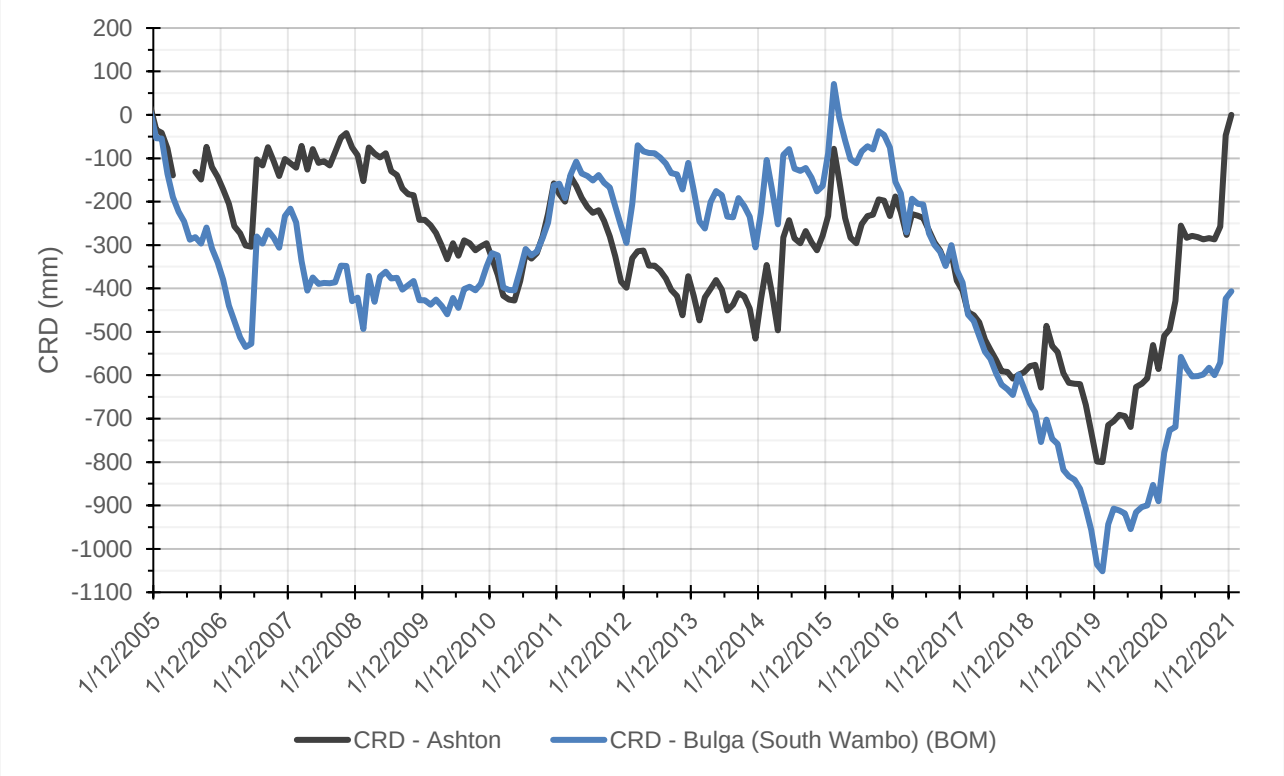


Figure 2.1 Cumulative Rainfall Departure – Ashton Coal and Bulga

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 in the middle section of the creek on the ML, upstream to the western diversion.

2.3 Mining

The longwall panels accessing the ULLD 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	03/03/2009
LW4	PG	02/04/2009	15/10/2009
LW5	PG	04/01/2010	07/06/2010
LW6A	PG	09/07/2010	22/11/2010
LW7A	PG	22/03/2011	08/08/2011
LW7B	PG	03/10/2011	17/01/2012
LW8	PG	27/02/2012	05/06/2012
LW101	ULD	31/07/2012	16/06/2013

Longwall panel	Target seam	Start date	End date
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	03/02/2016	11/04/2016
LW105	ULD	17/05/2016	26/09/2016
LW106A	ULD	18/10/2016	31/05/2017
LW201	ULLD	07/07/2017	04/05/2018
LW202	ULLD	07/06/2018	20/08/2019
LW203	ULLD	08/10/2019	25/05/2020
LW204	ULLD	02/07/2020	14/04/2021
LW205	ULLD	3/06/2021	5/12/2021

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.

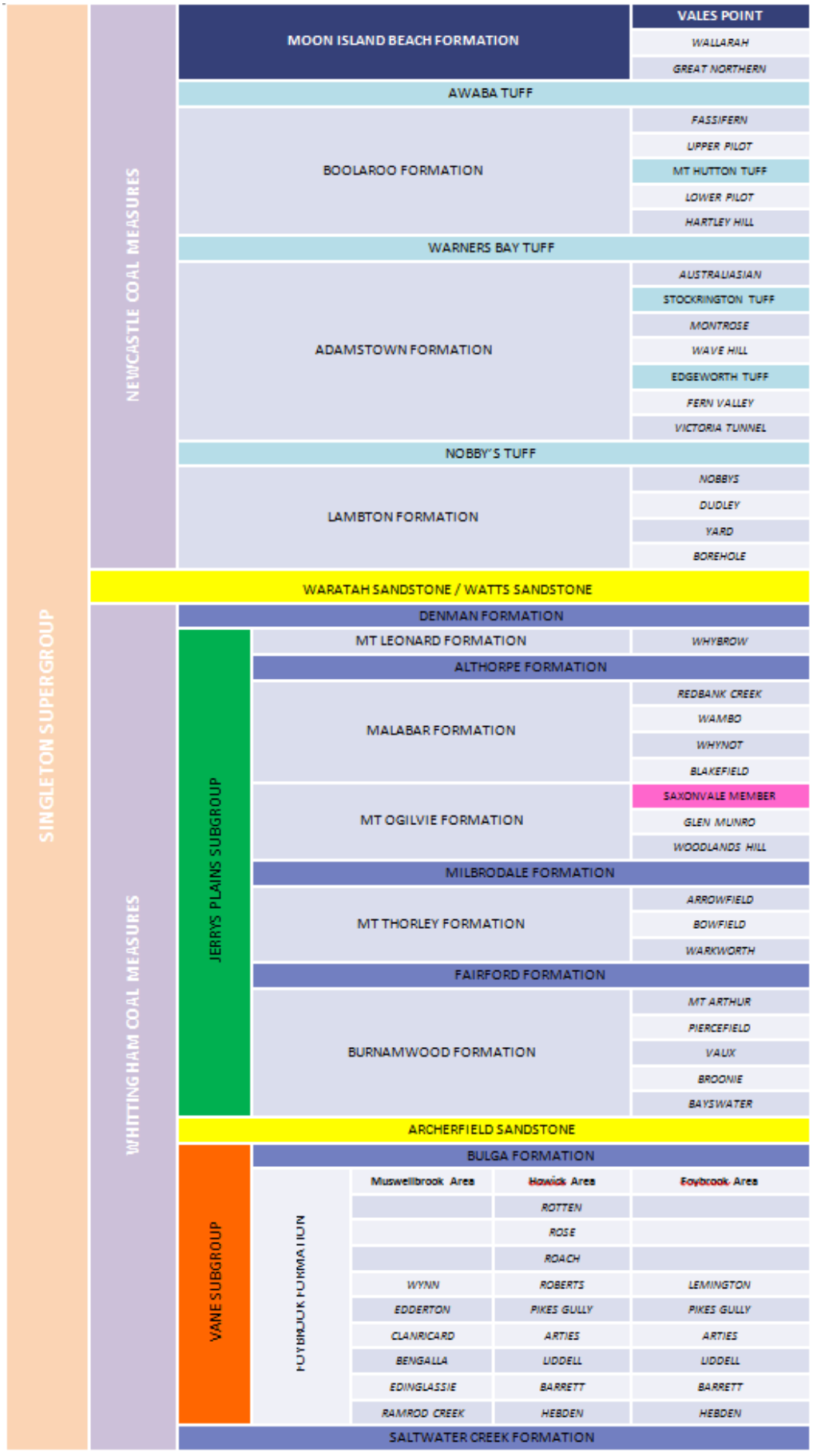


Figure 2.2 Singleton Super Group sequence stratigraphy (AGE, 2016)

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 into (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.

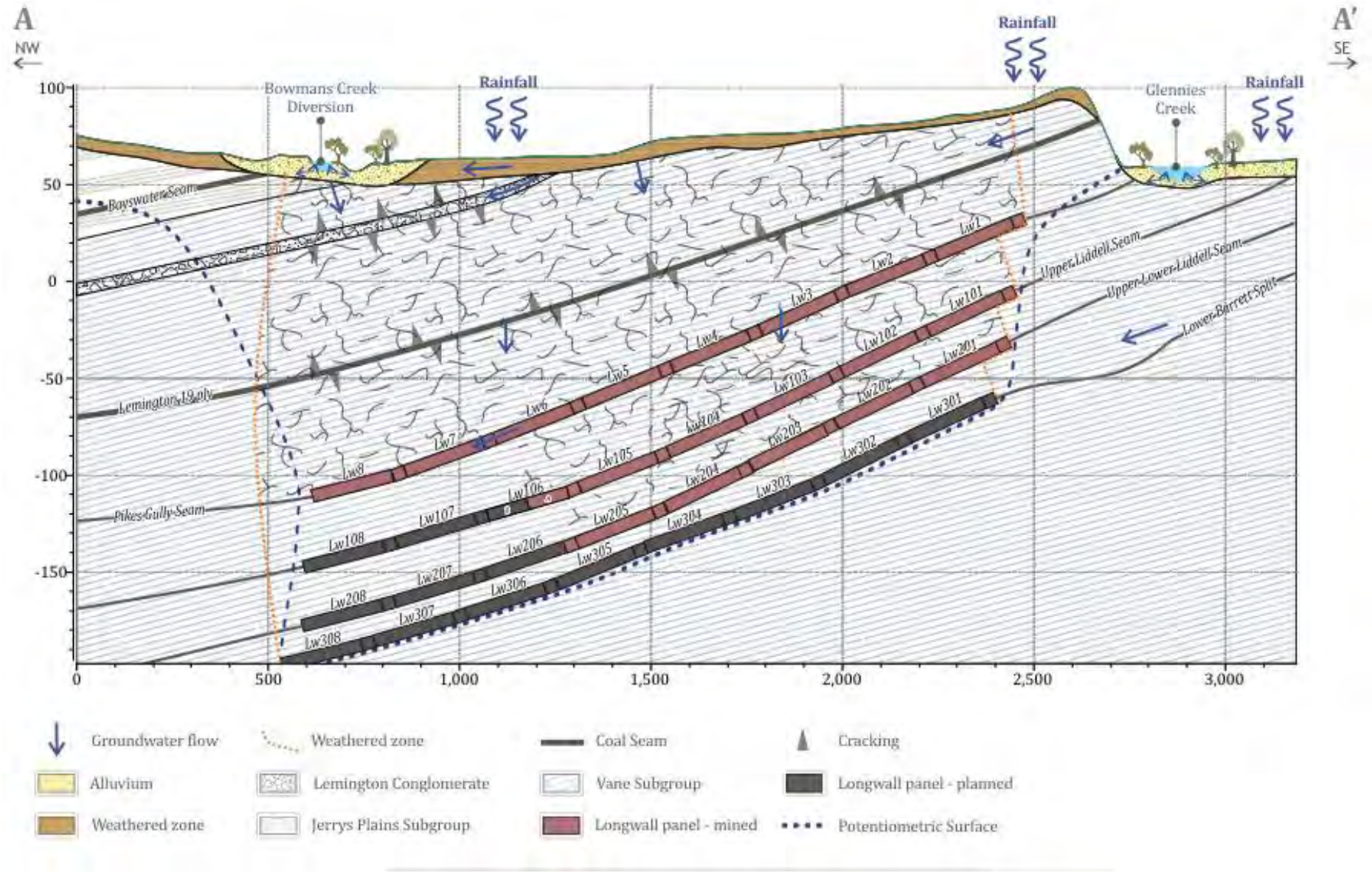


Figure 2.3 Conceptual hydrogeology – north-west to south-east – not to scale

3 Groundwater management plan

The previous WMP (2018) was updated and submitted to DPI Water for approval in March 2018. The updated WMP (2020) (herein referred to as WMP) includes an update to targeted water quality triggers. Details of the monitoring locations are summarised in Appendix A. The groundwater monitoring plan, including monitoring parameters and frequency, is summarised in Appendix B. The WMP received approval in September 2020, therefore, groundwater monitoring was conducted as per WMP version 11 (2020) following its approval.

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 A 1).

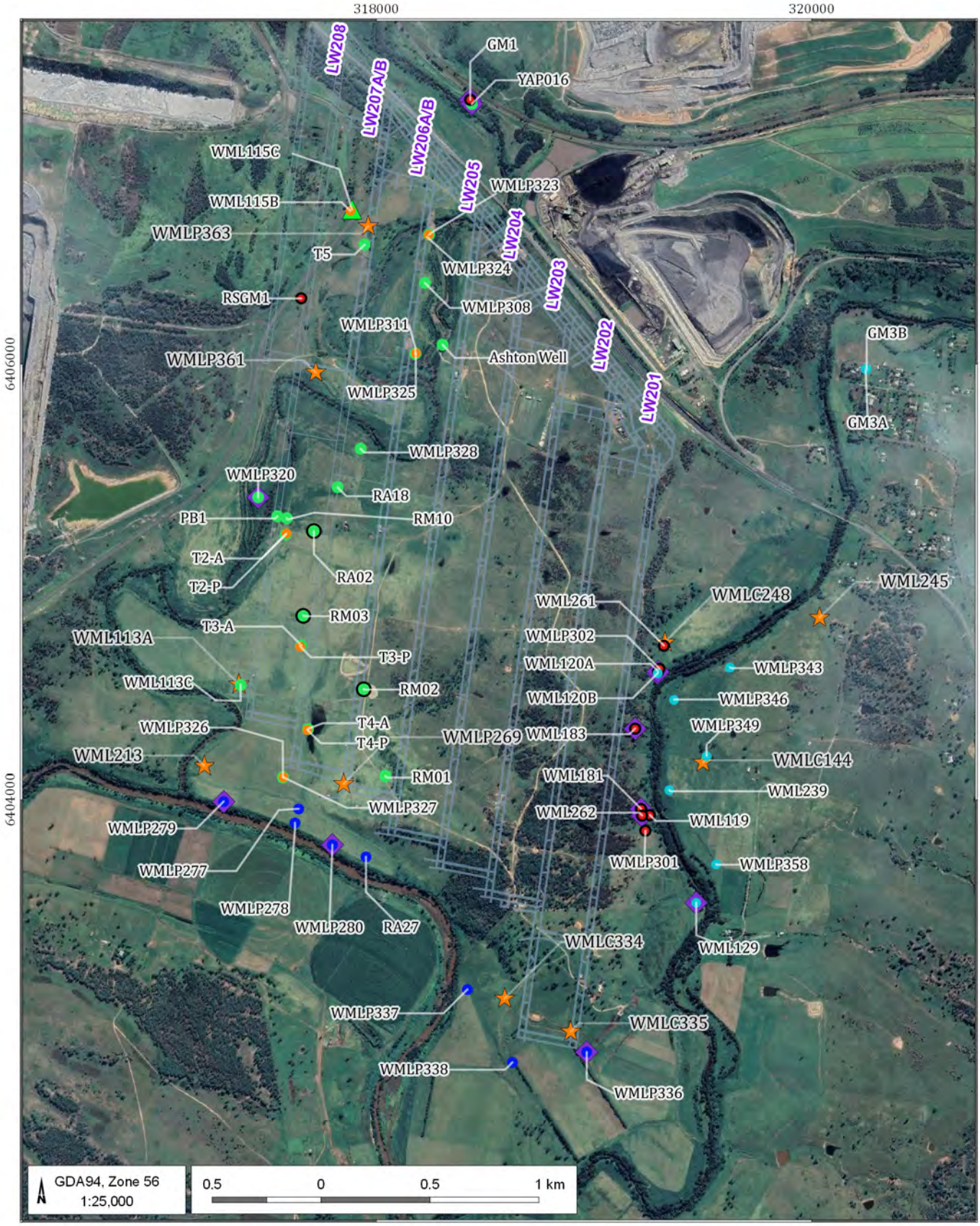
The groundwater monitoring program includes the monitoring of:

- 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 B 1).



LEGEND

- Longwall panels (ULLD)
- Bowmans Creek Alluvium
- Bowmans Creek Alluvium and Coal Measure Overburden
- Bowmans Creek Colluvium
- Coal measure
- Coal measure overburden
- EPL Bores - Updated Nov 2019
- Glennies Creek Alluvium
- Hunter River Alluvium
- VWPs

Yancoal Ashton - AGMR 2021 (G1922P)

WMP groundwater monitoring network

AGE

DATE 20/01/2022

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 BCA, GCA and the 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	57.50
	WMLP323	59.47	59.20
	WMLP328	49.42	55.15
	T2A	49.69	54.17
GCA	WML120B	51.12	51.45
	WML129	45.44	49.80
	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	8.0	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	8.0	740
	WML239	6.3	7.4	984
	WMLP343	6.7	7.2	994
	WMLP346	6.5	7.1	750
	WMLP349	6.5	6.8	983
	WMLP358	6.2	6.9	401
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

Note: Data reviewed for trigger derivation includes historical data to June 2017.

3.3 Sampling methods

Groundwater sampling at Ashton in 2021 adhered to the following standards and procedures:

- Australian Government – National Water Commission (2020). *"Minimum Construction Requirements for Water Bores in Australia".* Fourth edition ISBN 978-0-646-81881-8.
- 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 2021 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 2021, groundwater sampling was conducted by AGE Hydrogeologist Jordan Reeds.

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 4.28.

4.1 Alluvium monitoring

4.1.1 WMP compliance groundwater elevations

The groundwater elevation 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 2021:

- Excepting an increase in March and November, BCA regulatory bore groundwater elevations were stable throughout 2021 (Figure 4.1). All BCA groundwater elevations remained above established triggers in 2021. 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;
- Excepting an increase during the April and December monitoring period, GCA groundwater elevations were generally stable throughout the year (Figure 4.2 and Figure 4.3). The increase in groundwater elevation followed higher than average rainfall, indicated by an increasing CRD. A minor decline in groundwater elevation was recorded between January to March 2021 in monitoring bore WML120B and WML129. All GCA groundwater elevations remained above established triggers in 2021;
- HRA regulatory bore groundwater elevations were relatively steady throughout the year. Increased water elevations in HRA regulatory bores were recorded in the April and December monitoring periods, following heavy rainfall (Figure 4.4). The stability of HRA water elevations can be partly attributed to controlled releases upstream of the HR section that traverses ACP. All HRA groundwater elevations remained above established triggers in 2021; and
- Surface water elevation has continuously been recorded in Bowmans Creek throughout 2021. Large increases in surface water elevation in January, March, November and December can be attributed to heavy rainfall in the region (Figure 4.5). The Glennies Creek water elevation was relatively stable throughout the year, with sharp increases in water elevation recorded after heavy rainfall. Hunter River recorded large increases in water elevation in January, March, June, November and December following high rainfall. Hunter River water elevation remained stable throughout periods of low rainfall.

The site area experienced average rainfall from March to October 2021, as indicated by a stable CRD. An increasing CRD from January to March and October to December 2021 indicates periods of significant rainfall in the region. Increased groundwater elevation in BCA, GCA and HRA regulatory bores in the April and December monitoring periods is attributed to these periods of above average rainfall. No mining impacts outside of predictions are noted in the alluvium.

[2] WaterNSW (2021). Real-time water data. Available at: http://realtimedata.water.nsw.gov.au/water

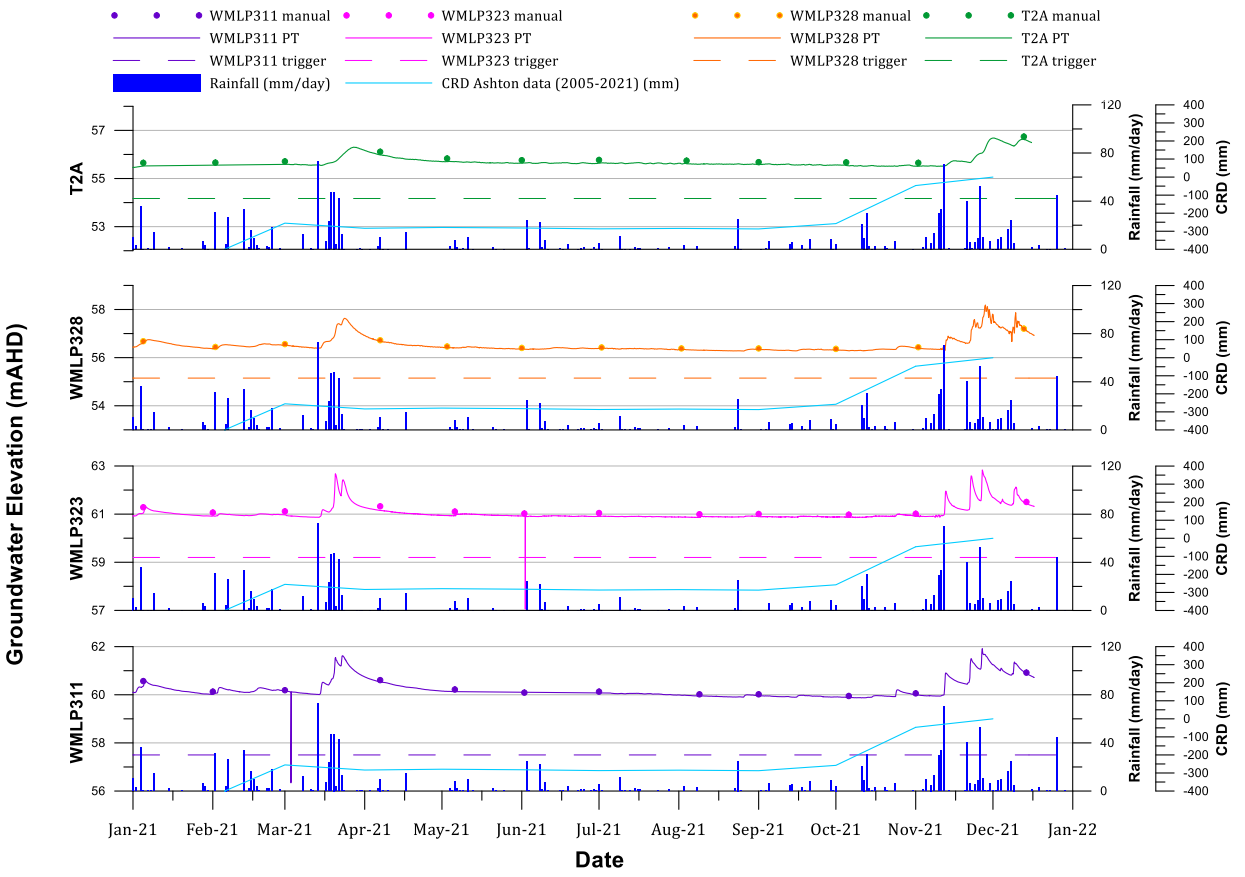

Figure 4.1 Bowmans Creek alluvium trigger bore hydrographs

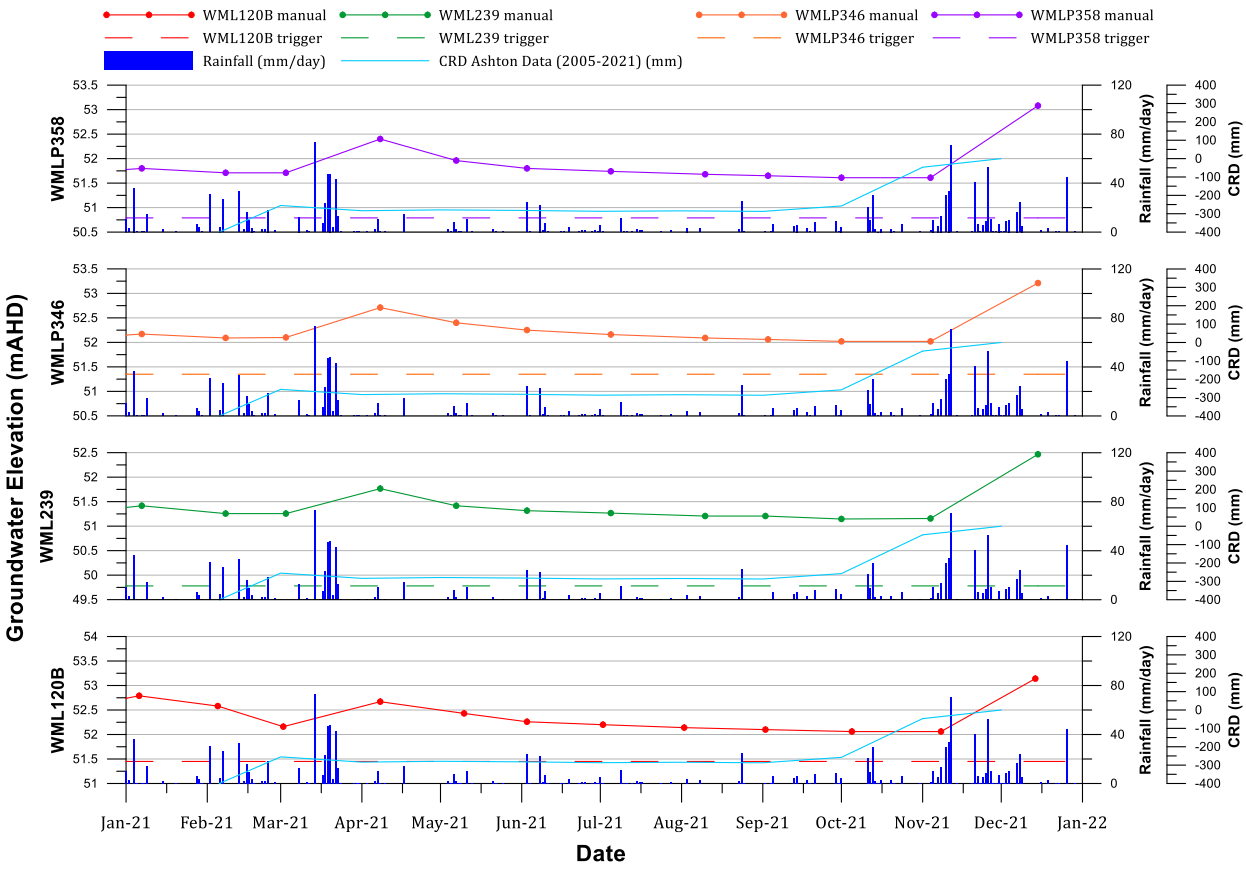

Figure 4.2 Glennies Creek alluvium trigger bore hydrographs (1)

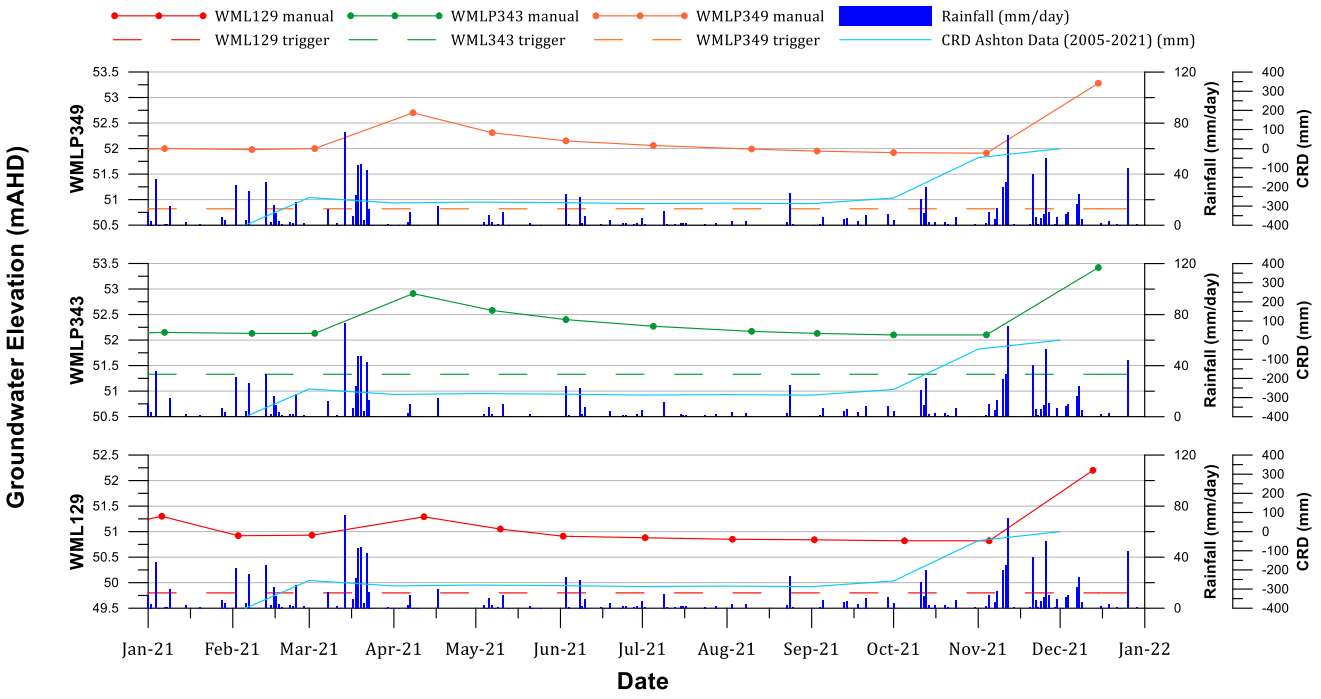

Figure 4.3 Glennies Creek alluvium trigger bore hydrographs (2)

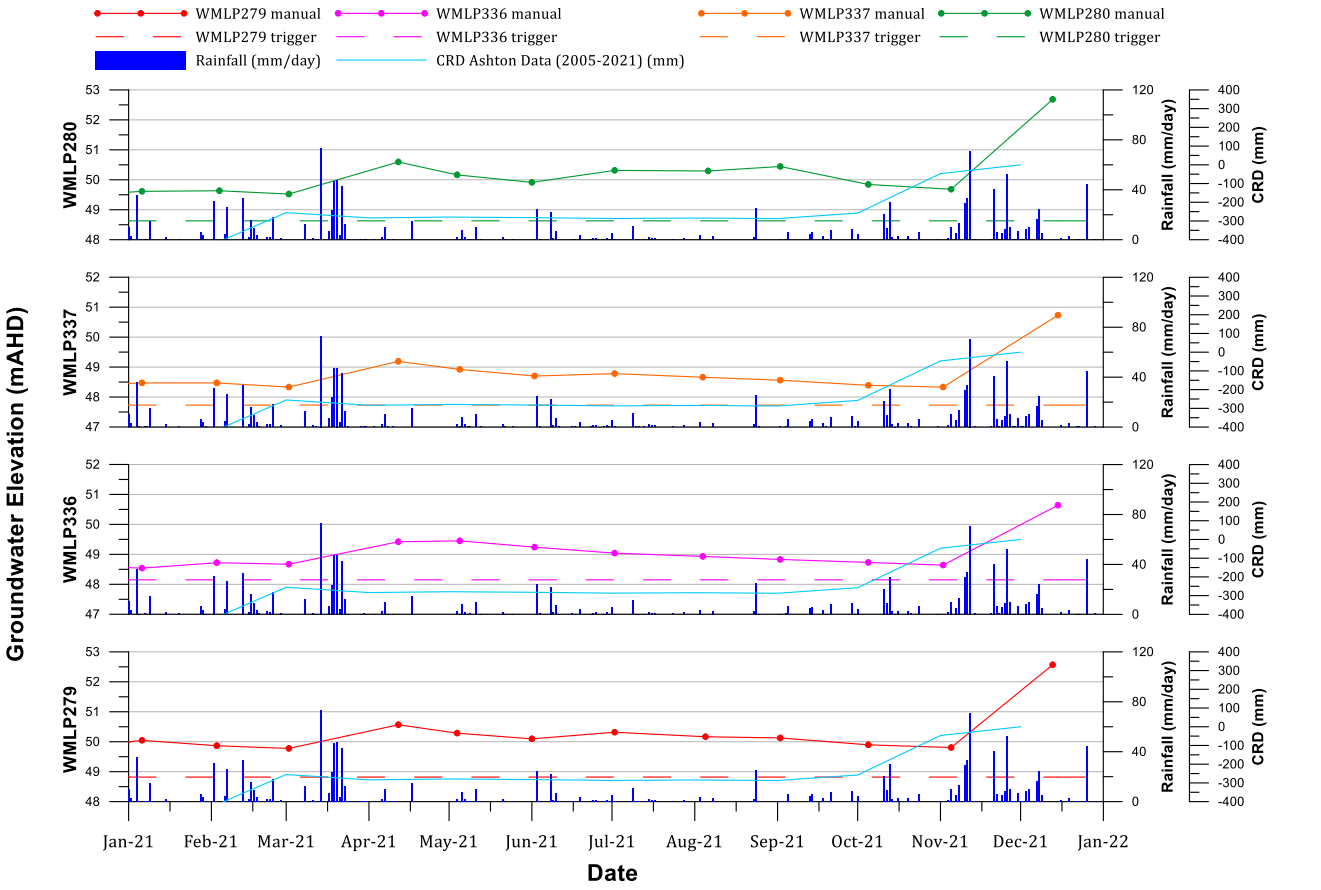

Figure 4.4 Hunter River alluvium trigger bore hydrographs

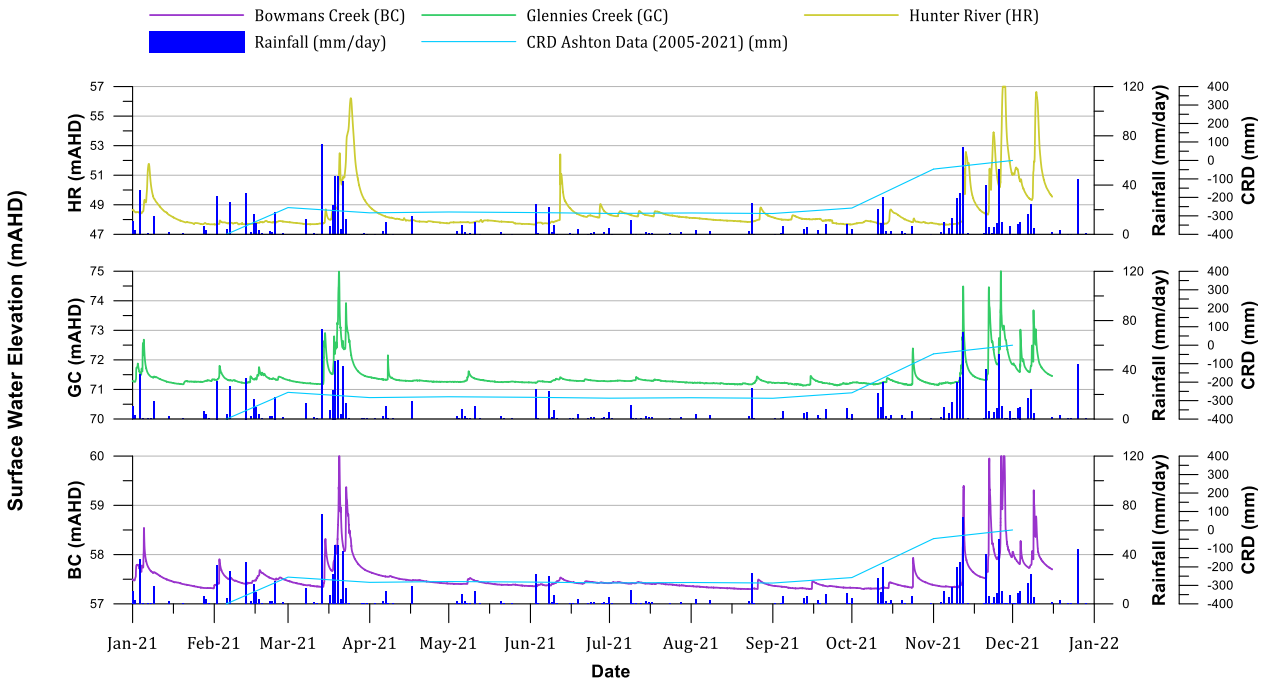

Figure 4.5 Surface water level hydrographs

4.1.2 Other alluvium groundwater levels

Groundwater elevation trends observed in 2021 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 elevation trends. As for the BCA regulatory bores, the other BCA alluvial bores generally recorded stable groundwater elevations. The exception to this was during April and December where increased groundwater elevation was recorded in these bores. RM02 in the BCA recorded increased groundwater elevation between June and August, stabilising thereafter. The other HRA bores responded to periods of increased rainfall throughout 2021 with groundwater elevations varying throughout the year. RM02 and T4A were unable to be sampled in December due to surface water impeding access. No mining impacts outside of predictions are noted.

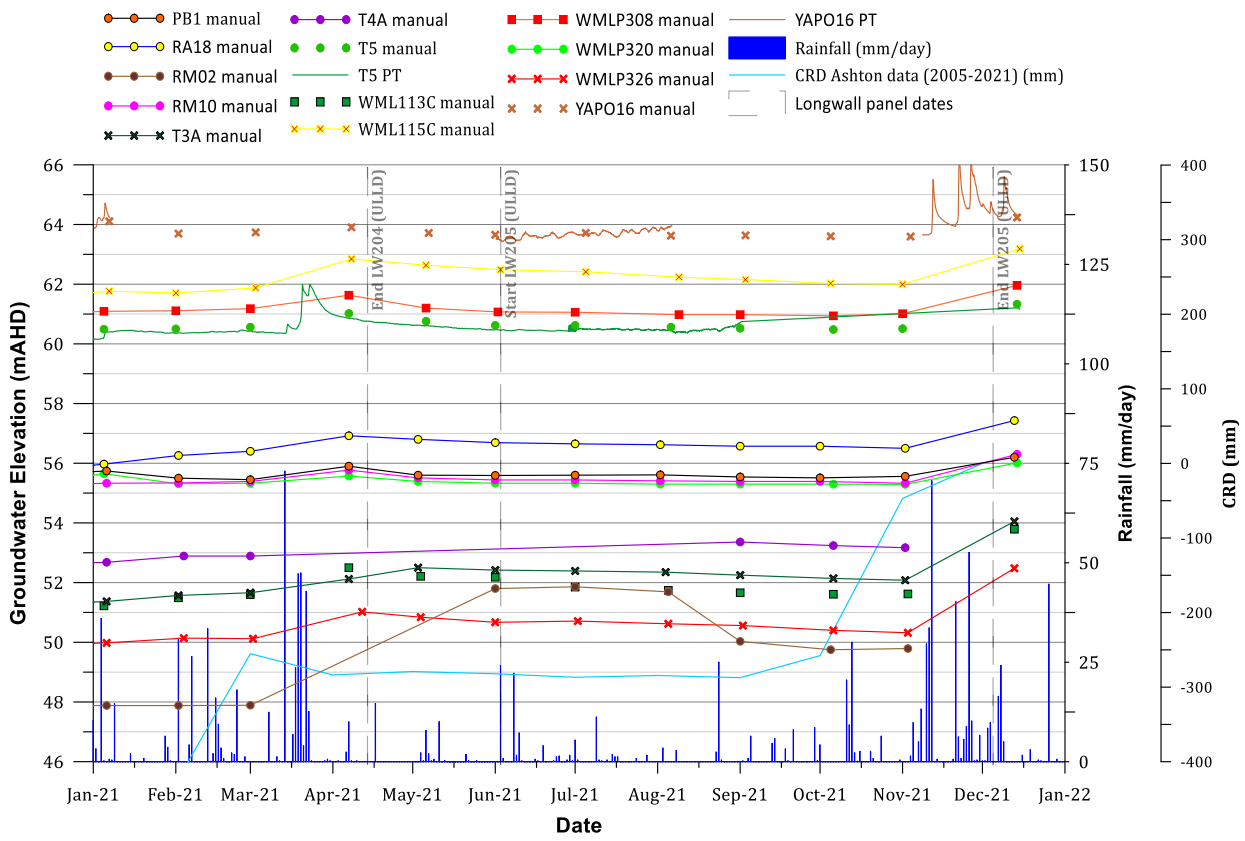

Figure 4.6 Other Bowmans Creek alluvium monitoring bore hydrographs

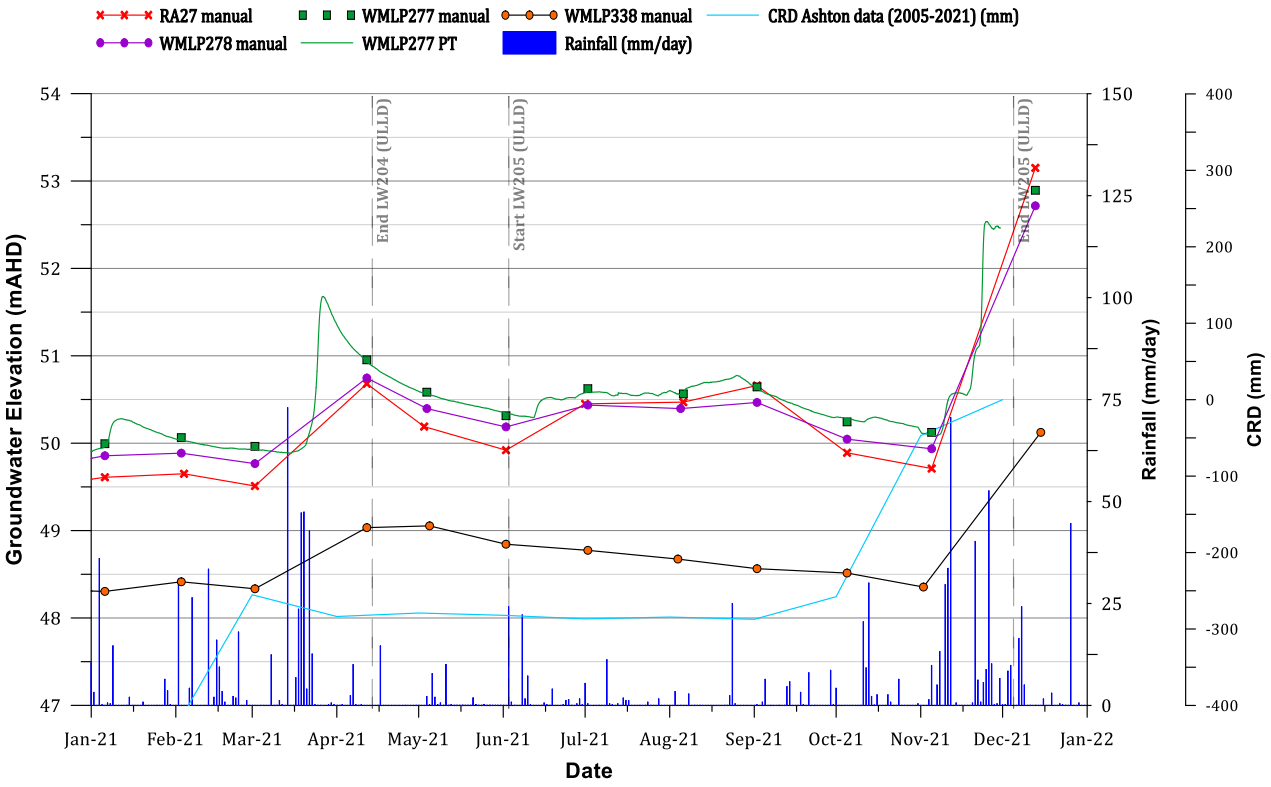

Figure 4.7 Other Hunter River alluvium monitoring bore hydrographs

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 2021, 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 Table D1; together with comprehensive analysis measurements recorded during annual sampling in August 2021. 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 2021. Two bores recorded an exceedance of pH trigger value throughout the year. WML129 in February and WMLP349 in February, May, June, August, September, November and December. However, these events were not consecutive for three months and as such did not require a response under the WMP. Values for pH were stable in 2021, 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 2021 were:

- BCA – pH 6.52 (T5) to pH 7.24 (WMLP326);
- GCA – pH 6.20 (WMLP358) to pH 6.95 (WMLP343 and WML129); and
- HRA – pH 6.40 (WMLP336) to pH 7.14 (WMLP337 and WMLP277).

Groundwater EC was fresh to slightly brackish across the BCA, GCA and HRA regulatory monitoring network in 2021; mirroring the conditions in previous years. Two bores exceeded EC trigger criteria in 2021, WMLP279 in October and November (two consecutive exceedances only); and WMLP349 from May to November (>3 consecutive exceedances). The EC exceedance in WMLP349 was investigated (AGE, 2021). The investigation concluded that a significant increase in groundwater level was recorded during the April monitoring period, indicating that the water table was rising through the historically unsaturated zone. It is likely that a mobilisation of natural salts occurred as a result of this water table rise, contributing to an increase in the groundwater salinity, and hence an increase in EC. Given time, the natural flushing of the groundwater system will likely occur, and it is expected that groundwater EC values will return to levels below the trigger value. It was also recommended that the headworks and concrete pad be repaired.

BCA monitoring bores recorded varied EC values during 2021. WMLP328 and T2A recorded steadily declining EC trends throughout the monitoring period. WMLP323 recorded a steadily decreasing EC trend until April before increasing and stabilising from May to November, decreasing thereafter. WMLP311 increased significantly in February, steadily decreasing throughout the remainder of the year. WMLP326 and WML113C were stable throughout 2021. Groundwater EC in GCA monitoring bores were relatively stable in 2021, the exception being WMLP343 which recorded an increase in the August monitoring period, stabilising thereafter; and WMLP349 which increased and exceeded its trigger criteria in May until November, recording a decreased EC value in the December monitoring period. HRA monitoring bores recorded stable EC values throughout 2021. The exception being WMLP279, which recorded steadily increasing EC values from April to November; before a significant decrease was recorded in the December monitoring period.

For alluvial bores, the observed EC ranges in 2021 were:

- BCA – 492 µS/cm (WMLP323) to 3,306 µS/cm (RM02);
- GCA – 303 µS/cm (WMLP358) to 1,186 µS/cm (WMLP349); and
- HRA – 430 µS/cm (WMLP279) to 3,018 µS/cm (WMLP337).

River and creek EC levels (sourced from the WaterNSW online database) were also examined during 2021. Bowmans Creek and Glennies Creek recorded stable EC values from April to November. EC values dropped sharply following multiple heavy rainfall events throughout January to March and November to December, recovering rapidly thereafter. Hunter River EC oscillated over the course of 2021, with fluctuations remaining within historic ranges.

The major ion content of each alluvial system was also assessed in 2021 as shown in the classification table and Piper diagram from August 2021 (Appendix E). The cation water type in all monitoring bores were Na or Ca dominant. With respect to anions, Cl dominates over HCO_3 and 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.

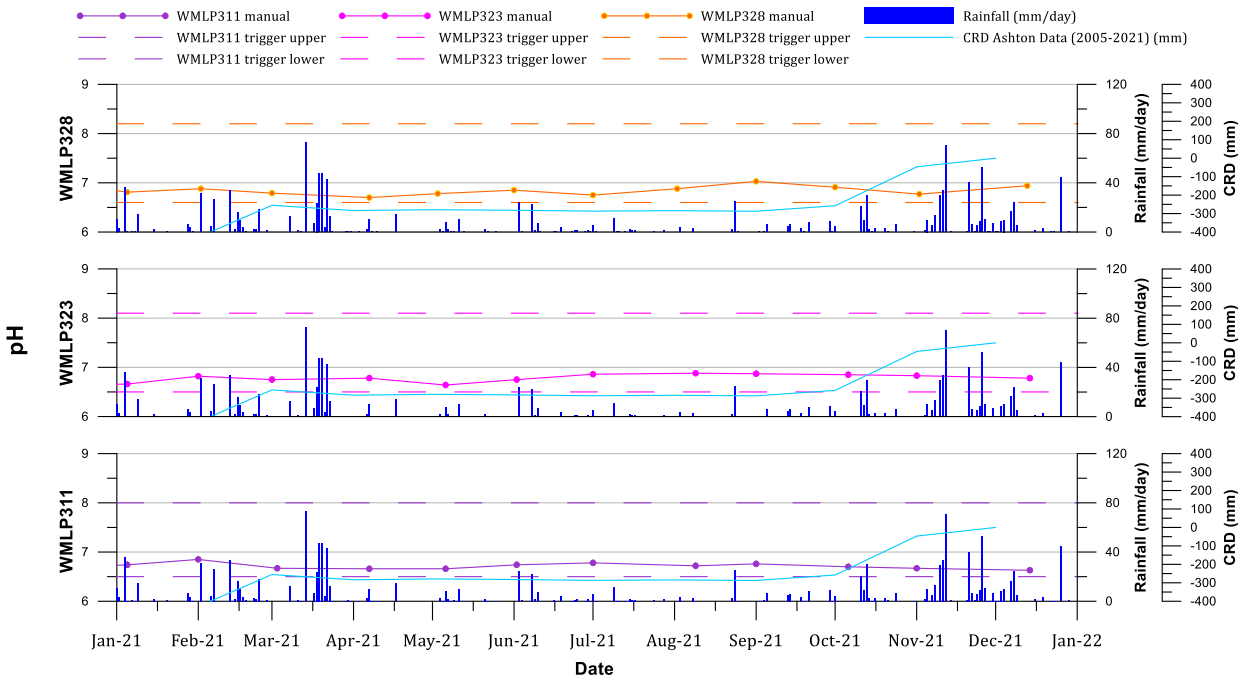

Figure 4.8 Bowmans Creek alluvium trigger bore pH trends (1)

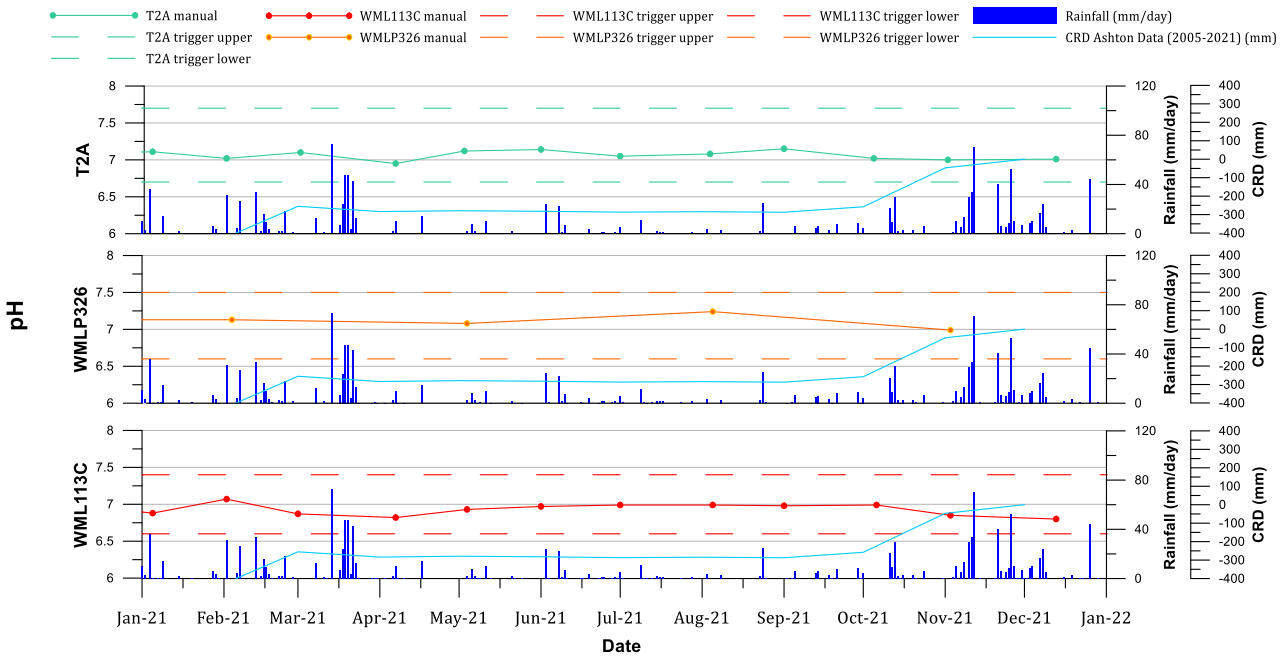

Figure 4.9 Bowmans Creek alluvium trigger bore pH trends (2)

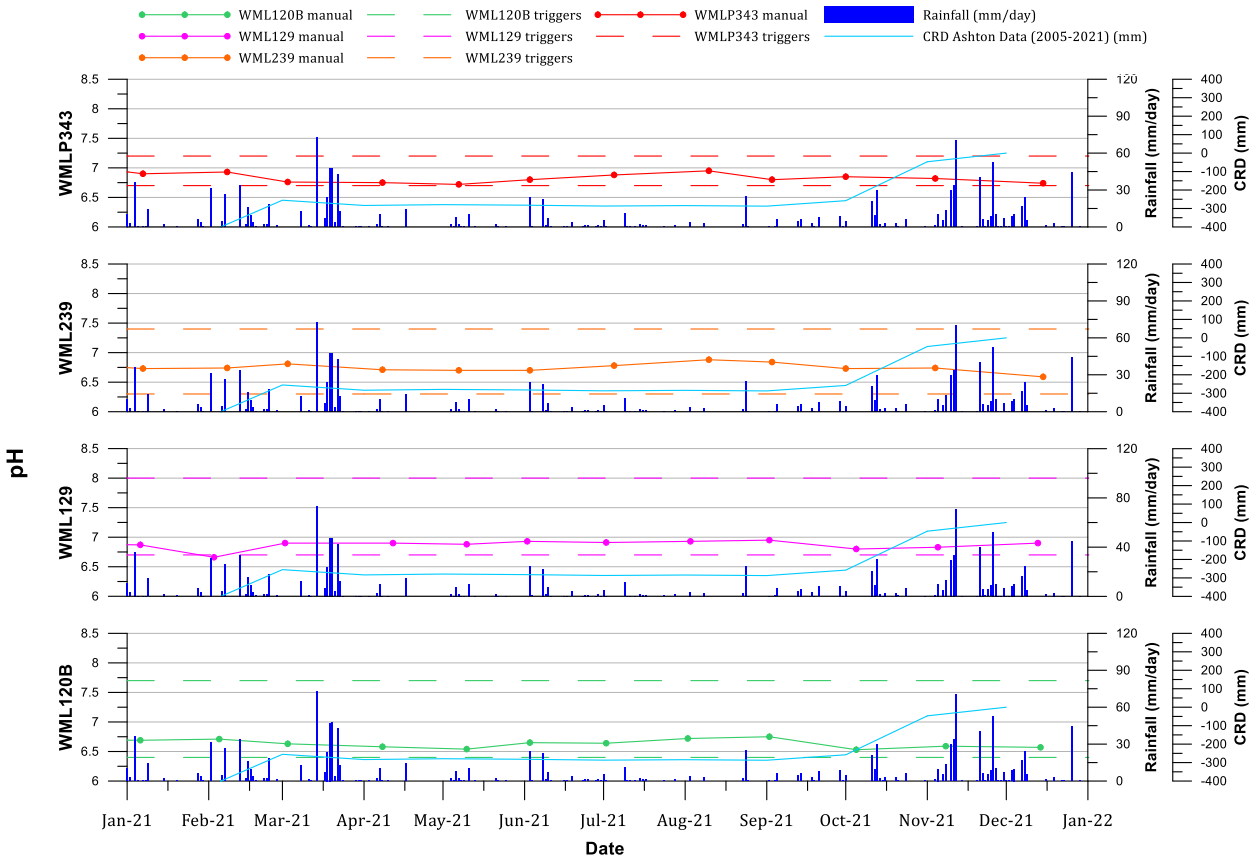

Figure 4.10 Glennies Creek alluvium trigger bore pH trends (1)

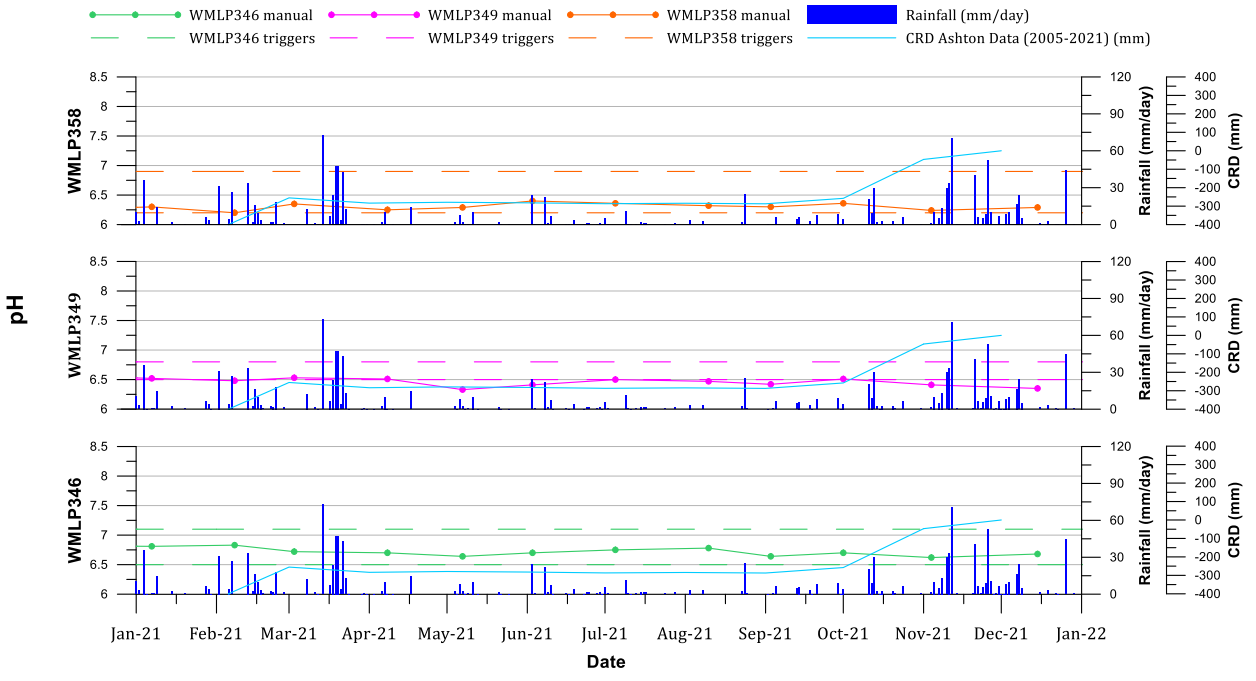

Figure 4.11 Glennies Creek alluvium trigger bore pH trends (2)

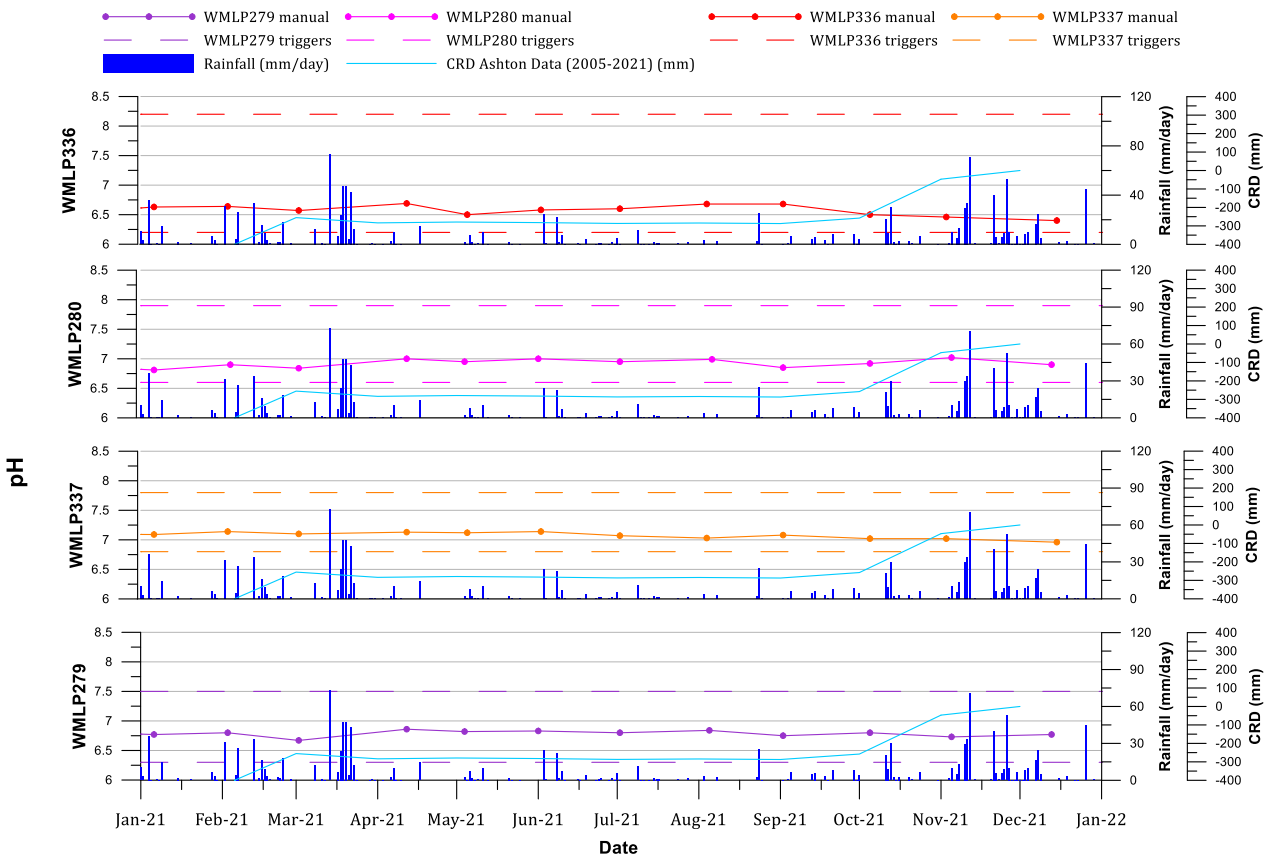

Figure 4.12 Hunter River alluvium trigger bore pH trends

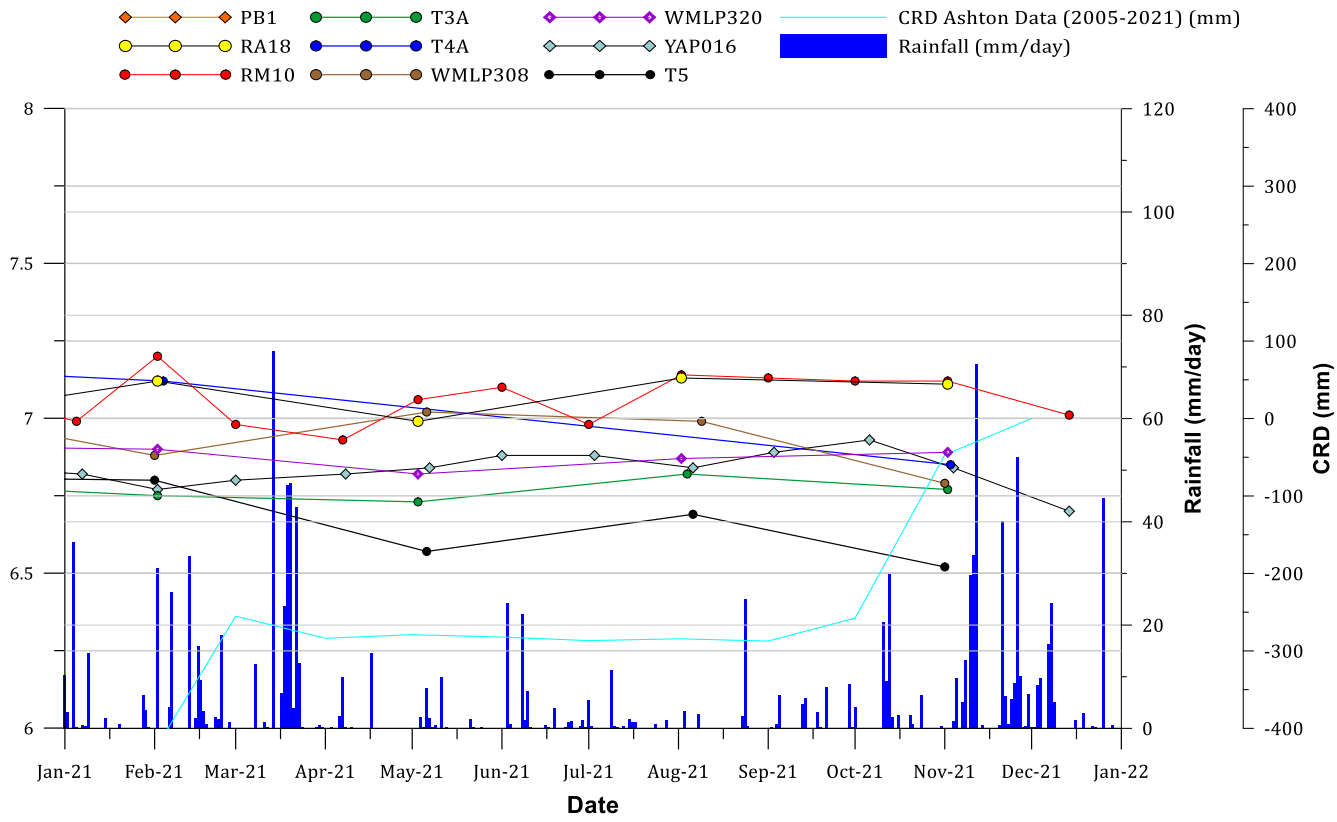

Figure 4.13 Other Bowmans Creek alluvium bore pH trends

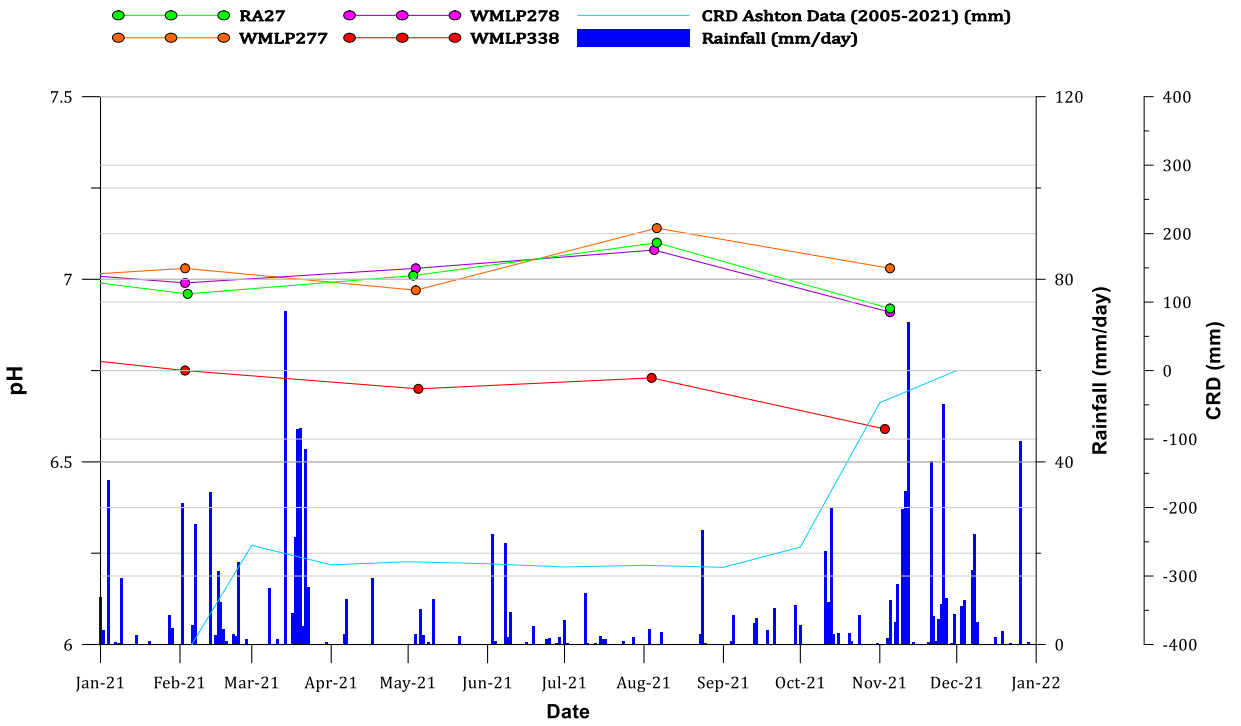

Figure 4.14 Other Hunter River alluvium bore pH trends

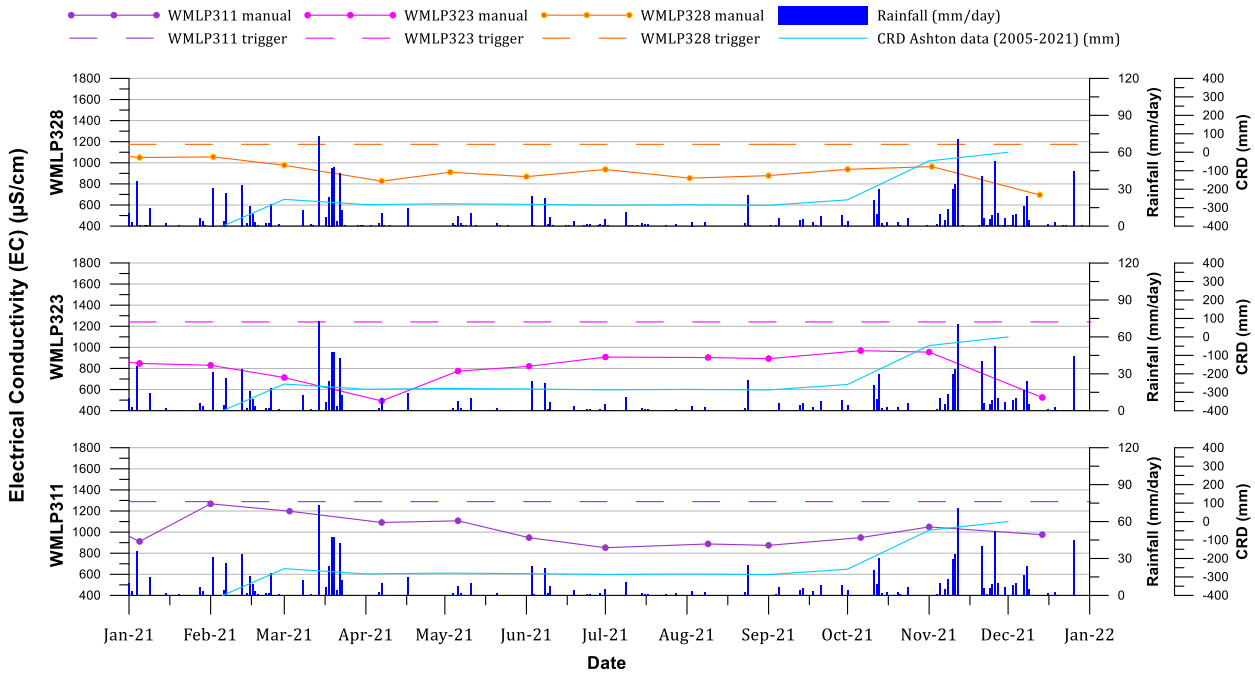

Figure 4.15 Bowmans Creek alluvium trigger bore EC trends (1)

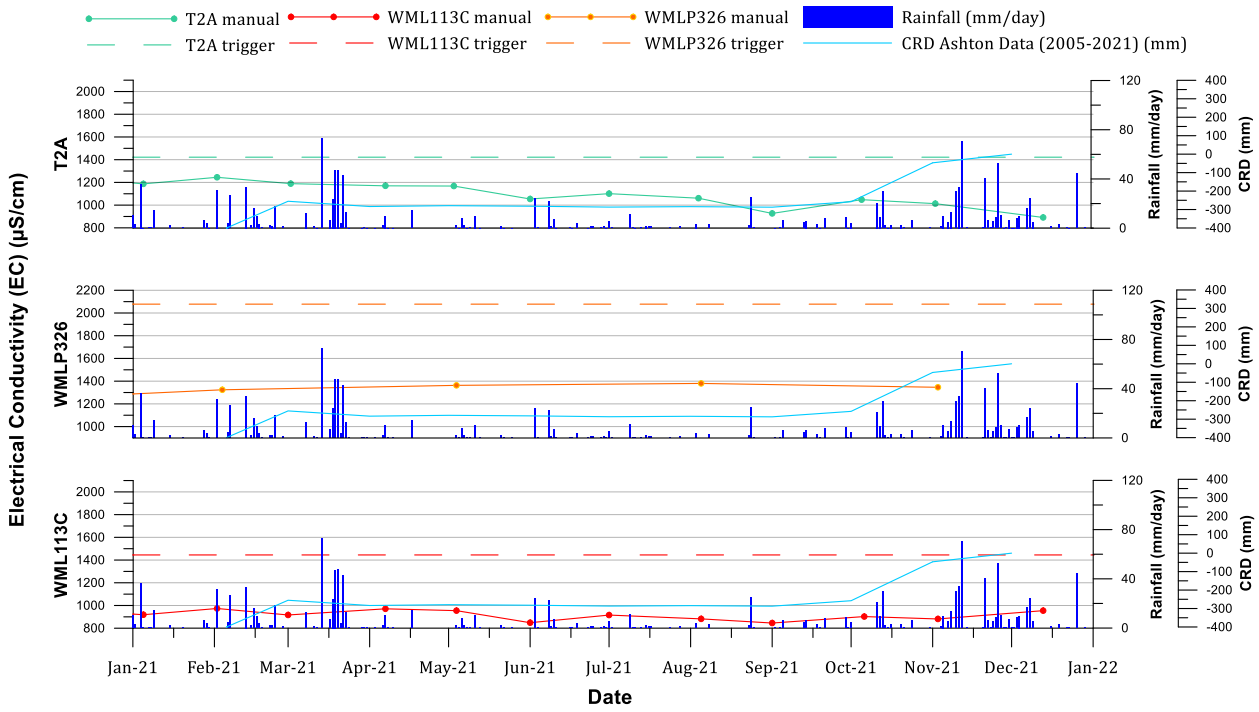

Figure 4.16 Bowmans Creek alluvium trigger bore EC trends (2)

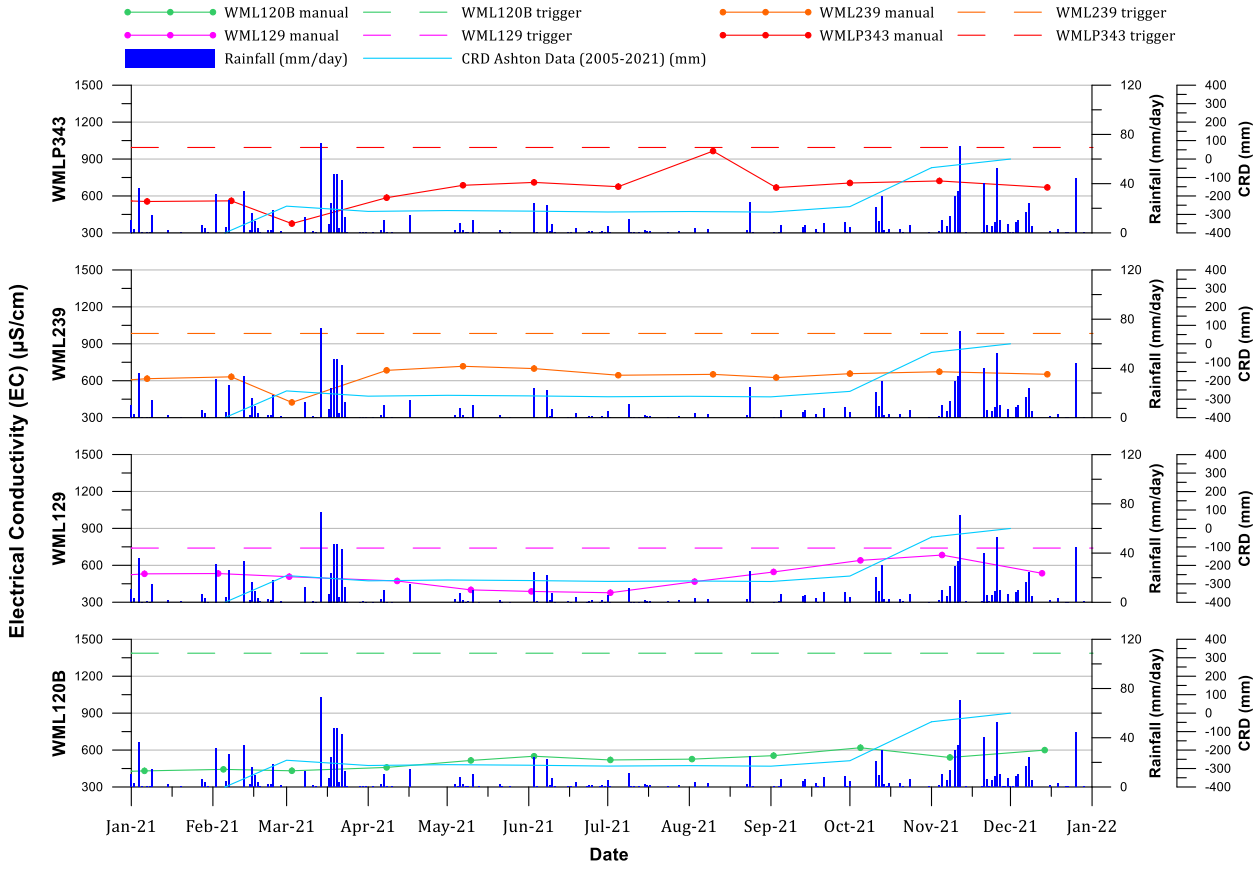

Figure 4.17 Glennies Creek alluvium trigger bore EC trends (1)

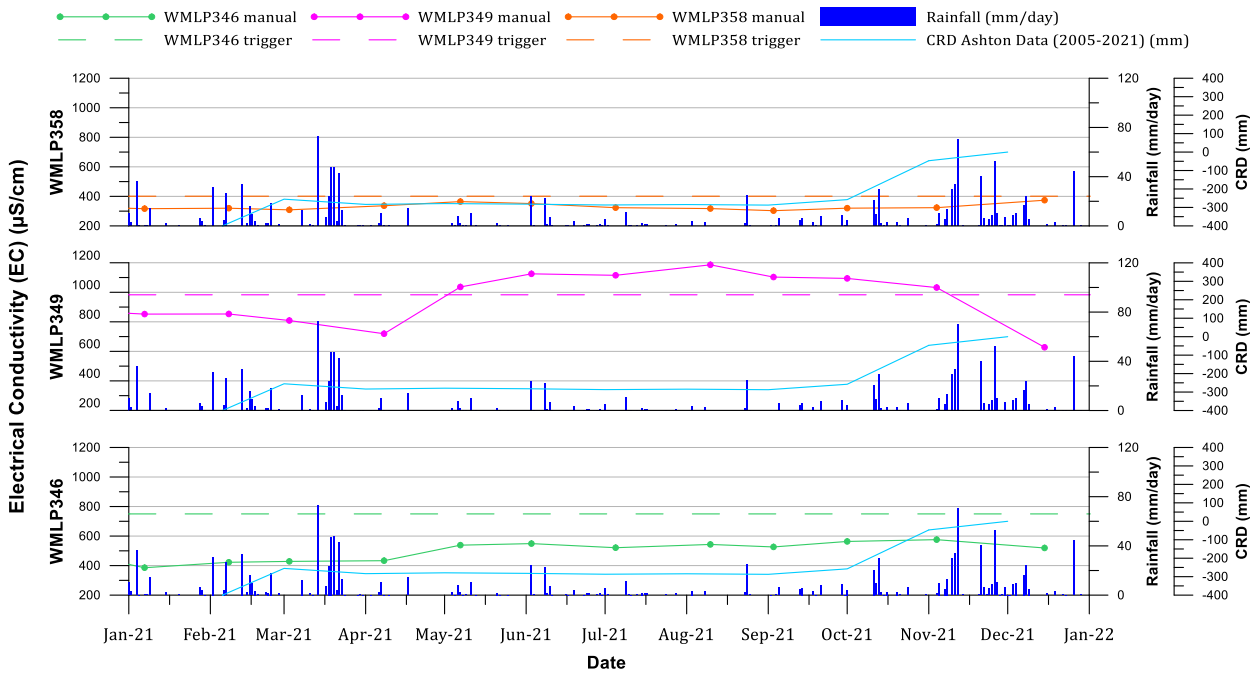

Figure 4.18 Glennies Creek alluvium trigger bore EC trends (2)

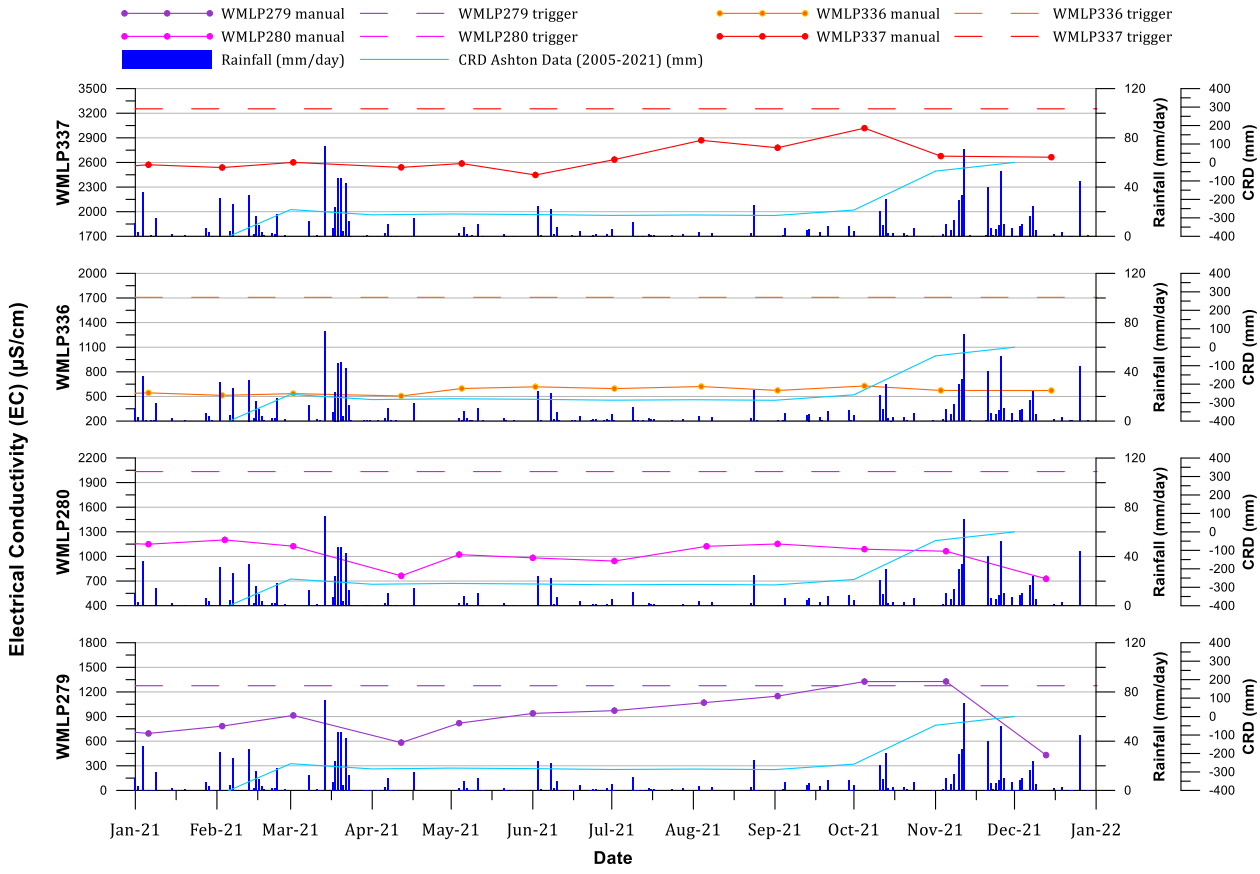

Figure 4.19 Hunter River alluvium trigger bore EC trends

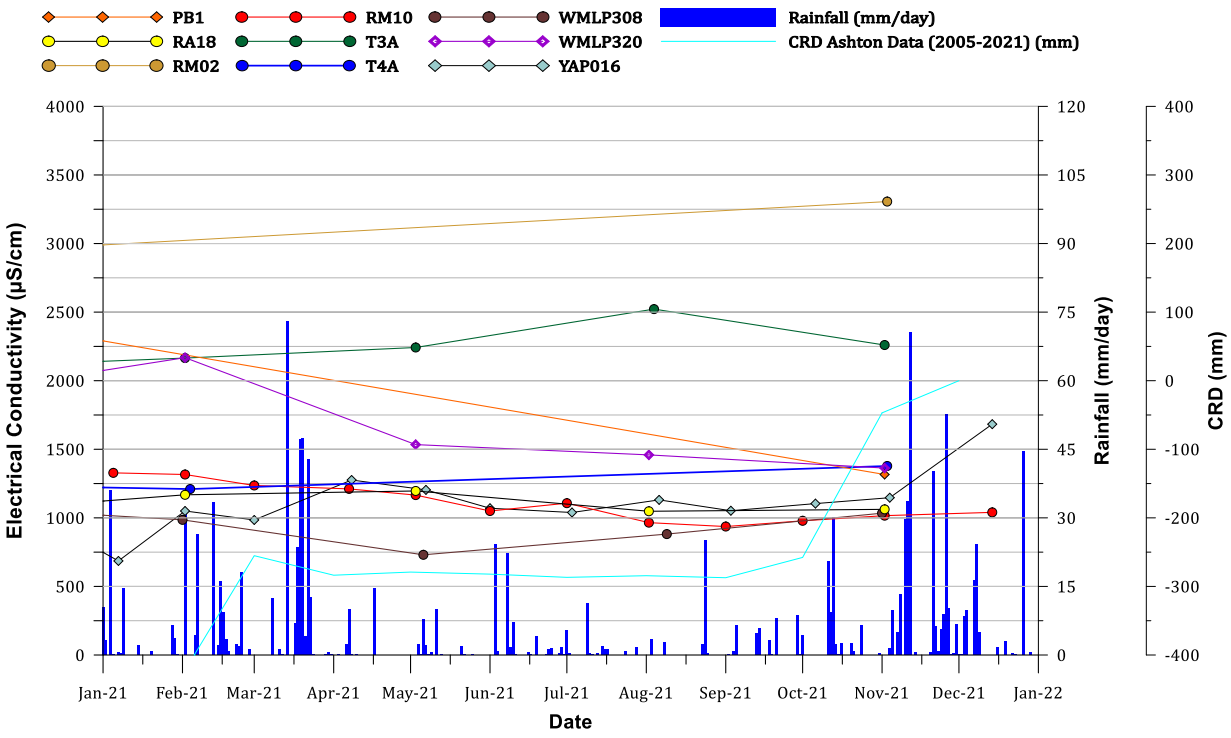

Figure 4.20 Other Bowmans Creek alluvium bore EC trends

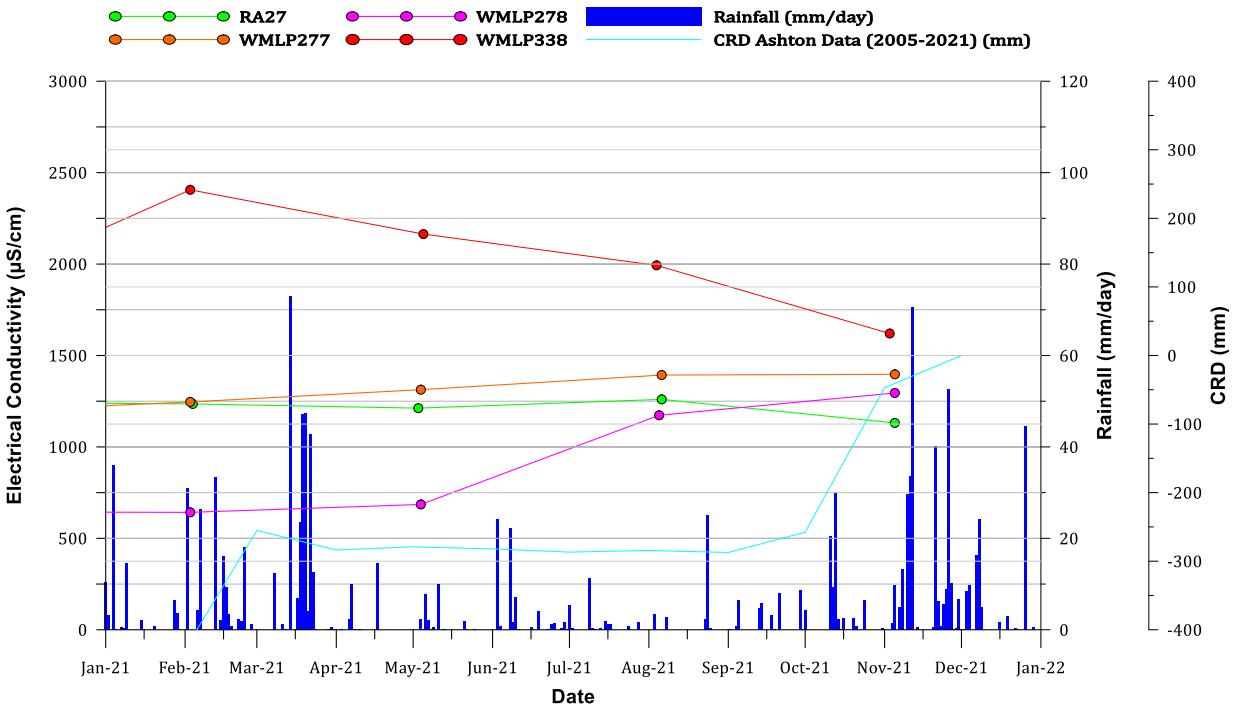

Figure 4.21 Other Hunter River alluvium bore EC trends

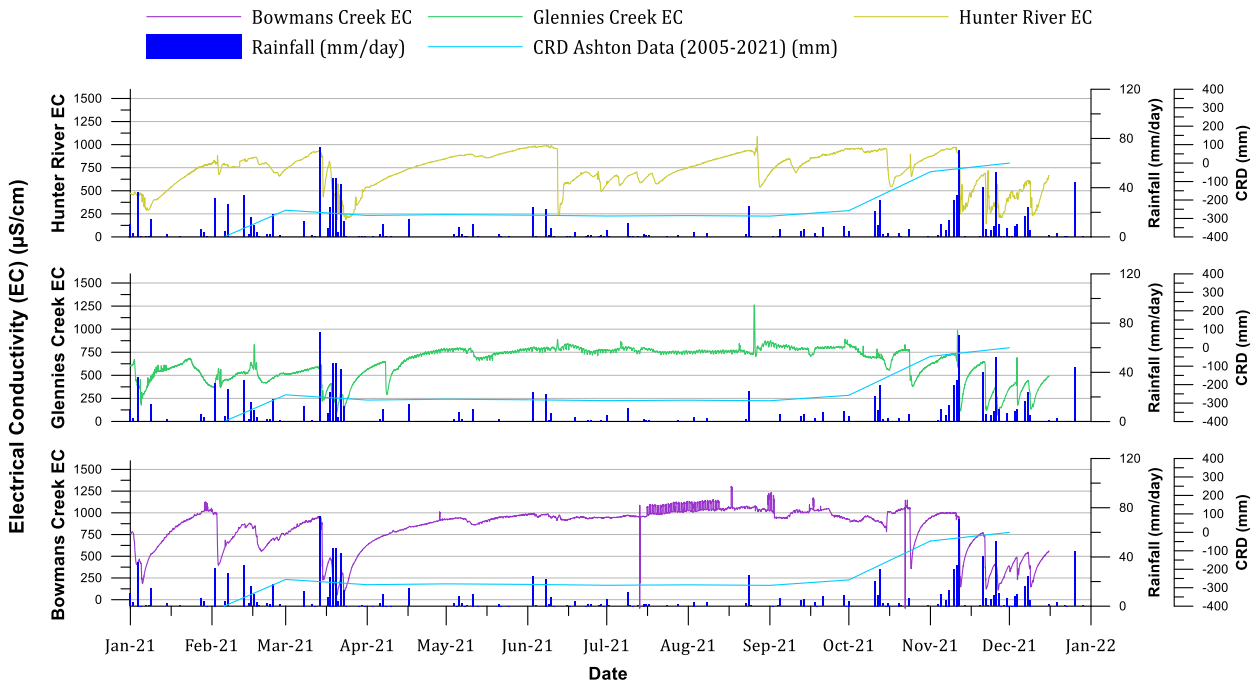

Figure 4.22 Surface water EC trends

4.1.4 Dissolved metals, select nutrients, turbidity and cyanide

Comprehensive lab analysis during August 2021 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 were close to 400 mg/L. Nor were 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. No bores exceeded the P concentration trigger (0.8-12 mg/L). However, 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 2021. Longwall specific VWP pressure heads were also recorded. Hydrographs for these bores are presented in Figure 4.23 through to Figure 4.30.

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 LW204/205 specific monitoring bores are presented in Figure 4.25. Longwall specific VWP readings for LW204/LW205 are shown in Figure 4.26. Daily rainfall measurements and CRD have also been plotted and used to compare water elevation trends.

The following observations can be noted for 2021:

- Groundwater elevations were stable in coal measure bores throughout the year (Figure 4.23);
- Groundwater elevation in CMOB bores generally remined stable in 2021, increasing at the start and the end of the monitoring period. The increase in groundwater elevation correlates with the CRD trend (Figure 4.24);
- Excepting an increase in December, groundwater elevations in monitoring bores within the vicinity of LW204/205 remained stable throughout 2021 (Figure 4.25);
- VWP measurements in WMLP269 (adjacent LW204/205) sensors at 30 m and 59 m were stable throughout the 2021 monitoring period. Pressure head in the remaining sensors (70 m, 97 m, 127 m and 147 m) have recorded erroneous data since July. Erroneous data is likely due to fracturing of strata in which the deeper sensors are positioned. This correlates with the start of mining in LW205 nearby WMLP269; and
- Coal measure and CMOB bores were not impacted by mining outside of predictions in 2021.

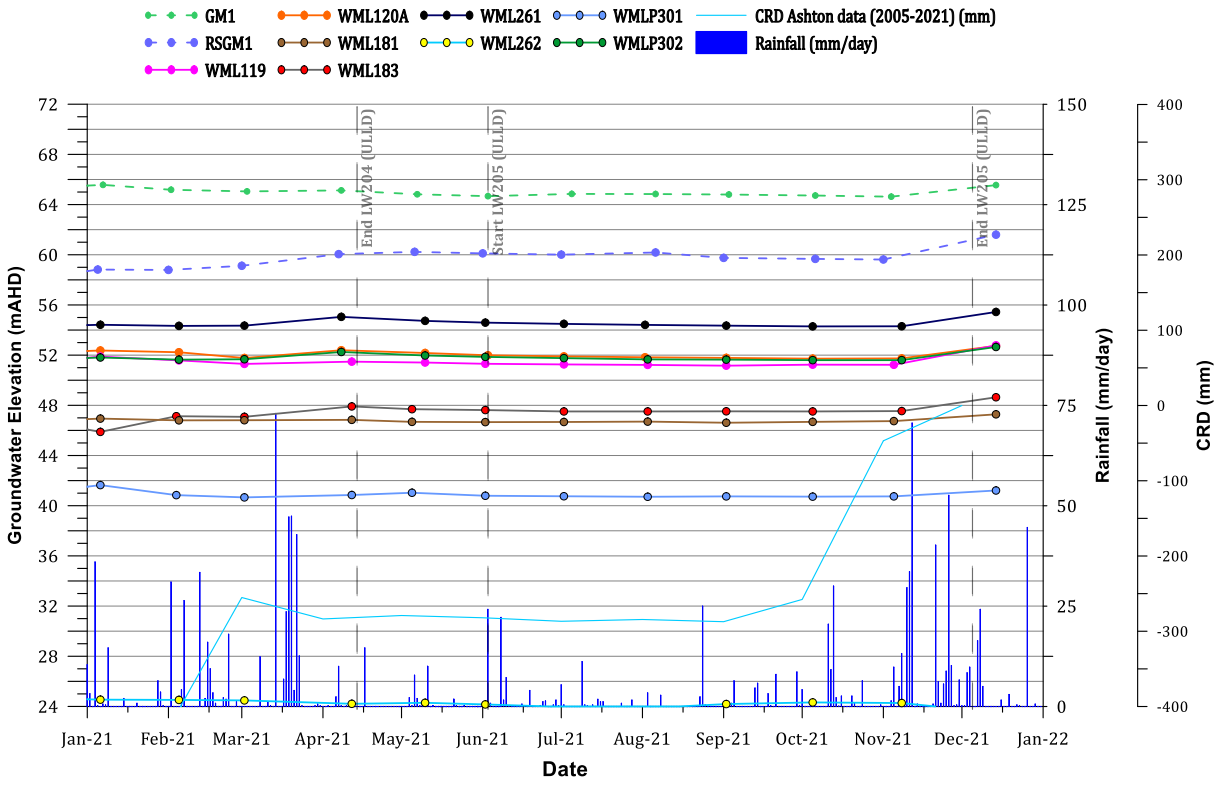

Figure 4.23 Coal measure bore hydrographs

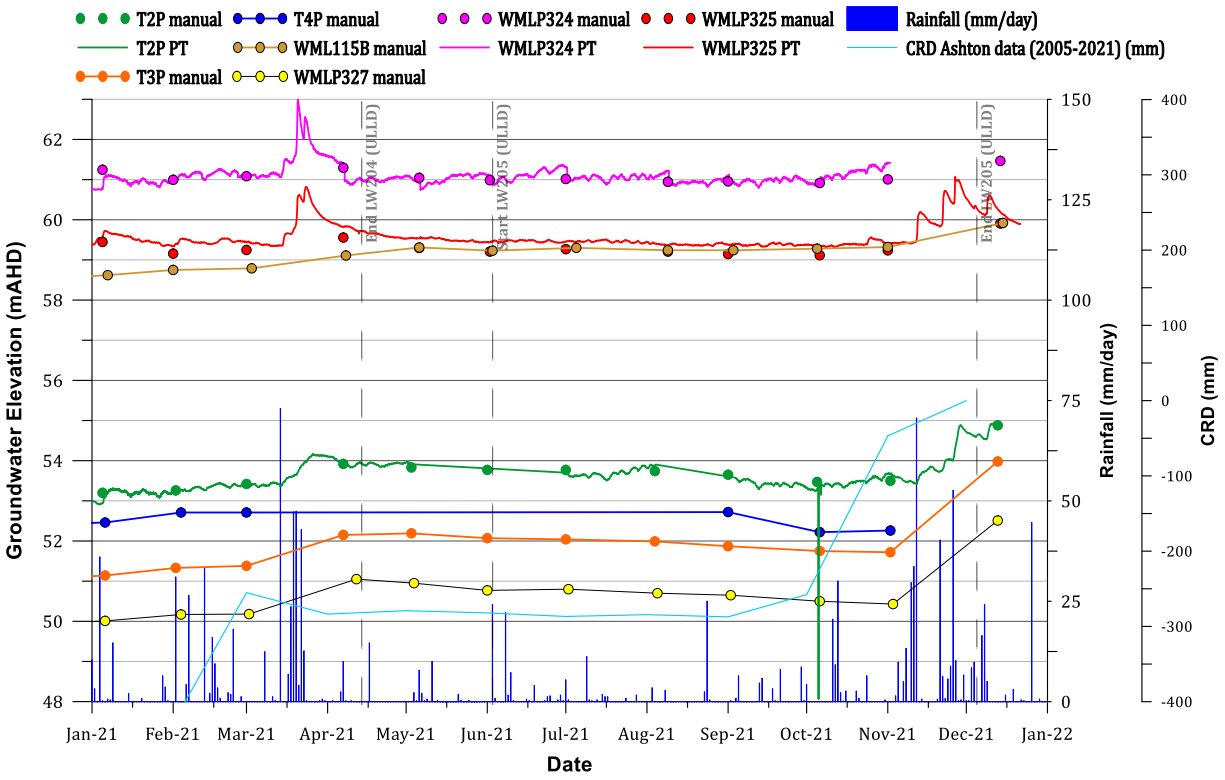

Figure 4.24 Coal measure overburden bore hydrographs

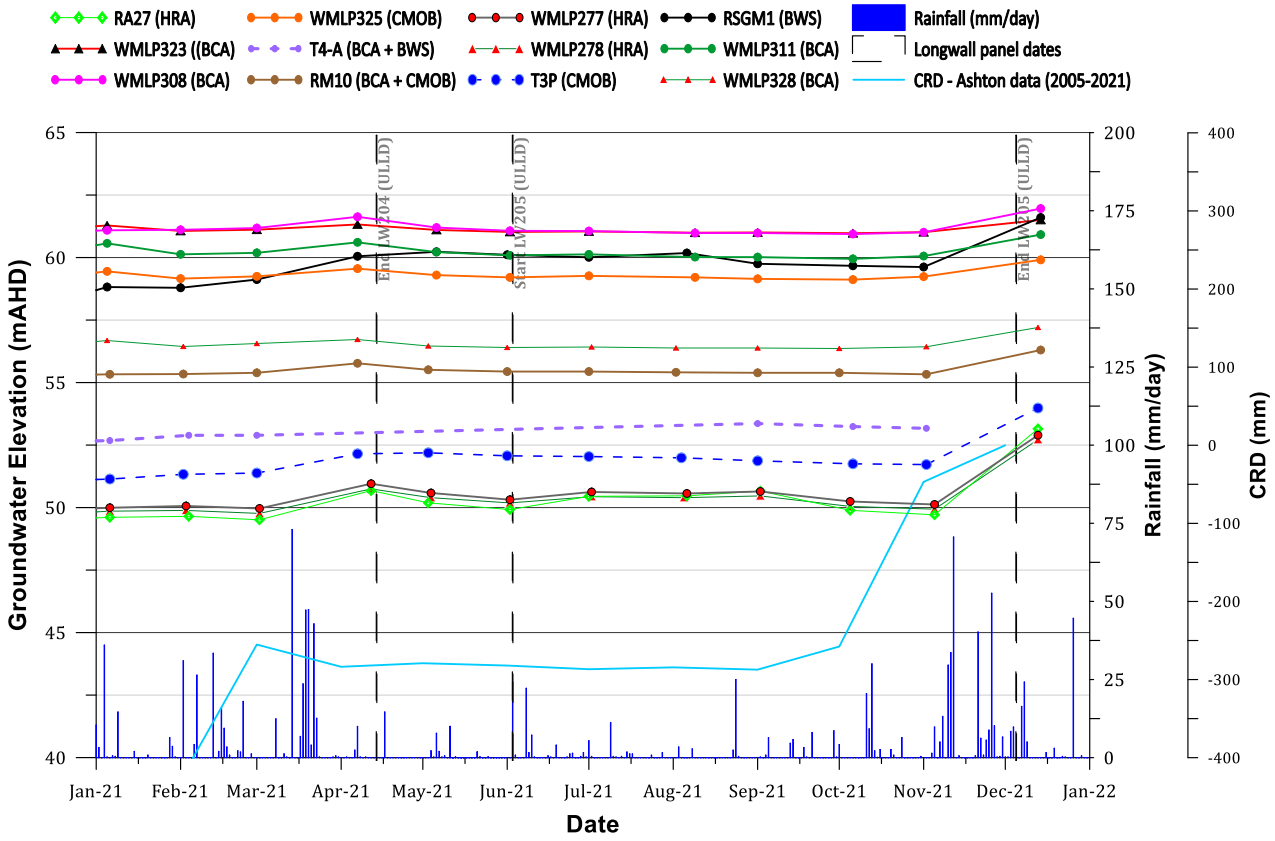

Figure 4.25 Hydrographs for monitoring bores in vicinity of LW204/205

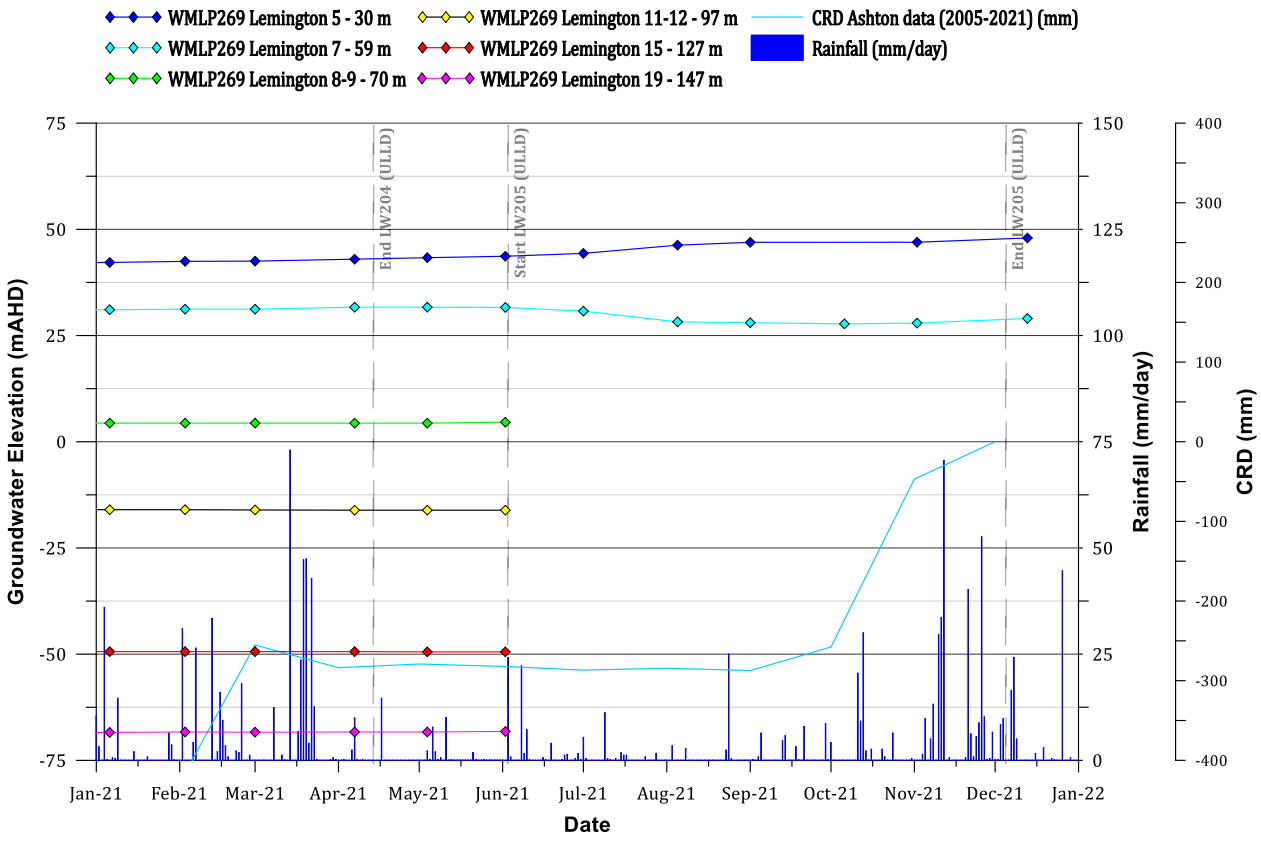

Figure 4.26 Hydrographs for VWP WMLP269 in vicinity of LW204/LW205

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 2021, and the results are presented graphically in Figure 4.27 through to Figure 4.30. 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 2021. All associated laboratory files can be found in Appendix F.

Groundwater pH in coal measure and CMOB bores were generally neutral to slightly alkaline in 2021, as has been the case in previous years. pH readings were broadly stable over 2021, 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 2021 were:

- Coal measure – pH 6.22 (WMLP302) to pH 8.05 (WML262); and
- CMOB – pH 6.56 (T2P) to pH 7.44 (T3P and T4P).

Groundwater EC was fresh to brackish across the coal measure and CMOB monitoring network in 2021. EC values were relatively steady throughout 2021, except for RSGM1 which recorded a sharp increase in EC between the February and May monitoring round; decreasing in the August monitoring period before stabilising in November. WML183 recorded a sharp decrease in EC during the August monitoring round, stabilising thereafter. No other prevailing trends were evident. Minor fluctuations occurred during the year, though the overall EC trend was stable. EC ranges for coal measure and CMOB bores in 2021 were:

- Coal measure – 636 µS/cm (WML120A) to 4,666 µS/cm (RSGM1); and
- CMOB – 749 µS/cm (WMLP324) to 2,359 µS/cm (T3P).

The major ion content for coal measure and CMOB bores was also assessed in 2021 (Appendix E). The cation water type in all monitoring bores were Na or Ca dominant. With respect to anions, Cl dominates coal measure and CMOB monitoring bores. The coal measure water types are readily distinguished from the CMOB water types with coal measure bores being enriched in Mg, whilst CMOB bores contain higher Ca concentrations.

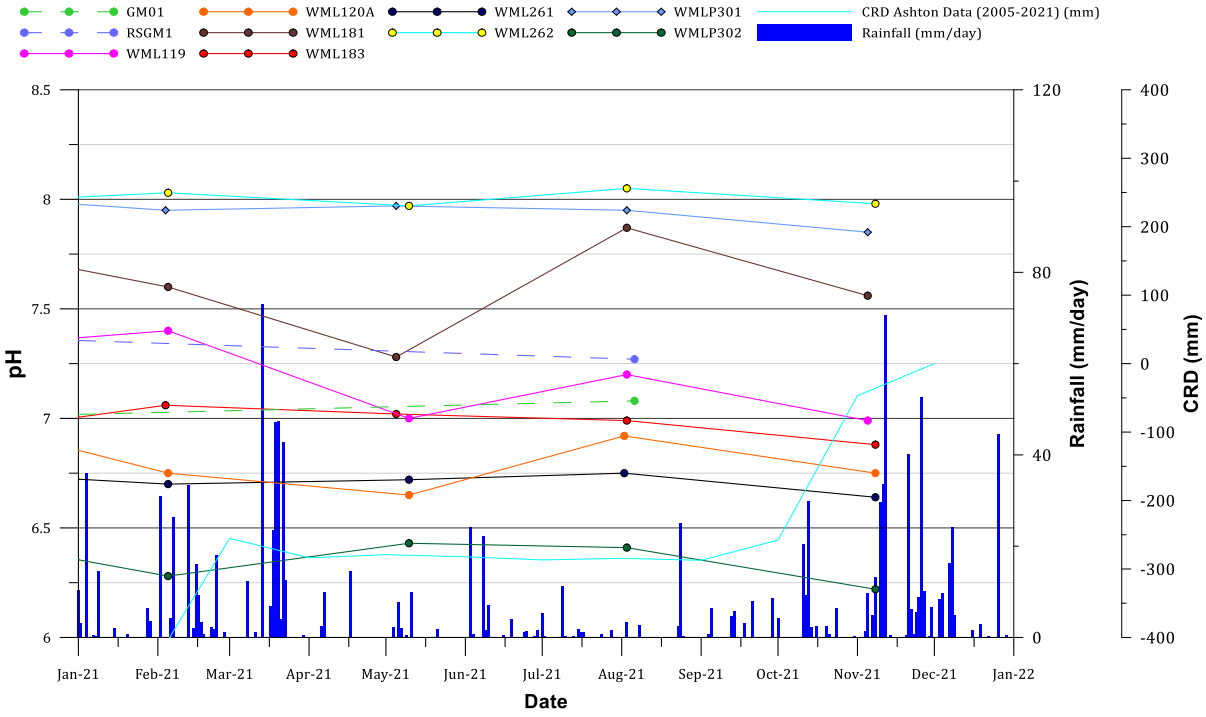

Figure 4.27 Coal measure bore pH trends

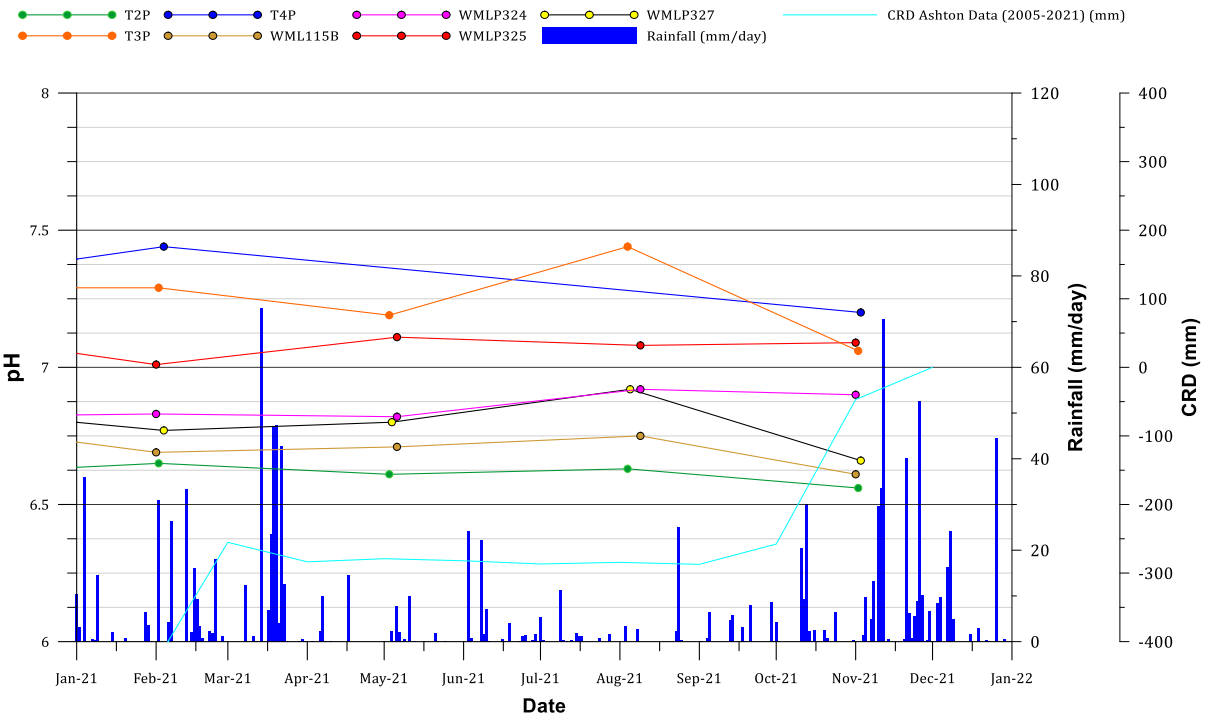

Figure 4.28 Coal measure overburden bore pH trends

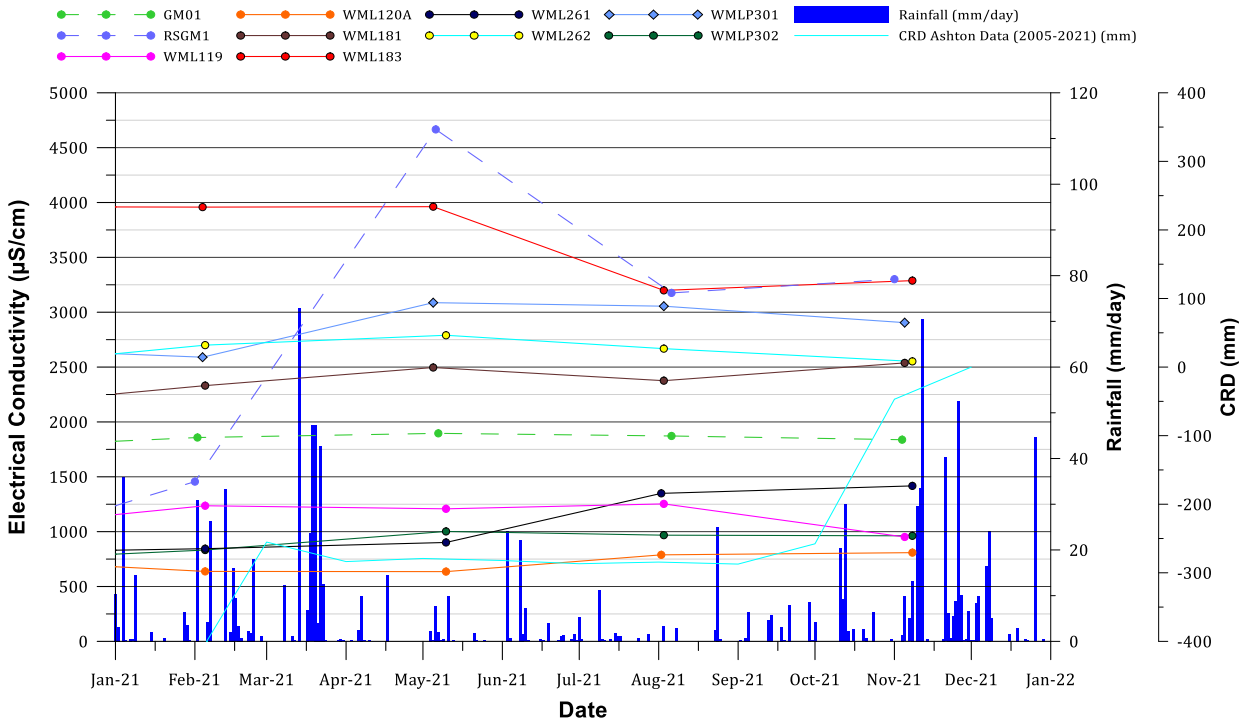

Figure 4.29 Coal measure bore EC trends

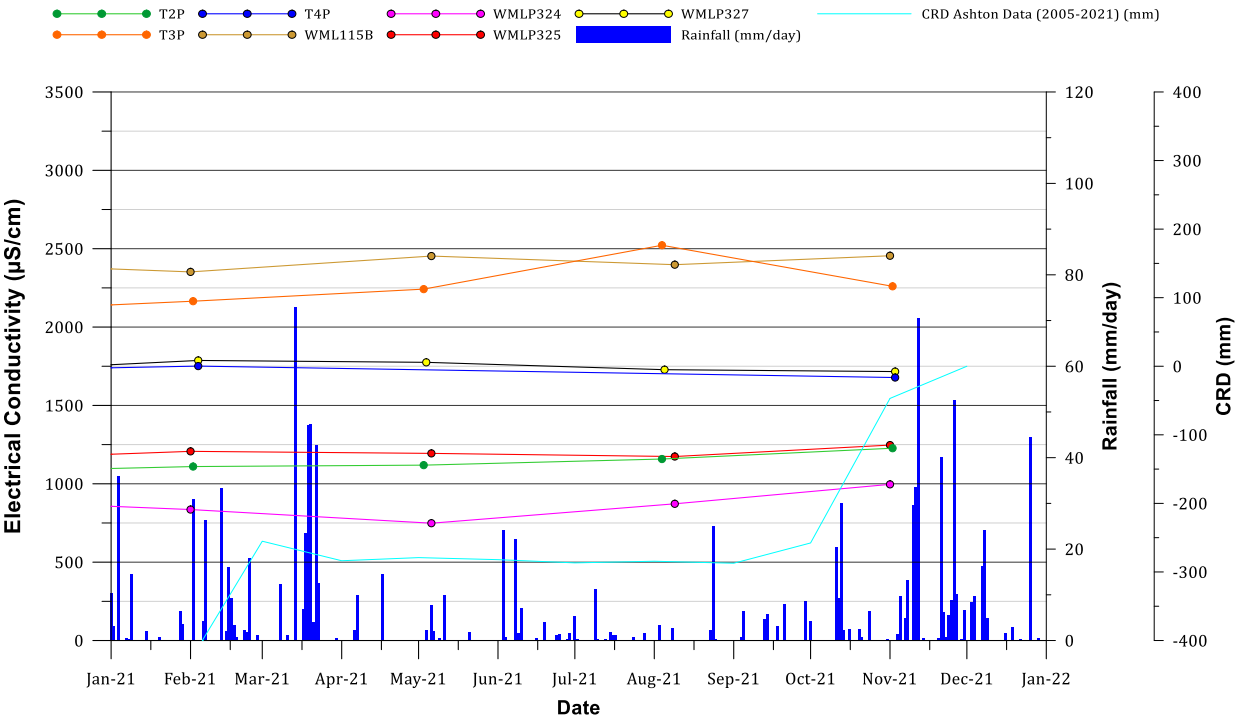

Figure 4.30 Coal measure overburden bore EC trends

4.2.3 Dissolved metals, select nutrients, turbidity and cyanide

Comprehensive lab analysis during August 2021 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 to 125 mg/L. RSGM1 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.

5 EPL 11879 monitoring bores

Results for 2021 monitoring of EPL 11879 monitoring bores (per Licence Variation November 2019) are summarised in Table 5.1 (levels) and Table 5.2 (EC).

Table 5.1 EPL 11879 monitoring bore groundwater levels (2021)

Bore ID	Feb-21	May-21	Aug-21	Nov-21
	Groundwater levels (mTOC)			
YAP016	3.6	3.58	3.67	3.7
WMLP320	6.65	6.57	6.66	6.67
WMLP279	12.33	11.91	12.03	12.39
WMLP280	10.89	10.36	10.23	10.84
WML120B	7.93	8.08	8.37	8.45
WML129	4.42	4.29	4.49	4.52
WMLP336	12.08	11.35	11.87	12.16
GM1	8.26	8.62	8.6	8.81
WML120A	8.72	8.78	9.12	9.21
WML262	35.2	35.43	35.85	35.45
WML181	17.5	17.62	17.6	17.56
WML183	29.59	29.03	29.21	29.18

Note: mtoc = metres top of casing.

Table 5.2 EPL 11879 monitoring bore groundwater EC measurements (2021)

Bore ID	Feb-21	May-21	Aug-21	Nov-21
	Groundwater EC (µS/cm)			
YAP016	1050	1204	1131	1147
WMLP320	2168	1534	1459	1363
WMLP279	783	819.1	1069	1327
WMLP280	1201	1022	1123	1063
WML120B	443	515.6	526	539.7
WML129	533	400.2	467	683.3
WMLP336	514	596.8	624	573
GM1	1858	1896	1872	1838
WML120A	638	635.7	789	808.6
WML262	2700	2790	2668	2552
WML181	2331	2496	2376	2538
WML183	3958	3962	3199	3288

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 several 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 2021 and was stored temporarily in the goaf. A proportion of the 2021 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 2021, Ashton abstracted 632.7 ML of water via borehole 5 (BH5), borehole 6 (BH6), borehole 7 (BH7) and the underground portal. Of that volume, 218.8 ML was introduced into the mine as operational water; therefore, the difference of 413.9 ML is considered a portion of the incidental water take. The remainder of the predicted incidental water (142.4 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.

During Q4 2021, ACOL engaged AGE to conduct an assessment to determine the potential sources of water for anomalously high water inflow rates into a particular part of the underground workings (AGE, 2021a). Water samples were taken from three underground locations, as well as from a flooded surface dam overlying the affected part of the workings. The results from these samples were compared to those collected during the August 2021 annual groundwater monitoring round to determine if the inflows could be attributed to the overlying dam. The report concluded that the inflow source water was not from the dam and was likely deep groundwater from seams below and including the Pikes Gully coal seam.

The groundwater model (AGE, 2021) predicted that the underground inflow rate into the mine for the period of 2021 would have been 17.4 L/sec. The average 2021 water abstraction rate was 20.1 L/sec.

Table 6.1 Breakdown of abstracted water volumes (2021)

Total water abstracted from mine via BH5, BH6, BH7 and Portal	632.7 ML	Mine water input (metered)	218.8 ML		
		Estimate of abstracted water considered inflow water	413.9 ML	556.3 ML	Total predicted incidental water-take for 2021 (from 2021 GW)
		Portion of incidental water take considered stored in underground and/or lost via coal moisture and water vapour in out-by air	142.4 ML		

7 Summary

Groundwater monitoring over the 2021 reporting period was consistent with the requirements outlined in the WMP. A summary of the findings of this report is as follows:

- Except for an increase in March and November, BCA regulatory bore groundwater elevations were stable throughout 2021. All BCA groundwater elevations remained above established triggers in 2021. It should be noted that ACP is approved to intercept the BCA groundwater resource under DA 309-11-2011-i MOD 5;
- Other BCA alluvial bores recorded generally stable groundwater elevations, except during April and December where increased groundwater elevation was recorded. Monitoring bore RM02 recorded increased groundwater elevation between June and August, stabilising thereafter;
- Excepting an increase to groundwater level during the April and December monitoring period, GCA groundwater elevations were generally stable throughout the year. The increase in groundwater elevation followed higher than average rainfall, indicated by an inclining CRD. A minor decline in groundwater elevation was recorded between January to March in monitoring bore WML120B and WMl129. All GCA groundwater elevations remained above established triggers in 2021;
- HRA regulatory bore groundwater elevations were relatively steady throughout the year. Increased groundwater elevations in HRA regulatory bores were recorded in the April and December monitoring periods, following heavy rainfall. All HRA groundwater elevations remained above established triggers in 2021;
- The other HRA bores responded to periods of increased rainfall throughout 2021 with groundwater elevations varying throughout the year;
- Surface water elevation in Hunter River, Glennies Creek and Bowmans Creek were stable throughout 2021 with increases to water elevation recorded following heavy rainfall events. Bowmans Creek held water for the duration of 2021;
- Groundwater elevations were stable in coal measure bores throughout the year. Groundwater elevation in CMOB bores were relatively stable throughout the year, with increases recorded at the start and end of the 2021 monitoring period;
- VWP measurements in WMLP269 (adjacent LW204/205) sensors at 30 m and 59 m were stable throughout the 2021 monitoring period. Pressure head in the remaining sensors (70 m, 97 m, 127 m and 147 m) have recorded erroneous data since July. Erroneous data is likely due to fracturing of strata in which the deeper sensors are positioned;
- Groundwater pH measurements in alluvial bores were stable during 2021 with values typically ranging from pH 6.5 to pH 7.5. Discrepancies in pH were minor and considered within natural variation. WML129 and WMLP349 recorded exceedances throughout the year. However, these events were not consecutive for three months and as such did not require a response under the WMP;
- pH in coal measure and CMOB bores were stable over 2021, predominantly ranging from pH 6.75 to pH 8. Exceptions to the outlined pH range were few and minor, with the degree of variation considered within natural variation;
- Two bores exceeded EC trigger criteria in 2021, WMLP279 and WMLP349. However, only the exceedance in WMLP349 was consecutive for three or more rounds, triggering an investigation under the WMP. The investigation concluded that the water table was rising through the historically unsaturated zone following heavy rainfall. It is likely that a mobilisation of natural salts occurred as a result of this water table rise, contributing to an increase in the groundwater salinity, and hence an increase in EC. Given time, the natural flushing of the groundwater system will likely occur, and it is expected that groundwater EC values will return to levels below the trigger value. It was also recommended that the headworks and concrete pad be repaired;
- GCA and HRA EC levels in 2021 were steady overall, except for GCA bores WMLP343 and WMLP349 and HRA bore WMLP279 in which EC varied throughout the monitoring period. BCA monitoring bores recorded varied EC values during 2021. No EC trigger exceedances were recorded in the BCA in 2021;
- Coal measure and CMOB EC levels were relatively steady during the year, except for RSGM1 which recorded a sharp increase in EC between the February and May monitoring round; decreasing in the August monitoring period before stabilising in November. No other prevailing trends were evident;

- 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. RSGM1 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 displayed varying results for groundwater elevations and EC during the 2021 monitoring period; and
- Underground mine inflows were slightly above predictions. An investigation into the source of the inflows concluded it is likely from deep Permian strata and not from surficial water.

Generally, the site has experienced no mining impacts to the BCA, GCA and HRA alluvial aquifers and impacts are within predictions in the coal measures.

8 References

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Appendix A

Summary of WMP monitoring locations

Table A 1 GWMP monitoring locations summary

ID	Type	Easting (GDA94 Z56)	Northing (GDA94 Z56)	Top of casing (mAHD)	Depth (mBGL)
Ashton Well	Monitoring bore	318355	6406029	62	-
GM1	EPL Monitoring bore*	318431	6407214	67	203
GM3A	Monitoring bore	320246.5	6405976.9	59	7.5
GM3B	Monitoring bore	320250.9	6405976.7	59	16.2
PB1	Monitoring bore	317545	6405301	61.1	7.8
RA02	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	10.7
RM01	Monitoring bore	318041	6404109.5	69.4	9.8
RM02	Monitoring bore	317942	6404506	61.1	12.9
RM03	Monitoring bore	317667	6404844.5	62.1	9.5
RM10	Monitoring bore	317589	6405292	61.6	10.5
RSGM1	Monitoring bore	317655	6406302	65.6	8.5
T2-A	Monitoring bore	317583.3	6405217.4	60.8	7.9
T2-P	Monitoring bore	317587	6405222	60.7	14.5
T3-A	Monitoring bore	317654.2	6404708	59.9	10.8
T3-P	Monitoring bore	317650	6404702	59.8	22.8
T4-A	Monitoring bore	317685.8	6404323.1	58.6	10.7
T4-P	Monitoring bore	317683	6404319	58.5	17.5
T5	Monitoring bore	317946.1	6406549.4	65.3	8.3
WML113A	Vibrating wire piezometer	317369	6404529	60.2	125
WML113C	Monitoring bore	317377	6404526	60.2	11.2
WML115B	Monitoring bore	317881	6406704	66.4	13
WML115C	Monitoring bore	317888	6406710	66.2	6.2
WML119	Monitoring bore	319255.3	6403930.1	61.5	25.8
WML120A	EPL Monitoring bore*	319292	6404579.6	60.4	15
WML120B	EPL Monitoring bore*	319293.6	6404587.5	60.1	9
WML129	EPL Monitoring bore*	319468.4	6403527.8	55.3	4.6
WML181	EPL Monitoring bore*	319215	6403958.3	64.3	36.7
WML183	EPL 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	12.2
WML245	Vibrating wire piezometer	320035	6404835	64.9	110
WML261	Monitoring bore	319320.2	6404705.9	58.7	43
WML262	EPL Monitoring bore*	319220.1	6403927.7	63.2	60.3
WMLP269	Vibrating wire piezometer	317850	6404073	65.5	147

ID	Type	Easting (GDA94 Z56)	Northing (GDA94 Z56)	Top of casing (mAHD)	Depth (mBGL)
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	13.3
WMLP278	Monitoring bore	317626.3	6403894.2	62.3	11.5
WMLP279	EPL Monitoring bore*	317298.9	6403991.8	62.7	17.2
WMLP280	EPL Monitoring bore*	317797.6	6403793.4	62.5	14.9
WMLP301	Monitoring bore	319235	6403858	60.2	41.5
WMLP302	Monitoring bore	319299.6	6404600.2	59.7	25.2
WMLP308	Monitoring bore	318222.7	6406373	65.7	8.9
WMLP311	Monitoring bore	318178.9	6406047.9	63.6	7.6
WMLP320	EPL Monitoring bore*	317457.2	6405388	61.5	8.5
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	11.9
WMLP327	Monitoring bore	317573	6404103	59.4	18.3
WMLP328	Monitoring bore	317927.3	6405611.6	62.8	11.5
WMLP336	EPL 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	9.6
WMLP346	Monitoring bore	319366.5	6404457.2	60.68	11.5
WMLP349	Monitoring bore	319516	6404198	58.3	8.7
WMLP358	Monitoring bore	319560	6403704	59.49	9.3
WMLP361	Vibrating wire piezometer	317722	6405962	62.9	191
WMLP363	Vibrating wire piezometer	317963	6406634	66	164
YAP016	EPL Monitoring bore*	318438	6407195	66.8	7.3

Note: * Per EPL 11879 (Licence version date: 21 November 2019).

Appendix B

Summary of GWMP Plan – parameters and frequency

Table B 1 GWMP plan summary

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*	-	Coal measure	Water level only	Monthly plus field EC only	Quarterly plus field parameters and **comprehensive** analysis
GM3A	Monitoring bore	-	GCA	Water level only	Monthly plus field parameters	Quarterly plus minor lab analysis
GM3B	Monitoring bore	-	GCA	Water level only	Monthly plus field parameters	Quarterly plus minor lab analysis
PB1	Monitoring bore	-	BCA	Water level only	Monthly plus field EC only	Quarterly plus minor lab analysis
RA02	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	Monitoring bore	-	BCA	Water level only	Monthly plus field EC only	Quarterly plus minor lab analysis
RM02	Monitoring bore	-	BCA + CMOB	Water level only	Monthly plus field EC only	Water level and field EC only
RM03	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	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
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

ID	Type	Data recording method	Targets	Monthly	Quarterly	Annually
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	-	BW 2, Lem 4, Lem 9, Lem 11-12, Lem 15	Pressure head	Pressure head	Pressure head
WML113C	Monitoring bore	Pressure transducer	BCA	Water level and field parameters	Monthly plus minor lab analysis	Quarterly plus **comprehensive** analysis
WML115B	Monitoring bore	-	CMOB & Lem 3-4	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	EPL Monitoring bore*	-	PG	Water level only	Monthly plus field parameters and minor lab analysis	Quarterly plus **comprehensive** analysis
WML120B	EPL Monitoring bore*	-	GCA	Water level and field parameters	Monthly plus minor lab analysis	Quarterly plus **comprehensive** analysis
WML129	EPL Monitoring bore*	Pressure transducer	GCA	Water level and field parameters	Monthly plus minor lab analysis	Quarterly plus **comprehensive** analysis
WML181	EPL Monitoring bore*	-	PG	Water level only	Monthly plus field parameters and minor lab analysis	Quarterly plus **comprehensive** analysis
WML183	EPL 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	Pressure transducer	GCA	Water level and field parameters	Monthly plus minor lab analysis	Quarterly plus **comprehensive** analysis

ID	Type	Data recording method	Targets	Monthly	Quarterly	Annually
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	EPL 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	-	ULD, ULLD, 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, ULD, 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
WMLP279	EPL Monitoring bore*	-	HRA	Water level and field parameters	Monthly plus minor lab analysis	Quarterly plus **comprehensive** analysis
WMLP280	EPL 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

ID	Type	Data recording method	Targets	Monthly	Quarterly	Annually
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	EPL 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	EPL Monitoring bore*	-	HRA + CMOB	Water level and field parameters	Monthly plus minor lab analysis	Quarterly plus **comprehensive** analysis
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	Pressure transducer	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

ID	Type	Data recording method	Targets	Monthly	Quarterly	Annually
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	EPL Monitoring bore*	Pressure transducer	BCA	Water level and field parameters	Monthly plus minor lab analysis	Quarterly plus **comprehensive** analysis

Note: * Per EPL 11879 (Licence version date: 21 November 2019).

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 2021

Table D1

Bore ID Units Limit of Reporting (LOR) ANZECC livestock limits	Geology	Laboratory ID	Date	pH Value (Field) pH	pH Value (Lab) pH 0.01	pH RPD %	EC (Field) µS/cm 5970	EC (Lab) µS/cm 1 5970	EC RPD %	Total Dissolved Solids (TDS) mg/L 10 4000
Ashton well	BCA	ES2128991033	06-Aug-21	7.47	7.56	-1.20	407.7	412	-1.05	279.7
GM1	Coal	ES2128991029	06-Aug-21	7.08	7.18	-1.40	1872	1970	-5.10	1373
RA18	BCA	ES2128991005	02-Aug-21	7.13	7.21	-1.12	1048	1150	-9.28	731.8
RA27	HRA	ES2128991030	06-Aug-21	7.10	7.17	-0.98	1260	1310	-3.89	886.2
RM10	CMOB	ES2128991002	02-Aug-21	7.14	7.23	-1.25	965	1080	-11.25	670.2
T2A	BCA	ES2128991018	04-Aug-21	7.08	7.18	-1.40	1061	1060	0.09	740.2
T2P	CMOB	ES2128991019	04-Aug-21	6.63	6.76	-1.94	1158	1140	1.57	809.6
T3A	BCA	ES2128991021	04-Aug-21	6.82	6.88	-0.88	2522	2630	-4.19	1887
T3P	CMOB	ES2128991022	04-Aug-21	7.44	7.27	2.31	2359	2380	-0.89	1752
RM03	BCA	ES2128991020	04-Aug-21	7.23	7.38	-2.05	1601	1620	-1.18	1160
RSGM1	Coal	ES2128991035	06-Aug-21	7.27	7.32	-0.69	3176	3420	-7.40	2407
T5	BCA	ES2128991034	06-Aug-21	6.69	6.82	-1.92	866.2	894	-3.16	598.1
WML113C	BCA	ES2128991023	05-Aug-21	6.99	7.02	-0.43	882.2	945	-6.87	611.6
WML115B	CMOB	ES2128991041	09-Aug-21	6.75	6.88	-1.91	2398	2680	-11.11	1790
WML115C	BCA	ES2128991042	09-Aug-21	6.70	6.98	-4.09	636.8	666	-4.48	433.8
WML119	Coal	ES2128991014	03-Aug-21	7.20	7.36	-2.20	1253	1320	-5.21	879
WML120A	Coal	ES2128991007	02-Aug-21	6.92	7.03	-1.58	788.6	858	-8.43	541.8
WML120B	GCA	ES2128991006	02-Aug-21	6.72	6.90	-2.64	526.3	579	-9.54	355.4
WML129	GCA	ES2128991010	03-Aug-21	6.93	7.08	-2.14	467.1	482	-3.14	314.3
WML181	Coal	ES2128991013	03-Aug-21	7.87	8.03	-2.01	2376	2560	-7.46	1771
WML183	Coal	ES2128991009	03-Aug-21	6.99	7.08	-1.28	3199	3560	-10.68	2426
WML239	GCA	ES2128991045	10-Aug-21	6.88	6.95	-1.01	651.7	723	-10.37	444.5
WML261	Coal	ES2128991004	02-Aug-21	6.75	6.91	-2.34	1349	1490	-9.93	951

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	ES2128991012	03-Aug-21	8.05	8.11	-0.74	2668	2910	-8.68	2011
WMLP277	HRA	ES2128991032	06-Aug-21	7.14	7.06	1.13	1393	1140	19.98	981.5
WMLP278	HRA	ES2128991027	05-Aug-21	7.08	7.11	-0.42	1173	1280	-8.72	823.8
WMLP279	HRA	ES2128991026	05-Aug-21	6.84	6.96	-1.74	1069	1170	-9.02	747.7
WMLP280	HRA	ES2128991031	06-Aug-21	6.99	7.07	-1.14	1123	1170	-4.10	784.3
WMLP301	Coal	ES2128991011	03-Aug-21	7.95	8.00	-0.63	3055	3340	-8.91	2320
WMLP302	Coal	ES2128991008	03-Aug-21	6.41	6.55	-2.16	967.9	1010	-4.26	674.8
WMLP308	BCA	ES2128991036	09-Aug-21	6.99	7.02	-0.43	881.6	953	-7.78	613.2
WMLP311	BCA	ES2128991039	09-Aug-21	6.72	6.88	-2.35	887.6	961	-7.94	614.2
WMLP320	BCA	ES2128991001	02-Aug-21	6.87	6.90	-0.44	1459	1630	-11.07	1033
WMLP323	BCA	ES2128991038	09-Aug-21	6.88	7.00	-1.73	903.4	974	-7.52	625.3
WMLP324	CMOB	ES2128991037	09-Aug-21	6.92	6.98	-0.86	872.3	941	-7.58	602.3
WMLP325	CMOB	ES2128991040	09-Aug-21	7.08	7.20	-1.68	1174	1260	-7.07	823.3
WMLP326	BCA	ES2128991025	05-Aug-21	7.24	7.27	-0.41	1380	1500	-8.33	974.3
WMLP327	CMOB	ES2128991024	05-Aug-21	6.92	7.03	-1.58	1728	1890	-8.96	1240
WMLP328	BCA	ES2128991003	02-Aug-21	6.88	6.98	-1.44	854.5	946	-10.16	593
WMLP336	HRA	ES2128991017	04-Aug-21	6.68	6.78	-1.49	621	636	-2.39	423.9
WMLP337	HRA	ES2128991015	04-Aug-21	7.03	7.18	-2.11	2870	2940	-2.41	2159
WMLP338	HRA	ES2128991016	04-Aug-21	6.73	6.86	-1.91	1993	2000	-0.35	1446
WMLP343	GCA	ES2128991048	10-Aug-21	6.95	7.00	-0.72	964.6	752	24.77	474.3
WMLP346	GCA	ES2128991046	10-Aug-21	6.78	6.89	-1.61	543.3	582	-6.88	367.6
WMLP349	GCA	ES2128991044	10-Aug-21	6.47	6.57	-1.53	1186	1270	-6.84	832.2
WMLP358	GCA	ES2128991043	10-Aug-21	6.32	6.85	-8.05	317.3	328	-3.32	210.5
YAP016	BCA	ES2128991028	06-Aug-21	6.84	7.07	-3.31	1131	1170	-3.39	793.8

Table D2

Bore ID Units Limit of Reporting (LOR) ANZECC livestock limits	Geology	Laboratory ID	Date	Calcium mg/L 1	Magnesium mg/L 1	Sodium mg/L 1	Potassium mg/L 1	Chloride mg/L 1
Ashton well	BCA	ES2128991033	06-Aug-21	38.00	14.00	36.00	4	32
GM1	Coal	ES2128991029	06-Aug-21	73.00	49.00	263.00	3	338
RA18	BCA	ES2128991005	02-Aug-21	48.00	24.00	163.00	1	148
RA27	HRA	ES2128991030	06-Aug-21	35.00	27.00	195.00	<1	210
RM10	CMOB	ES2128991002	02-Aug-21	48.00	25.00	148.00	2	136
T2A	BCA	ES2128991018	04-Aug-21	53.00	24.00	139.00	2	129
T2P	CMOB	ES2128991019	04-Aug-21	88.00	37.00	89.00	2	197
T3A	BCA	ES2128991021	04-Aug-21	67.00	54.00	372.00	<1	599
T3P	CMOB	ES2128991022	04-Aug-21	69.00	56.00	356.00	4	430
RM03	BCA + CMOB	ES2128991020	04-Aug-21	72.00	57.00	200.00	2	115
RSGM1	Coal	ES2128991035	06-Aug-21	36.00	37.00	620.00	1	657
T5	BCA	ES2128991034	06-Aug-21	45.00	18.00	115.00	2	112
WML113C	BCA	ES2128991023	05-Aug-21	57.00	20.00	108.00	1	138
WML115B	CMOB	ES2128991041	09-Aug-21	81.00	40.00	456.00	2	383
WML115C	BCA	ES2128991042	09-Aug-21	20.00	8.00	107.00	2	94
WML119	Coal	ES2128991014	03-Aug-21	32.00	26.00	236.00	4	182
WML120A	Coal	ES2128991007	02-Aug-21	35.00	27.00	94.00	2	149
WML120B	GCA	ES2128991006	02-Aug-21	31.00	18.00	62.00	<1	86
WML129	GCA	ES2128991010	03-Aug-21	29.00	15.00	48.00	2	79
WML181	Coal	ES2128991013	03-Aug-21	24.00	25.00	521.00	4	418
WML183	Coal	ES2128991009	03-Aug-21	92.00	121.00	506.00	7	579
WML239	GCA	ES2128991045	10-Aug-21	45.00	19.00	72.00	1	112
WML261	Coal	ES2128991004	02-Aug-21	36.00	35.00	205.00	2	286
WML262	Coal	ES2128991012	03-Aug-21	6.00	5.00	649.00	3	408

Bore ID Units Limit of Reporting (LOR) ANZECC livestock limits	Geology	Laboratory ID	Date	Calcium mg/L 1	Magnesium mg/L 1	Sodium mg/L 1	Potassium mg/L 1	Chloride mg/L 1
WMLP277	HRA	ES2128991032	06-Aug-21	48.00	27.00	220.00	<1	248
WMLP278	HRA	ES2128991027	05-Aug-21	55.00	25.00	174.00	<1	212
WMLP279	HRA	ES2128991026	05-Aug-21	71.00	29.00	124.00	<1	205
WMLP280	HRA	ES2128991031	06-Aug-21	44.00	24.00	169.00	<1	171
WMLP301	Coal	ES2128991011	03-Aug-21	7.00	4.00	747.00	2	510
WMLP302	Coal	ES2128991008	03-Aug-21	26.00	27.00	142.00	2	182
WMLP308	BCA	ES2128991036	09-Aug-21	41.00	24.00	126.00	2	132
WMLP311	BCA	ES2128991039	09-Aug-21	38.00	22.00	130.00	2	123
WMLP320	BCA	ES2128991001	02-Aug-21	99.00	50.00	179.00	3	165
WMLP323	BCA	ES2128991038	09-Aug-21	51.00	26.00	116.00	2	141
WMLP324	CMOB	ES2128991037	09-Aug-21	48.00	24.00	115.00	2	136
WMLP325	CMOB	ES2128991040	09-Aug-21	63.00	27.00	164.00	2	217
WMLP326	BCA	ES2128991025	05-Aug-21	59.00	29.00	221.00	<1	236
WMLP327	CMOB	ES2128991024	05-Aug-21	68.00	37.00	290.00	4	338
WMLP328	BCA	ES2128991003	02-Aug-21	49.00	24.00	110.00	2	129
WMLP336	HRA	ES2128991017	04-Aug-21	39.00	18.00	63.00	6	95
WMLP337	HRA	ES2128991015	04-Aug-21	108.00	119.00	327.00	5	591
WMLP338	HRA	ES2128991016	04-Aug-21	101.00	60.00	230.00	<1	399
WMLP343	GCA	ES2128991048	10-Aug-21	47.00	21.00	78.00	<1	111
WMLP346	GCA	ES2128991046	10-Aug-21	33.00	17.00	60.00	<1	90
WMLP349	GCA	ES2128991044	10-Aug-21	63.00	32.00	146.00	<1	275
WMLP358	GCA	ES2128991043	10-Aug-21	28.00	12.00	25.00	<1	39
YAP016	BCA	ES2128991028	06-Aug-21	38.00	22.00	168.00	2	169

Table D3

Bore ID Units Limit of Reporting (LOR) ANZECC livestock limits	Geology	Laboratory ID	Date	Hydroxide Alkalinity as CaCO3 mg/L 1	Carbonate Alkalinity as CaCO3 mg/L 1	Bicarbonate Alkalinity as CaCO3 mg/L 1	Total Alkalinity mg/L 1	Sulfate as SO4 mg/L 1 1000
Ashton well	BCA	ES2128991033	06-Aug-21	<1	<1	165.00	165	16
GM1	Coal	ES2128991029	06-Aug-21	<1	<1	336.00	336	195
RA18	BCA	ES2128991005	02-Aug-21	<1	<1	193	193	191
RA27	HRA	ES2128991030	06-Aug-21	<1	<1	277.00	277	106
RM10	CMOB	ES2128991002	02-Aug-21	<1	<1	214.00	214	168
T2A	BCA	ES2128991018	04-Aug-21	<1	<1	194.00	194	171
T2P	CMOB	ES2128991019	04-Aug-21	<1	<1	164.00	164	157
T3A	BCA	ES2128991021	04-Aug-21	<1	<1	196.00	196	153
T3P	CMOB	ES2128991022	04-Aug-21	<1	<1	415.00	415	180
RM03	BCA + CMOB	ES2128991020	04-Aug-21	<1	<1	390.00	309	115
RSGM1	Coal	ES2128991035	06-Aug-21	<1	<1	437.00	437	228
T5	BCA	ES2128991034	06-Aug-21	<1	<1	145.00	145	138
WML113C	BCA	ES2128991023	05-Aug-21	<1	<1	160.00	160	126
WML115B	CMOB	ES2128991041	09-Aug-21	<1	<1	592.00	592	284
WML115C	BCA	ES2128991042	09-Aug-21	<1	<1	138.00	138	57
WML119	Coal	ES2128991014	03-Aug-21	<1	<1	465.00	465	14
WML120A	Coal	ES2128991007	02-Aug-21	<1	<1	221.00	221	15
WML120B	GCA	ES2128991006	02-Aug-21	<1	<1	180.00	180	12
WML129	GCA	ES2128991010	03-Aug-21	<1	<1	120.00	120	19
WML181	Coal	ES2128991013	03-Aug-21	<1	<1	812.00	812	<1
WML183	Coal	ES2128991009	03-Aug-21	<1	<1	786.00	786	276
WML239	GCA	ES2128991045	10-Aug-21	<1	<1	185.00	185	15
WML261	Coal	ES2128991004	02-Aug-21	<1	<1	322.00	322	40

Bore ID Units Limit of Reporting (LOR) ANZECC livestock limits	Geology	Laboratory ID	Date	Hydroxide Alkalinity as CaCO3 mg/L 1	Carbonate Alkalinity as CaCO3 mg/L 1	Bicarbonate Alkalinity as CaCO3 mg/L 1	Total Alkalinity mg/L 1	Sulfate as SO4 mg/L 1 1000
WML262	Coal	ES2128991012	03-Aug-21	<1	<1	997.00	997	<1
WMLP277	HRA	ES2128991032	06-Aug-21	<1	<1	260.00	260	117
WMLP278	HRA	ES2128991027	05-Aug-21	<1	<1	242.00	242	110
WMLP279	HRA	ES2128991026	05-Aug-21	<1	<1	192.00	192	106
WMLP280	HRA	ES2128991031	06-Aug-21	<1	<1	268.00	268	88
WMLP301	Coal	ES2128991011	03-Aug-21	<1	<1	1050.00	1050	<1
WMLP302	Coal	ES2128991008	03-Aug-21	<1	<1	240.00	240	25
WMLP308	BCA	ES2128991036	09-Aug-21	<1	<1	207.00	207	102
WMLP311	BCA	ES2128991039	09-Aug-21	<1	<1	237.00	237	94
WMLP320	BCA	ES2128991001	02-Aug-21	<1	<1	205.00	205	409
WMLP323	BCA	ES2128991038	09-Aug-21	<1	<1	197.00	197	106
WMLP324	CMOB	ES2128991037	09-Aug-21	<1	<1	184.00	184	102
WMLP325	CMOB	ES2128991040	09-Aug-21	<1	<1	249.00	249	88
WMLP326	BCA	ES2128991025	05-Aug-21	<1	<1	267.00	267	206
WMLP327	CMOB	ES2128991024	05-Aug-21	<1	<1	364.00	364	118
WMLP328	BCA	ES2128991003	02-Aug-21	<1	<1	189.00	189	116
WMLP336	HRA	ES2128991017	04-Aug-21	<1	<1	161.00	161	25
WMLP337	HRA	ES2128991015	04-Aug-21	<1	<1	508.00	508	122
WMLP338	HRA	ES2128991016	04-Aug-21	<1	<1	390.00	390	54
WMLP343	GCA	ES2128991048	10-Aug-21	<1	<1	228.00	228	12
WMLP346	GCA	ES2128991046	10-Aug-21	<1	<1	175.00	175	5
WMLP349	GCA	ES2128991044	10-Aug-21	<1	<1	184.00	184	51
WMLP358	GCA	ES2128991043	10-Aug-21	<1	<1	114.00	114	4
YAP016	BCA	ES2128991028	06-Aug-21	<1	<1	237.00	237	138

Table D4

Bore ID	Geology	Laboratory ID	Date	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	0.1	1	0.4		0.1		1	0.02	20
Ashton well	BCA	ES2128991033	06-Aug-21										
GM1	Coal	ES2128991029	06-Aug-21	0.002	<0.0001	<0.001	<0.001	2.05	<0.001	0.483	<0.001	<0.01	0.012
RA18	BCA	ES2128991005	02-Aug-21										
RA27	HRA	ES2128991030	06-Aug-21	<0.001	<0.0001	<0.001	<0.001	<0.05	<0.001	0.007	0.003	<0.01	<0.005
RM10	CMOB	ES2128991002	02-Aug-21										
T2A	BCA	ES2128991018	04-Aug-21	<0.001	<0.0001	0.02	<0.001	<0.05	<0.001	0.004	0.004	<0.01	0.007
T2P	CMOB	ES2128991019	04-Aug-21	0.006	<0.0001	<0.001	<0.001	4.04	<0.001	0.395	0.005	<0.01	<0.005
T3A	BCA	ES2128991021	04-Aug-21	<0.001	<0.0001	<0.001	<0.001	<0.05	<0.001	0.005	<0.001	<0.01	<0.005
T3P	CMOB	ES2128991022	04-Aug-21	<0.001	<0.0001	<0.001	<0.001	0.34	<0.001	0.048	<0.001	<0.01	<0.005
RM03	BCA + CMOB	ES2128991020	04-Aug-21										
RSGM1	Coal	ES2128991035	06-Aug-21	0.002	<0.0001	0.003	<0.001	<0.05	<0.001	0.053	0.05	<0.01	0.033
T5	BCA	ES2128991034	06-Aug-21	<0.001	<0.0001	0.009	<0.001	0.06	<0.001	0.007	0.016	<0.01	<0.005
WML113C	BCA	ES2128991023	05-Aug-21	<0.001	<0.0001	0.003	<0.001	<0.05	<0.001	0.003	0.006	<0.01	<0.005
WML115B	CMOB	ES2128991041	09-Aug-21										
WML115C	BCA	ES2128991042	09-Aug-21										
WML119	Coal	ES2128991014	03-Aug-21	0.001	<0.0001	0.007	<0.001	0.38	<0.001	0.104	0.002	<0.01	<0.005
WML120A	Coal	ES2128991007	02-Aug-21	<0.001	<0.0001	<0.001	<0.001	0.72	<0.001	0.135	<0.001	<0.01	<0.005
WML120B	GCA	ES2128991006	02-Aug-21	<0.001	<0.0001	<0.001	<0.001	<0.05	<0.001	0.005	<0.001	<0.01	<0.005

Bore ID	Geology	Laboratory ID	Date	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	0.1	1	0.4		0.1		1	0.02	20
WML129	GCA	ES2128991010	03-Aug-21	<0.001	<0.0001	<0.001	<0.001	0.19	<0.001	0.272	<0.001	<0.01	<0.005
WML181	Coal	ES2128991013	03-Aug-21	0.004	<0.0001	0.01	<0.001	<0.05	<0.001	0.018	<0.001	<0.01	<0.005
WML183	Coal	ES2128991009	03-Aug-21	<0.001	0.001	<0.001	0.007	<0.05	0.001	0.119	0.006	<0.01	0.236
WML239	GCA	ES2128991045	10-Aug-21	<0.001	<0.0001	<0.001	<0.001	0.07	<0.001	0.022	0.007	<0.01	<0.005
WML261	Coal	ES2128991004	02-Aug-21	<0.001	<0.0001	0.001	<0.001	0.72	<0.001	0.031	0.002	<0.01	0.006
WML262	Coal	ES2128991012	03-Aug-21	<0.001	<0.0001	<0.001	<0.001	0.07	<0.001	0.031	<0.001	<0.01	<0.005
WMLP277	HRA	ES2128991032	06-Aug-21	<0.001	<0.0001	<0.001	<0.001	<0.05	<0.001	0.007	0.002	<0.01	<0.005
WMLP278	HRA	ES2128991027	05-Aug-21	<0.001	<0.0001	0.002	<0.001	<0.05	<0.001	0.009	0.003	<0.01	<0.005
WMLP279	HRA	ES2128991026	05-Aug-21	<0.001	<0.0001	<0.001	<0.001	<0.05	<0.001	0.009	0.001	<0.01	<0.005
WMLP280	HRA	ES2128991031	06-Aug-21	<0.001	<0.0001	0.001	<0.001	<0.05	<0.001	0.016	0.002	<0.01	<0.005
WMLP301	Coal	ES2128991011	03-Aug-21	0.001	<0.0001	<0.001	<0.001	<0.05	<0.001	0.032	0.007	<0.01	<0.005
WMLP302	Coal	ES2128991008	03-Aug-21	0.001	0.0001	<0.001	<0.001	1.62	<0.001	0.029	0.001	<0.01	0.009
WMLP308	BCA	ES2128991036	09-Aug-21	<0.001	<0.0001	<0.001	<0.001	<0.05	<0.001	0.006	0.003	<0.01	<0.005
WMLP311	BCA	ES2128991039	09-Aug-21	<0.001	<0.0001	<0.001	<0.001	<0.05	<0.001	0.010	0.002	<0.01	<0.005
WMLP320	BCA	ES2128991001	02-Aug-21										
WMLP323	BCA	ES2128991038	09-Aug-21	<0.001	<0.0001	<0.001	<0.001	<0.05	<0.001	0.025	0.001	<0.01	<0.005
WMLP324	CMOB	ES2128991037	09-Aug-21	<0.001	<0.0001	<0.001	<0.001	<0.05	<0.001	0.081	0.001	<0.01	<0.005
WMLP325	CMOB	ES2128991040	09-Aug-21	<0.001	<0.0001	<0.001	<0.001	0.75	<0.001	0.359	<0.001	<0.01	<0.005
WMLP326	BCA	ES2128991025	05-Aug-21										
WMLP327	CMOB	ES2128991024	05-Aug-21										

Bore ID	Geology	Laboratory ID	Date	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	0.1	1	0.4		0.1		1	0.02	20
WMLP328	BCA	ES2128991003	02-Aug-21	<0.001	<0.0001	<0.001	<0.001	<0.05	<0.001	0.022	<0.001	<0.01	<0.005
WMLP336	HRA	ES2128991017	04-Aug-21	<0.001	<0.0001	<0.001	<0.001	0.14	<0.001	0.055	0.002	<0.01	<0.005
WMLP337	HRA	ES2128991015	04-Aug-21	<0.001	<0.0001	<0.001	<0.001	0.08	<0.001	0.280	0.006	<0.01	0.013
WMLP338	HRA	ES2128991016	04-Aug-21	0.002	<0.0001	<0.001	<0.001	3.74	<0.001	0.732	0.003	<0.01	0.005
WMLP343	GCA	ES2128991048	10-Aug-21	<0.001	<0.0001	<0.001	<0.001	<0.05	<0.001	0.014	0.002	<0.01	<0.005
WMLP346	GCA	ES2128991046	10-Aug-21	<0.001	<0.0001	<0.001	<0.001	0.12	<0.001	0.123	0.002	<0.01	<0.005
WMLP349	GCA	ES2128991044	10-Aug-21	<0.001	<0.0001	<0.001	<0.001	0.88	<0.001	0.150	0.002	<0.01	0.006
WMLP358	GCA	ES2128991043	10-Aug-21	<0.001	<0.0001	0.002	<0.001	<0.05	<0.001	0.019	0.004	<0.01	0.006
YAP016	BCA	ES2128991028	06-Aug-21	<0.001	<0.0001	0.003	<0.001	<0.05	<0.001	0.004	0.003	<0.01	0.006

Table D5

Bore ID	Geology	Laboratory ID	Date	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												
Ashton well	BCA	ES2128991033	06-Aug-21							4.53	4.72	1.99
GM1	Coal	ES2128991029	06-Aug-21	107	<0.004	0.03	0.2	0.2	0.03	20.3	19.2	2.82
RA18	BCA	ES2128991005	02-Aug-21							12	1.5	2.22
RA27	HRA	ES2128991030	06-Aug-21	42.2	<0.004	0.88	0.1	1	0.3	13.7	12.4	4.65
RM10	CMOB	ES2128991002	02-Aug-21							11.6	10.9	2.96
T2A	BCA	ES2128991018	04-Aug-21	2.3	<0.004	0.53	<0.1	0.5	0.02	11.1	10.7	1.64
T2P	CMOB	ES2128991019	04-Aug-21	42.2	<0.004	0.04	<0.1	<0.1	0.01	12.1	11.4	3.17
T3A	BCA	ES2128991021	04-Aug-21	22.2	<0.004	1.77	0.1	1.9	0.06	24	24	0.06
T3P	CMOB	ES2128991022	04-Aug-21	3	<0.004	0.03	0.6	0.6	0.01	24.2	23.6	1.11
RM03	BCA + CMOB	ES2128991020	04-Aug-21							17.5	17	1.33
RSGM1	Coal	ES2128991035	06-Aug-21	1660	<0.004	1	1.5	2.5	0.9	32	31.8	0.28
T5	BCA	ES2128991034	06-Aug-21	11.2	<0.004	2.55	0.4	3	0.03	8.93	8.78	0.84
WML113C	BCA	ES2128991023	05-Aug-21	7.4	<0.004	0.47	0.1	0.6	0.02	9.71	9.21	2.64
WML115B	CMOB	ES2128991041	09-Aug-21							28.5	27.2	2.38
WML115C	BCA	ES2128991042	09-Aug-21							6.6	6.36	1.8
WML119	Coal	ES2128991014	03-Aug-21	23.6	<0.004	0.01	1.8	1.8	0.22	14.7	14.1	2.12
WML120A	Coal	ES2128991007	02-Aug-21	7.4	<0.004	<0.01	0.1	0.1	0.05	8.93	8.11	4.83
WML120B	GCA	ES2128991006	02-Aug-21	5	<0.004	0.16	<0.1	0.2	0.05	6.27	5.72	4.56
WML129	GCA	ES2128991010	03-Aug-21	1.2	<0.004	<0.01	0.2	0.2	0.08	5.02	4.82	2.04
WML181	Coal	ES2128991013	03-Aug-21	26.7	<0.004	<0.01	1.2	1.2	0.24	28	26	3.69
WML183	Coal	ES2128991009	03-Aug-21	235	<0.004	2.75	2	4.8	0.18	37.8	36.7	1.4
WML239	GCA	ES2128991045	10-Aug-21	156	<0.004	0.07	0.2	0.3	0.12	7.17	6.97	1.42
WML261	Coal	ES2128991004	02-Aug-21	19.5	<0.004	<0.01	0.2	0.2	0.05	15.3	13.6	5.83

Bore ID	Geology	Laboratory ID	Date	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												
WML262	Coal	ES2128991012	03-Aug-21	70.4	<0.004	0.01	1.4	1.4	0.7	31.4	29	3.99
WMLP277	HRA	ES2128991032	06-Aug-21	1.8	<0.004	0.64	<0.1	0.6	0.12	14.6	14.2	1.53
WMLP278	HRA	ES2128991027	05-Aug-21	0.7	<0.004	0.58	0.1	0.7	0.08	13.1	12.4	2.88
WMLP279	HRA	ES2128991026	05-Aug-21	1.4	<0.004	0.86	0.1	1	0.06	11.8	11.3	2.17
WMLP280	HRA	ES2128991031	06-Aug-21	4	<0.004	2.56	0.4	3	0.15	12	11.5	2.08
WMLP301	Coal	ES2128991011	03-Aug-21	395	<0.004	<0.01	1.5	1.5	0.41	35.4	33.2	3.12
WMLP302	Coal	ES2128991008	03-Aug-21	13.3	<0.004	<0.01	0.4	0.4	0.05	10.4	9.75	3.48
WMLP308	BCA	ES2128991036	09-Aug-21	1	<0.004	0.02	<0.1	<0.1	0.02	9.98	9.55	2.2
WMLP311	BCA	ES2128991039	09-Aug-21	11.4	<0.004	0.02	<0.1	<0.1	0.02	10.2	9.41	3.83
WMLP320	BCA	ES2128991001	02-Aug-21							17.3	16.9	1.02
WMLP323	BCA	ES2128991038	09-Aug-21	15.5	<0.004	<0.01	0.1	0.1	0.02	10.1	9.78	1.7
WMLP324	CMOB	ES2128991037	09-Aug-21	1.4	<0.004	<0.01	0.1	0.1	0.02	9.64	9.42	1.12
WMLP325	CMOB	ES2128991040	09-Aug-21	17.4	<0.004	<0.01	0.2	0.2	0.05	12.9	12.6	1.48
WMLP326	BCA	ES2128991025	05-Aug-21							16.3	14.9	4.28
WMLP327	CMOB	ES2128991024	05-Aug-21							19.3	19.2	0.28
WMLP328	BCA	ES2128991003	02-Aug-21	61.8	<0.004	0.31	0.2	0.5	0.04	9.83	9.26	3.01
WMLP336	HRA	ES2128991017	04-Aug-21	136	<0.004	3.02	1.9	4.9	0.62	6.42	6.32	0.75
WMLP337	HRA	ES2128991015	04-Aug-21	92.9	<0.004	0.03	0.4	0.4	0.09	29.4	29.5	0.29
WMLP338	HRA	ES2128991016	04-Aug-21	173	<0.004	0.03	0.2	0.2	0.16	20.2	20	0.47
WMLP343	GCA	ES2128991048	10-Aug-21	0.1	<0.004	0.23	0.1	0.3	0.04	7.94	7.47	3.05
WMLP346	GCA	ES2128991046	10-Aug-21	2	<0.004	<0.01	<0.1	<0.1	0.03	6.14	5.66	4.1
WMLP349	GCA	ES2128991044	10-Aug-21	7.7	<0.004	0.06	<0.1	<0.1	0.04	12.5	12.1	1.49
WMLP358	GCA	ES2128991043	10-Aug-21	0.9	<0.004	0.13	<0.1	0.1	0.04	3.46	3.47	0.16
YAP016	BCA	ES2128991028	06-Aug-21	2.7	<0.004	0.3	<0.1	0.3	0.03	12.4	11.1	5.59

Appendix E

Groundwater chemistry – aquifer speciation

Table E1 Ashton August 2021 key monitoring bore water types

Bore ID	Geology	Individual Water Type	General Water Type
RA18	BCA	Na-Ca-Cl-SO4-HCO3	Na-Ca
T2A		Na-Ca-Cl-SO4-HCO3	
T5		Na-Ca-Cl-SO4-HCO3	
WML113C		Na-Ca-Cl-SO4-HCO3	
WMLP308		Na-Ca-Mg-Cl-HCO3-SO4	
WMLP311		Na-Ca-HCO3-Cl-SO4	
WMLP320		Na-Ca-Mg-SO4-Cl-HCO3	
WMLP323		Na-Ca-Mg-Cl-HCO3-SO4	
WMLP328		Na-Ca-Mg-Cl-HCO3-SO4	
WML120B	GCA	Na-Ca-Mg-HCO3-Cl	
WML129		Na-Ca-Mg-Cl-HCO3	
WML239		Na-Ca-Mg-Cl-HCO3	
WMLP343		Na-Ca-Mg-HCO3-Cl	
WMLP346		Na-Ca-Mg-HCO3-Cl	
WMLP349		Na-Ca-Mg-Cl-HCO3	
WMLP278	HRA	Na-Ca-Cl-HCO3	
WMLP279		Na-Ca-Mg-Cl-HCO3	
WMLP336		Na-Ca-Mg-Cl-HCO3	
WMLP338		Na-Ca-Mg-Cl-HCO3	
RM10	CMOB	Na-Ca-Cl-HCO3-SO4	
WMLP324		Na-Ca-Mg-Cl-HCO3-SO4	
WMLP325		Na-Ca-Cl-HCO3	
RM03	BCA	Na-Mg-Ca-HCO3-Cl	Na-Mg
WMLP337	HRA	Na-Mg-Cl-HCO3	
GM1	Coal	Na-Mg-Cl-HCO3-SO4	
WML120A		Na-Mg-Ca-Cl-HCO3	
WML183		Na-Mg-Cl-HCO3	
WML261		Na-Mg-Cl-HCO3	
WMLP302		Na-Mg-Cl-HCO3	
T3A	BCA	Na-Cl	Na-Cl
WML115C		Na-Cl-HCO3	
WMLP326		Na-Cl-HCO3-SO4	
YAP016		Na-Cl-HCO3-SO4	
RA27	HRA	Na-Cl-HCO3	
WMLP277		Na-Cl-HCO3	
WMLP280		Na-Cl-HCO3	
T3P	CMOB	Na-Cl-HCO3	
WML115B		Na-Cl-HCO3-SO4	
WMLP327		Na-Cl-HCO3	
RSGM1	Coal	Na-Cl-HCO3	
WML119		Na-HCO3-Cl	Na-HCO3
WML181		Na-HCO3-Cl	
WML262		Na-HCO3-Cl	
WMLP301		Na-HCO3-Cl	
Ashton well	BCA	Ca-Na-Mg-HCO3-Cl	Ca-Na
WMLP358	GCA	Ca-Na-Mg-HCO3-Cl	
T2P	CMOB	Ca-Na-Mg-Cl-SO4-HCO3	

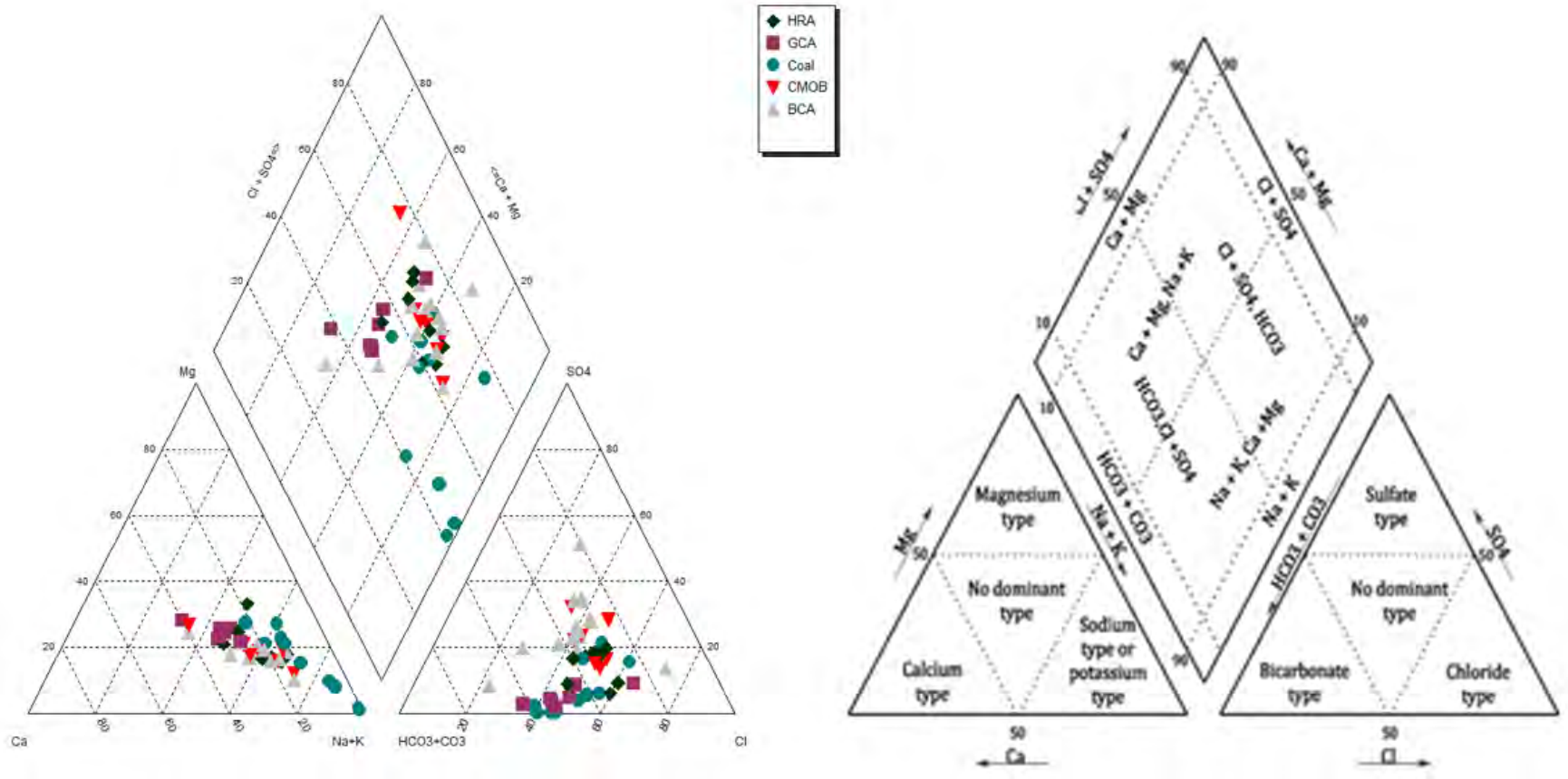

Figure E1 Ashton August 2021 key monitoring bore Piper Diagram

Appendix F

Laboratory certificate of analysis and chain of custody documents (August 2021)

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES2128991**	Page	: 1 of 22
Client	: **AUSTRALASIAN GROUNDWATER AND ENVIRONMENTAL CONSULTANTS PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: BYRCE MCKAY	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	: G1922P Ashton Coal Mine GW Sampling	Date Samples Received	: 10-Aug-2021 14:46
Order number	: ----	Date Analysis Commenced	: 10-Aug-2021
C-O-C number	: ----	Issue Date	: 17-Aug-2021 12:03
Sampler	: Jordan Reeds		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 48		
No. of samples analysed	: 48		

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, unless the sampling was conducted by ALS. 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
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Neil Martin	Team Leader - Chemistry	Chemistry, Newcastle West, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the 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.

- TDS by method EA-015 may bias high for sample36 due to the presence of fine particulate matter, which may pass through the prescribed GF/C paper.
- 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)			Sample ID	WMLP320	RM10	WMLP328	WML261	RA18
			Sampling date / time	02-Aug-2021 08:55	02-Aug-2021 09:30	02-Aug-2021 10:15	02-Aug-2021 12:30	02-Aug-2021 10:50
Compound	CAS Number	LOR	Unit	ES2128991-001	ES2128991-002	ES2128991-003	ES2128991-004	ES2128991-005
				Result	Result	Result	Result	Result
EA005: pH								
pH Value	----	0.01	pH Unit	6.90	7.23	6.98	6.91	7.21
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	1630	1080	946	1490	1150
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Total Dissolved Solids @180°C	----	10	mg/L	----	----	574	818	----
EA045: Turbidity								
Turbidity	----	0.1	NTU	----	----	61.8	19.5	----
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	205	214	189	322	193
Total Alkalinity as CaCO3	----	1	mg/L	205	214	189	322	193
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	409	168	116	40	191
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	165	136	129	286	148
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	99	48	49	36	48
Magnesium	7439-95-4	1	mg/L	50	25	24	35	24
Sodium	7440-23-5	1	mg/L	179	148	110	205	163
Potassium	7440-09-7	1	mg/L	3	2	2	2	1
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	----
Nickel	7440-02-0	0.001	mg/L	----	----	<0.001	0.002	----
Lead	7439-92-1	0.001	mg/L	----	----	<0.001	<0.001	----
Zinc	7440-66-6	0.005	mg/L	----	----	<0.005	0.006	----
Manganese	7439-96-5	0.001	mg/L	----	----	0.022	0.031	----
Selenium	7782-49-2	0.01	mg/L	----	----	<0.01	<0.01	----
Iron	7439-89-6	0.05	mg/L	----	----	<0.05	0.72	----
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)			Sample ID	WMLP320	RM10	WMLP328	WML261	RA18
			Sampling date / time	02-Aug-2021 08:55	02-Aug-2021 09:30	02-Aug-2021 10:15	02-Aug-2021 12:30	02-Aug-2021 10:50
Compound	CAS Number	LOR	Unit	ES2128991-001	ES2128991-002	ES2128991-003	ES2128991-004	ES2128991-005
				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	----
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	----	----	**0.31**	<0.01	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	----	----	**0.31**	<0.01	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	----	----	**0.2**	**0.2**	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
^ Total Nitrogen as N	----	0.1	mg/L	----	----	**0.5**	**0.2**	----
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	----	----	**0.04**	**0.05**	----
EN055: Ionic Balance								
ø Total Anions	----	0.01	meq/L	**17.3**	**11.6**	**9.83**	**15.3**	**12.0**
ø Total Cations	----	0.01	meq/L	**16.9**	**10.9**	**9.26**	**13.6**	**11.5**
ø Ionic Balance	----	0.01	%	**1.02**	**2.96**	**3.01**	**5.83**	**2.22**

Analytical Results

Sub-Matrix: **WATER**
(Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Sample ID	WML120B	WML120A	WMLP302	WML183	WML129
				Sampling date / time	02-Aug-2021 13:30	02-Aug-2021 14:30	03-Aug-2021 08:00	03-Aug-2021 09:30	03-Aug-2021 10:45
					ES2128991-006	ES2128991-007	ES2128991-008	ES2128991-009	ES2128991-010
					Result	Result	Result	Result	Result
EA005: pH									
pH Value	----	0.01	pH Unit		**6.90**	**7.03**	**6.55**	**7.08**	**7.08**
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		**579**	**858**	**1010**	**3560**	**482**
EA015: Total Dissolved Solids dried at 180 ± 5 °C									
Total Dissolved Solids @180°C	----	10	mg/L		**336**	**460**	**563**	**2060**	**268**
EA045: Turbidity									
Turbidity	----	0.1	NTU		**5.0**	**7.4**	**13.3**	**235**	**1.2**
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		**180**	**221**	**240**	**786**	**120**
Total Alkalinity as CaCO3	----	1	mg/L		**180**	**221**	**240**	**786**	**120**
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		**12**	**15**	**25**	**276**	**19**
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		**86**	**149**	**182**	**579**	**79**
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		**31**	**35**	**26**	**92**	**29**
Magnesium	7439-95-4	1	mg/L		**18**	**27**	**27**	**121**	**15**
Sodium	7440-23-5	1	mg/L		**62**	**94**	**142**	**506**	**48**
Potassium	7440-09-7	1	mg/L		<1	**2**	**2**	**7**	**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	**0.007**	<0.001
Nickel	7440-02-0	0.001	mg/L		<0.001	<0.001	**0.001**	**0.006**	<0.001
Lead	7439-92-1	0.001	mg/L		<0.001	<0.001	<0.001	**0.001**	<0.001
Zinc	7440-66-6	0.005	mg/L		<0.005	<0.005	**0.009**	**0.236**	<0.005
Manganese	7439-96-5	0.001	mg/L		**0.005**	**0.135**	**0.029**	**0.119**	**0.272**
Selenium	7782-49-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
Iron	7439-89-6	0.05	mg/L		<0.05	**0.72**	**1.62**	<0.05	**0.19**
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)			Sample ID	WML120B	WML120A	WMLP302	WML183	WML129
			Sampling date / time	02-Aug-2021 13:30	02-Aug-2021 14:30	03-Aug-2021 08:00	03-Aug-2021 09:30	03-Aug-2021 10:45
Compound	CAS Number	LOR	Unit	ES2128991-006	ES2128991-007	ES2128991-008	ES2128991-009	ES2128991-010
				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	**0.07**	<0.01
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	**0.16**	<0.01	<0.01	**2.68**	<0.01
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	**0.16**	<0.01	<0.01	**2.75**	<0.01
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	**0.1**	**0.4**	**2.0**	**0.2**
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
^ Total Nitrogen as N	----	0.1	mg/L	**0.2**	**0.1**	**0.4**	**4.8**	**0.2**
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	**0.05**	**0.05**	**0.05**	**0.18**	**0.08**
EN055: Ionic Balance								
ø Total Anions	----	0.01	meq/L	**6.27**	**8.93**	**10.4**	**37.8**	**5.02**
ø Total Cations	----	0.01	meq/L	**5.72**	**8.11**	**9.75**	**36.7**	**4.82**
ø Ionic Balance	----	0.01	%	**4.56**	**4.83**	**3.48**	**1.40**	**2.04**

Analytical Results

Sub-Matrix: **WATER**
(Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Sample ID	WMLP301	WML262	MWL181	MWL119	WMLP337
				Sampling date / time	03-Aug-2021 11:45	03-Aug-2021 12:55	03-Aug-2021 13:30	03-Aug-2021 14:45	04-Aug-2021 08:45
					ES2128991-011	ES2128991-012	ES2128991-013	ES2128991-014	ES2128991-015
					Result	Result	Result	Result	Result
EA005: pH									
pH Value	----	0.01	pH Unit		**8.00**	**8.11**	**8.03**	**7.36**	**7.18**
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		**3340**	**2910**	**2560**	**1320**	**2940**
EA015: Total Dissolved Solids dried at 180 ± 5 °C									
Total Dissolved Solids @180°C	----	10	mg/L		**1960**	**1690**	**1480**	**764**	**1670**
EA045: Turbidity									
Turbidity	----	0.1	NTU		**395**	**70.4**	**26.7**	**23.6**	**92.9**
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		**1050**	**997**	**812**	**465**	**508**
Total Alkalinity as CaCO3	----	1	mg/L		**1050**	**997**	**812**	**465**	**508**
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		<1	<1	<1	**14**	**122**
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		**510**	**408**	**418**	**182**	**591**
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		**7**	**6**	**24**	**32**	**108**
Magnesium	7439-95-4	1	mg/L		**4**	**5**	**25**	**26**	**119**
Sodium	7440-23-5	1	mg/L		**747**	**649**	**521**	**236**	**327**
Potassium	7440-09-7	1	mg/L		**2**	**3**	**4**	**4**	**5**
EG020F: Dissolved Metals by ICP-MS									
Arsenic	7440-38-2	0.001	mg/L		**0.001**	<0.001	**0.004**	**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	**0.010**	**0.007**	<0.001
Copper	7440-50-8	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Nickel	7440-02-0	0.001	mg/L		**0.007**	<0.001	<0.001	**0.002**	**0.006**
Lead	7439-92-1	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	7440-66-6	0.005	mg/L		<0.005	<0.005	<0.005	<0.005	**0.013**
Manganese	7439-96-5	0.001	mg/L		**0.032**	**0.031**	**0.018**	**0.104**	**0.280**
Selenium	7782-49-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
Iron	7439-89-6	0.05	mg/L		<0.05	**0.07**	<0.05	**0.38**	**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)			Sample ID	WMLP301	WML262	MWL181	MWL119	WMLP337
			Sampling date / time	03-Aug-2021 11:45	03-Aug-2021 12:55	03-Aug-2021 13:30	03-Aug-2021 14:45	04-Aug-2021 08:45
Compound	CAS Number	LOR	Unit	ES2128991-011	ES2128991-012	ES2128991-013	ES2128991-014	ES2128991-015
				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**	<0.01	**0.01**	**0.03**
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	**0.01**	<0.01	**0.01**	**0.03**
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	**1.5**	**1.4**	**1.2**	**1.8**	**0.4**
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
^ Total Nitrogen as N	----	0.1	mg/L	**1.5**	**1.4**	**1.2**	**1.8**	**0.4**
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	**0.41**	**0.70**	**0.24**	**0.22**	**0.09**
EN055: Ionic Balance								
ø Total Anions	----	0.01	meq/L	**35.4**	**31.4**	**28.0**	**14.7**	**29.4**
ø Total Cations	----	0.01	meq/L	**33.2**	**29.0**	**26.0**	**14.1**	**29.5**
ø Ionic Balance	----	0.01	%	**3.12**	**3.99**	**3.69**	**2.12**	**0.29**

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Sample ID	WMLP338	WMLP336	T2A	T2P	RM03
				Sampling date / time	04-Aug-2021 09:25	04-Aug-2021 10:10	04-Aug-2021 11:30	04-Aug-2021 12:15	04-Aug-2021 13:00
					ES2128991-016	ES2128991-017	ES2128991-018	ES2128991-019	ES2128991-020
					Result	Result	Result	Result	Result
EA005: pH									
pH Value	----	0.01	pH Unit		**6.86**	**6.78**	**7.18**	**6.76**	**7.38**
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		**2000**	**636**	**1060**	**1140**	**1620**
EA015: Total Dissolved Solids dried at 180 ± 5 °C									
Total Dissolved Solids @180°C	----	10	mg/L		**1170**	**386**	**643**	**674**	**----**
EA045: Turbidity									
Turbidity	----	0.1	NTU		**173**	**136**	**2.3**	**42.2**	**----**
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		**390**	**161**	**194**	**164**	**390**
Total Alkalinity as CaCO3	----	1	mg/L		**390**	**161**	**194**	**164**	**390**
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		**54**	**25**	**171**	**157**	**115**
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		**399**	**95**	**129**	**197**	**259**
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		**101**	**39**	**53**	**88**	**72**
Magnesium	7439-95-4	1	mg/L		**60**	**18**	**24**	**37**	**57**
Sodium	7440-23-5	1	mg/L		**230**	**63**	**139**	**89**	**200**
Potassium	7440-09-7	1	mg/L		<1	**6**	**2**	**2**	**2**
EG020F: Dissolved Metals by ICP-MS									
Arsenic	7440-38-2	0.001	mg/L		**0.002**	<0.001	<0.001	**0.006**	**----**
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	**0.002**	<0.001	**----**
Copper	7440-50-8	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	**----**
Nickel	7440-02-0	0.001	mg/L		**0.003**	**0.002**	**0.004**	**0.005**	**----**
Lead	7439-92-1	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	**----**
Zinc	7440-66-6	0.005	mg/L		**0.005**	<0.005	**0.007**	<0.005	**----**
Manganese	7439-96-5	0.001	mg/L		**0.732**	**0.055**	**0.004**	**0.395**	**----**
Selenium	7782-49-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	**----**
Iron	7439-89-6	0.05	mg/L		**3.74**	**0.14**	<0.05	**4.04**	**----**
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)			Sample ID	WMLP338	WMLP336	T2A	T2P	RM03
			Sampling date / time	04-Aug-2021 09:25	04-Aug-2021 10:10	04-Aug-2021 11:30	04-Aug-2021 12:15	04-Aug-2021 13:00
Compound	CAS Number	LOR	Unit	ES2128991-016	ES2128991-017	ES2128991-018	ES2128991-019	ES2128991-020
				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	----
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	**0.03**	**3.02**	**0.53**	**0.04**	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	**0.03**	**3.02**	**0.53**	**0.04**	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	**0.2**	**1.9**	<0.1	<0.1	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
^ Total Nitrogen as N	----	0.1	mg/L	**0.2**	**4.9**	**0.5**	<0.1	----
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	**0.16**	**0.62**	**0.02**	**0.01**	----
EN055: Ionic Balance								
ø Total Anions	----	0.01	meq/L	**20.2**	**6.42**	**11.1**	**12.1**	**17.5**
ø Total Cations	----	0.01	meq/L	**20.0**	**6.32**	**10.7**	**11.4**	**17.0**
ø Ionic Balance	----	0.01	%	**0.47**	**0.75**	**1.64**	**3.17**	**1.33**

Analytical Results

Sub-Matrix: **WATER**
(Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Sample ID	T3A	T3P	WML113C	WMLP327	WMLP326
				Sampling date / time	04-Aug-2021 13:40	04-Aug-2021 14:15	05-Aug-2021 08:30	05-Aug-2021 09:45	05-Aug-2021 10:30
					ES2128991-021	ES2128991-022	ES2128991-023	ES2128991-024	ES2128991-025
					Result	Result	Result	Result	Result
EA005: pH									
pH Value	----	0.01	pH Unit		**6.88**	**7.27**	**7.02**	**7.03**	**7.27**
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		**2630**	**2380**	**945**	**1890**	**1500**
EA015: Total Dissolved Solids dried at 180 ± 5 °C									
Total Dissolved Solids @180°C	----	10	mg/L		**1490**	**1350**	**552**	----	----
EA045: Turbidity									
Turbidity	----	0.1	NTU		**22.2**	**3.0**	**7.4**	----	----
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		**196**	**415**	**160**	**364**	**267**
Total Alkalinity as CaCO3	----	1	mg/L		**196**	**415**	**160**	**364**	**267**
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		**153**	**180**	**126**	**118**	**206**
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		**599**	**430**	**138**	**338**	**236**
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		**67**	**69**	**57**	**68**	**59**
Magnesium	7439-95-4	1	mg/L		**54**	**56**	**20**	**37**	**29**
Sodium	7440-23-5	1	mg/L		**372**	**356**	**108**	**290**	**221**
Potassium	7440-09-7	1	mg/L		<1	**4**	**1**	**4**	<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	**0.003**	----	----
Copper	7440-50-8	0.001	mg/L		<0.001	<0.001	<0.001	----	----
Nickel	7440-02-0	0.001	mg/L		<0.001	<0.001	**0.006**	----	----
Lead	7439-92-1	0.001	mg/L		<0.001	<0.001	<0.001	----	----
Zinc	7440-66-6	0.005	mg/L		<0.005	<0.005	<0.005	----	----
Manganese	7439-96-5	0.001	mg/L		**0.005**	**0.048**	**0.003**	----	----
Selenium	7782-49-2	0.01	mg/L		<0.01	<0.01	<0.01	----	----
Iron	7439-89-6	0.05	mg/L		<0.05	**0.34**	<0.05	----	----
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)			Sample ID	T3A	T3P	WML113C	WMLP327	WMLP326
			Sampling date / time	04-Aug-2021 13:40	04-Aug-2021 14:15	05-Aug-2021 08:30	05-Aug-2021 09:45	05-Aug-2021 10:30
Compound	CAS Number	LOR	Unit	ES2128991-021	ES2128991-022	ES2128991-023	ES2128991-024	ES2128991-025
				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	----	----
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	**1.77**	**0.03**	**0.47**	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	**1.77**	**0.03**	**0.47**	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	**0.1**	**0.6**	**0.1**	----	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
^ Total Nitrogen as N	----	0.1	mg/L	**1.9**	**0.6**	**0.6**	----	----
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	**0.06**	**0.01**	**0.02**	----	----
EN055: Ionic Balance								
ø Total Anions	----	0.01	meq/L	**24.0**	**24.2**	**9.71**	**19.3**	**16.3**
ø Total Cations	----	0.01	meq/L	**24.0**	**23.6**	**9.21**	**19.2**	**14.9**
ø Ionic Balance	----	0.01	%	**0.06**	**1.11**	**2.64**	**0.28**	**4.28**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	WMLP279	WMLP278	YAP016	GM01	RA27
			Sampling date / time	05-Aug-2021 12:00	05-Aug-2021 12:45	06-Aug-2021 08:15	06-Aug-2021 09:00	06-Aug-2021 10:40
Compound	CAS Number	LOR	Unit	ES2128991-026	ES2128991-027	ES2128991-028	ES2128991-029	ES2128991-030
				Result	Result	Result	Result	Result
EA005: pH								
pH Value	----	0.01	pH Unit	**6.96**	**7.11**	**7.07**	**7.18**	**7.17**
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**1170**	**1280**	**1170**	**1970**	**1310**
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Total Dissolved Solids @180°C	----	10	mg/L	**646**	**710**	**659**	**1100**	**728**
EA045: Turbidity								
Turbidity	----	0.1	NTU	**1.4**	**0.7**	**2.7**	**107**	**42.2**
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	**192**	**242**	**237**	**336**	**277**
Total Alkalinity as CaCO3	----	1	mg/L	**192**	**242**	**237**	**336**	**277**
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**106**	**110**	**138**	**195**	**106**
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**205**	**212**	**169**	**338**	**210**
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**71**	**55**	**38**	**73**	**35**
Magnesium	7439-95-4	1	mg/L	**29**	**25**	**22**	**49**	**27**
Sodium	7440-23-5	1	mg/L	**124**	**174**	**168**	**263**	**195**
Potassium	7440-09-7	1	mg/L	<1	<1	**2**	**3**	<1
EG020F: Dissolved Metals by ICP-MS								
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	<0.001	**0.002**	<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	**0.002**	**0.003**	<0.001	<0.001
Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Nickel	7440-02-0	0.001	mg/L	**0.001**	**0.003**	**0.003**	<0.001	**0.003**
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	**0.006**	**0.012**	<0.005
Manganese	7439-96-5	0.001	mg/L	**0.009**	**0.009**	**0.004**	**0.483**	**0.007**
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	<0.05	**2.05**	<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)			Sample ID	WMLP279	WMLP278	YAP016	GM01	RA27
			Sampling date / time	05-Aug-2021 12:00	05-Aug-2021 12:45	06-Aug-2021 08:15	06-Aug-2021 09:00	06-Aug-2021 10:40
Compound	CAS Number	LOR	Unit	ES2128991-026	ES2128991-027	ES2128991-028	ES2128991-029	ES2128991-030
				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	**0.86**	**0.58**	**0.30**	**0.03**	**0.88**
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	**0.86**	**0.58**	**0.30**	**0.03**	**0.88**
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	**0.1**	**0.1**	<0.1	**0.2**	**0.1**
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
^ Total Nitrogen as N	----	0.1	mg/L	**1.0**	**0.7**	**0.3**	**0.2**	**1.0**
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	**0.06**	**0.08**	**0.03**	**0.03**	**0.30**
EN055: Ionic Balance								
ø Total Anions	----	0.01	meq/L	**11.8**	**13.1**	**12.4**	**20.3**	**13.7**
ø Total Cations	----	0.01	meq/L	**11.3**	**12.4**	**11.1**	**19.2**	**12.4**
ø Ionic Balance	----	0.01	%	**2.17**	**2.88**	**5.59**	**2.82**	**4.65**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	WMLP280	WMLP277	Ashton Well	T5	RSGM1
			Sampling date / time	06-Aug-2021 11:15	06-Aug-2021 12:10	06-Aug-2021 12:45	06-Aug-2021 13:30	06-Aug-2021 14:30
Compound	CAS Number	LOR	Unit	ES2128991-031	ES2128991-032	ES2128991-033	ES2128991-034	ES2128991-035
				Result	Result	Result	Result	Result
EA005: pH								
pH Value	----	0.01	pH Unit	7.07	7.06	7.56	6.82	7.32
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	1170	1440	412	894	3420
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Total Dissolved Solids @180°C	----	10	mg/L	646	808	----	494	2100
EA045: Turbidity								
Turbidity	----	0.1	NTU	4.0	1.8	----	11.2	1660
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	268	260	165	145	437
Total Alkalinity as CaCO3	----	1	mg/L	268	260	165	145	437
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	88	117	16	138	228
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	171	248	32	112	657
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	44	48	38	45	36
Magnesium	7439-95-4	1	mg/L	24	27	14	18	37
Sodium	7440-23-5	1	mg/L	169	220	36	115	620
Potassium	7440-09-7	1	mg/L	<1	<1	4	2	1
EG020F: Dissolved Metals by ICP-MS								
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	----	<0.001	0.002
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	----	0.009	0.003
Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	----	<0.001	<0.001
Nickel	7440-02-0	0.001	mg/L	0.002	0.002	----	0.016	0.050
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	----	<0.001	<0.001
Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	----	<0.005	0.033
Manganese	7439-96-5	0.001	mg/L	0.016	0.007	----	0.007	0.053
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	----	<0.01	<0.01
Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	----	0.06	<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

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	WMLP280	WMLP277	Ashton Well	T5	RSGM1
			Sampling date / time	06-Aug-2021 11:15	06-Aug-2021 12:10	06-Aug-2021 12:45	06-Aug-2021 13:30	06-Aug-2021 14:30
Compound	CAS Number	LOR	Unit	ES2128991-031	ES2128991-032	ES2128991-033	ES2128991-034	ES2128991-035
				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
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	**2.56**	**0.64**	----	**2.55**	**1.00**
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	**2.56**	**0.64**	----	**2.55**	**1.00**
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	**0.4**	<0.1	----	**0.4**	**1.5**
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
^ Total Nitrogen as N	----	0.1	mg/L	**3.0**	**0.6**	----	**3.0**	**2.5**
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	**0.15**	**0.12**	----	**0.03**	**0.90**
EN055: Ionic Balance								
ø Total Anions	----	0.01	meq/L	**12.0**	**14.6**	**4.53**	**8.93**	**32.0**
ø Total Cations	----	0.01	meq/L	**11.5**	**14.2**	**4.72**	**8.78**	**31.8**
ø Ionic Balance	----	0.01	%	**2.08**	**1.53**	**1.99**	**0.84**	**0.28**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	WMLP308	WMLP324	WMLP323	WMLP311	WMLP325
			Sampling date / time	09-Aug-2021 08:45	09-Aug-2021 09:30	09-Aug-2021 09:55	09-Aug-2021 11:10	09-Aug-2021 11:45
Compound	CAS Number	LOR	Unit	ES2128991-036	ES2128991-037	ES2128991-038	ES2128991-039	ES2128991-040
				Result	Result	Result	Result	Result
EA005: pH								
pH Value	----	0.01	pH Unit	7.02	6.98	7.00	6.88	7.20
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	953	941	974	961	1260
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Total Dissolved Solids @180°C	----	10	mg/L	536	525	550	540	704
EA045: Turbidity								
Turbidity	----	0.1	NTU	1.0	1.4	15.5	11.4	17.4
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	207	184	197	237	249
Total Alkalinity as CaCO3	----	1	mg/L	207	184	197	237	249
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	102	102	106	94	88
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	132	136	141	123	217
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	41	48	51	38	63
Magnesium	7439-95-4	1	mg/L	24	24	26	22	27
Sodium	7440-23-5	1	mg/L	126	115	116	130	164
Potassium	7440-09-7	1	mg/L	2	2	2	2	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
Nickel	7440-02-0	0.001	mg/L	0.003	0.001	0.001	0.002	<0.001
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Manganese	7439-96-5	0.001	mg/L	0.006	0.081	0.025	0.010	0.359
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	<0.05	<0.05	0.75
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)			Sample ID	WMLP308	WMLP324	WMLP323	WMLP311	WMLP325
			Sampling date / time	09-Aug-2021 08:45	09-Aug-2021 09:30	09-Aug-2021 09:55	09-Aug-2021 11:10	09-Aug-2021 11:45
Compound	CAS Number	LOR	Unit	ES2128991-036	ES2128991-037	ES2128991-038	ES2128991-039	ES2128991-040
				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	**0.02**	<0.01	<0.01	**0.02**	<0.01
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	**0.02**	<0.01	<0.01	**0.02**	<0.01
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	**0.1**	**0.1**	<0.1	**0.2**
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
^ Total Nitrogen as N	----	0.1	mg/L	<0.1	**0.1**	**0.1**	<0.1	**0.2**
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	**0.02**	**0.02**	**0.02**	**0.02**	**0.05**
EN055: Ionic Balance								
ø Total Anions	----	0.01	meq/L	**9.98**	**9.64**	**10.1**	**10.2**	**12.9**
ø Total Cations	----	0.01	meq/L	**9.55**	**9.42**	**9.78**	**9.41**	**12.6**
ø Ionic Balance	----	0.01	%	**2.20**	**1.12**	**1.70**	**3.83**	**1.48**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	WML115B	WML115C	WMLP358	WMLP349	WML239
			Sampling date / time	09-Aug-2021 13:35	09-Aug-2021 13:50	10-Aug-2021 08:20	10-Aug-2021 09:00	10-Aug-2021 10:10
Compound	CAS Number	LOR	Unit	ES2128991-041	ES2128991-042	ES2128991-043	ES2128991-044	ES2128991-045
				Result	Result	Result	Result	Result
EA005: pH								
pH Value	----	0.01	pH Unit	6.88	6.98	6.58	6.57	6.95
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	2680	666	328	1270	723
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Total Dissolved Solids @180°C	----	10	mg/L	----	----	191	702	412
EA045: Turbidity								
Turbidity	----	0.1	NTU	----	----	0.9	7.7	156
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	592	138	114	184	185
Total Alkalinity as CaCO3	----	1	mg/L	592	138	114	184	185
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	284	57	4	51	15
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	383	94	39	275	112
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	81	20	28	63	45
Magnesium	7439-95-4	1	mg/L	40	8	12	32	19
Sodium	7440-23-5	1	mg/L	456	107	25	146	72
Potassium	7440-09-7	1	mg/L	2	2	<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	----	----	0.002	<0.001	<0.001
Copper	7440-50-8	0.001	mg/L	----	----	<0.001	<0.001	<0.001
Nickel	7440-02-0	0.001	mg/L	----	----	0.004	0.002	0.007
Lead	7439-92-1	0.001	mg/L	----	----	<0.001	<0.001	<0.001
Zinc	7440-66-6	0.005	mg/L	----	----	0.006	0.006	<0.005
Manganese	7439-96-5	0.001	mg/L	----	----	0.019	0.150	0.022
Selenium	7782-49-2	0.01	mg/L	----	----	<0.01	<0.01	<0.01
Iron	7439-89-6	0.05	mg/L	----	----	<0.05	0.88	0.07
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**)

Compound	CAS Number	LOR	Unit	Sample ID	WML115B	WML115C	WMLP358	WMLP349	WML239
				Sampling date / time	09-Aug-2021 13:35	09-Aug-2021 13:50	10-Aug-2021 08:20	10-Aug-2021 09:00	10-Aug-2021 10:10
					ES2128991-041	ES2128991-042	ES2128991-043	ES2128991-044	ES2128991-045
					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
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		----	----	**0.13**	**0.04**	**0.07**
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		----	----	**0.13**	**0.06**	**0.07**
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		----	----	<0.1	<0.1	**0.2**
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ **Total Nitrogen as N**	----	0.1	mg/L		----	----	**0.1**	<0.1	**0.3**
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		----	----	**0.04**	**0.04**	**0.12**
EN055: Ionic Balance									
ø **Total Anions**	----	0.01	meq/L		**28.5**	**6.60**	**3.46**	**12.5**	**7.17**
ø **Total Cations**	----	0.01	meq/L		**27.2**	**6.36**	**3.47**	**12.1**	**6.97**
ø **Ionic Balance**	----	0.01	%		**2.38**	**1.80**	**0.16**	**1.49**	**1.42**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	WMLP346	DUPLICATE	WMLP343	----	----
			Sampling date / time	10-Aug-2021 10:45	10-Aug-2021 00:00	10-Aug-2021 11:45	----	----
Compound	CAS Number	LOR	Unit	ES2128991-046	ES2128991-047	ES2128991-048	--------	--------
				Result	Result	Result	----	----
EA005: pH								
pH Value	----	0.01	pH Unit	**6.89**	**6.89**	**7.00**	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**582**	**581**	**752**	----	----
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Total Dissolved Solids @180°C	----	10	mg/L	**302**	**338**	**426**	----	----
EA045: Turbidity								
Turbidity	----	0.1	NTU	**2.0**	**1.4**	**1.3**	----	----
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	**175**	**176**	**228**	----	----
Total Alkalinity as CaCO3	----	1	mg/L	**175**	**176**	**228**	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**5**	**4**	**12**	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**90**	**90**	**111**	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**33**	**33**	**47**	----	----
Magnesium	7439-95-4	1	mg/L	**17**	**17**	**21**	----	----
Sodium	7440-23-5	1	mg/L	**60**	**60**	**78**	----	----
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	<0.001	<0.001	<0.001	----	----
Nickel	7440-02-0	0.001	mg/L	**0.002**	**0.001**	**0.002**	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	----	----
Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	<0.005	----	----
Manganese	7439-96-5	0.001	mg/L	**0.123**	**0.129**	**0.014**	----	----
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	----	----
Iron	7439-89-6	0.05	mg/L	**0.12**	**0.12**	<0.05	----	----
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)			Sample ID	WMLP346	DUPLICATE	WMLP343	----	----
			Sampling date / time	10-Aug-2021 10:45	10-Aug-2021 00:00	10-Aug-2021 11:45	----	----
Compound	CAS Number	LOR	Unit	ES2128991-046	ES2128991-047	ES2128991-048	--------	--------
				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	<0.01	<0.01	**0.23**	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	<0.01	**0.23**	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	<0.1	**0.1**	----	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
^ **Total Nitrogen as N**	----	0.1	mg/L	<0.1	<0.1	**0.3**	----	----
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	**0.03**	**0.03**	**0.04**	----	----
EN055: Ionic Balance								
ø **Total Anions**	----	0.01	meq/L	**6.14**	**6.14**	**7.94**	----	----
ø **Total Cations**	----	0.01	meq/L	**5.66**	**5.66**	**7.47**	----	----
ø **Ionic Balance**	----	0.01	%	**4.10**	**4.09**	**3.05**	----	----

Inter-Laboratory Testing

Analysis conducted by ALS Newcastle - Water, NATA accreditation no. 825, site no. 1656 (Chemistry) 9854 (Biology).

(WATER) EA005: pH

ALS

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CLIENT: AGE Consultants
OFFICE: Newcastle
PROJECT: Ashton Coal Mine GW Sampling
PROJECT ID: G1922P
PROJECT MANAGER: Bryce McKay — CONTACT PH: 0414 324 504
SAMPLER: Jordan Reeds — SAMPLER MOBILE: 0437 121 386
COC Emailed to ALS? YES — EDD FORMAT (or default): XTAB, ENMRG, ESDAT, PDF
Email Reports to: jordan@ageconsultants.com.au, brycem@ageconsultants.com.au
Email Invoice to: As above + accounts@ageconsultants.com.au

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/222/20

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)
Custody Seal Intact? Yes No N/A (N/A circled)
Free ice / frozen ice bricks present upon receipt? Yes No N/A (Yes circled)
Random Sample Temperature on Receipt: 1.2
Other comment:

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
	MM 2.46pm	MM 5pm	Awanthi 7.40 pm
DATE/TIME:	DATE/TIME: 10/08/21	DATE/TIME: 10/08/21	DATE/TIME: 10/8/21

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

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	ED035 - HCO3	EK02SF	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
1	WMLP320	2/08/21, 0855	W	P	1	X	X									
2	RM10	2/08/21, 0930	W	P	1	X	X									
3	WMLP328	2/08/21, 1015	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	
4	WML261	2/08/21, 1230	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	
5	RA18	2/08/21, 1050	W	P	1	X	X									
6	WML120B	2/08/21, 1330	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	
7	WML120A	2/08/21, 1430	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	
8	WMLP302	3/08/21, 0800	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	
9	WML183	3/08/21, 0930	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	
10	WML129	3/08/21, 1045	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	
11	WMLP301	3/08/21, 1145	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	
12	WML262	3/08/21, 1255	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	
				TOTAL	48	X	X									

Environmental Division
Sydney
Work Order Reference
ES2128991

Telephone : +61-2-8784 8555

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;
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pH @ WN

E-MAILED

LAB OF ORIGIN:
NEWCASTLE

ALS

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OFFICE: Newcastle
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PROJECT ID: G1922P
PROJECT MANAGER: Bryce McKay — CONTACT PH: 0414 324 504
SAMPLER: Jordan Reeds — SAMPLER MOBILE: 0437 121 386
COC Emailed to ALS? YES — EDD FORMAT (or default): XTAB, ENMRG, ESDAT, PDF
Email Reports to: jordan@ageconsultants.com.au, brycem@ageconsultants.com.au
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Random Sample Temperature on Receipt:
Other comment:

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
	MM 2.46pm	MM 5pm	
DATE/TIME:	DATE/TIME: 10/08/21	DATE/TIME: 10/08/21	DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

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	ED035 - HCO3	EK02SF	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
13	WML181	3/08/21, 1330	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	
14	WML119	3/08/21, 1445	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	
15	WMLP337	4/08/21, 0845	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	
16	WMLP338	4/08/21, 0925	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	
17	WMLP336	4/08/21, 1010	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	
18	T2A	4/08/21, 1130	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	
19	T2P	4/08/21, 1215	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	
20	RM03	4/08/21, 1300	W	P	1	X	X									
21	T3A	4/08/21, 1340	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	
22	T3P	4/08/21, 1415	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	
23	WML113C	5/08/21, 0830	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	
24	WMLP327	5/08/21, 0945	W	P	1	X	X									
				TOTAL	52	X	X									

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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 = 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.

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CLIENT: AGE Consultants	TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g., Ultra Trace Organics)	☐ Standard TAT (List due date):	FOR LABORATORY USE ONLY (Circle)
OFFICE: Newcastle		☐ Non Standard or urgent TAT (List due date):	
PROJECT: Ashton Coal Mine GW Sampling	ALS QUOTE NO.: EN/222/20	COC SEQUENCE NUMBER (Circle)	
PROJECT ID: G1922P		COC: 1 2 3 4 5 6 7	
PROJECT MANAGER: Bryce McKay	CONTACT PH: 0414 324 504	OF: 1 2 3 4 5 6 7	
SAMPLER: Jordan Reeds	SAMPLER MOBILE: 0437 121 386	RELINQUISHED BY:	RECEIVED BY: MM 2:46pm
COC Emailed to ALS? YES	EDD FORMAT (or default): XTAB, ENMRG, ESDAT, PDF	DATE/TIME:	DATE/TIME: 10/08/21
Email Reports to: jordan@ageconsultants.com.au, brycem@ageconsultants.com.au		RELINQUISHED BY: MM 5pm	RECEIVED BY:
Email Invoice to: As above + accounts@ageconsultants.com.au		DATE/TIME: 10/08/21	DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

SAMPLE DETAILS (MATRIX: SOIL (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	ED035 - HCO3	EK02SF	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
25	WMLP326	5/08/21, 1030	W	P	1	X	X									
26	WMLP279	5/08/21, 1200	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	
27	WMLP278	5/08/21, 1245	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	
28	YAP016	6/08/21, 0815	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	
29	GM01	6/08/21, 0900	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	
30	RA27	6/08/21, 1040	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	
31	WMLP280	6/08/21, 1115	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	
32	WMLP277	6/08/21, 1210	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	
33	Ashton Well	6/08/21, 1245	W	P	1	X	X									
34	T5	6/08/21, 1330	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	
35	RSGM1	6/08/21, 1430	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	
36	WMLP308	9/08/21, 0845	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	
				TOTAL	52	X	X									

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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 = 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.

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☐TOWNSVILLE 14-15 Desma Court Bohle QLD 4818 Ph: 07 4796 0600 E: townsville.environmental@alsglobe.com

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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 Coal Mine GW Sampling	**ALS QUOTE NO.:** EN/222/20	**COC SEQUENCE NUMBER** (Circle) COC: 1 2 3 4 5 6 7 OF: 1 2 3 4 5 6 7
PROJECT ID: G1922P		
PROJECT MANAGER: Bryce McKay	**CONTACT PH:** 0414 324 504	
SAMPLER: Jordan Reeds	**SAMPLER MOBILE:** 0437 121 386	
COC Emailed to ALS? YES	**EDD FORMAT (or default):** XTAB, ENMRG, ESDAT, PDF	
Email Reports to: jordan@ageconsultants.com.au, brycem@ageconsultants.com.au		
Email Invoice to: As above + accounts@ageconsultants.com.au		

FOR LABORATORY USE ONLY (Circle):
Custody seal intact? Yes No N/A
Cooling Agent Present? Yes No N/A
Receipt Sample Temperature on Receipt: °C
Other comments:

RELINQUISHED BY:	**RECEIVED BY:**	**RELINQUISHED BY:**	**RECEIVED BY:**
	MM 2:46pm	MM 5pm	
DATE/TIME:	DATE/TIME: 10/08/21	DATE/TIME: 10/08/21	DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS MATRIX: SOIL (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	ED035 - HCO3	EK025F	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
37	WMLP324	9/08/21, 0930	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	
38	WMLP323	9/08/21, 0955	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	
39	WMLP311	9/08/21, 1110	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	
40	WMLP325	9/08/21, 1145	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	
41	WML115B	9/08/21, 1335	W	P	1	X	X									
42	WML115C	9/08/21, 1350	W	P	1	X	X									
43	WMLP358	10/08/21, 0820	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	
44	WMLP349	10/08/21, 0900	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	
45	WML239	10/08/21, 1010	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	
46	WMLP346	10/08/21, 1045	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	
47	DUPLICATE	-	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	
48	WMLP343	10/08/21, 1145	W	P, N, S, SP	5	X	X	X	X	X	X	X	X	X	X	
				TOTAL	52	X	X									

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.