2022
Annual Review

BULGA
COAL

GLENCORE

ANNUAL REVIEW

1 January – 31 December 2022

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Bulga Coal Management Pty Limited

Project Director:	Adam Williams
Project Manager:	Adam Williams
Report No.	23149/R01
Date:	March 2023

Environmental & Social Consultants

This report was prepared using Umwelt's ISO 9001 certified Quality Management System.

Acknowledgement of Country

Umwelt would like to acknowledge the traditional custodians of the country on which we work and pay respect to their cultural heritage, beliefs, and continuing relationship with the land. We pay our respect to the Elders – past, present, and future.

Cover photograph: Rehabilitation next to our clean coal stockpiles ready to be railed. The rehabilitation was seeded between 2018 and 2020, the photograph was taken in May 2022.

Document Status

Rev No.	Reviewer		Approved for Issue	
	Name	Date	Name	Date
Final V2	Adam Williams	27/03/2023	Adam Williams	27/03/2023

Name of Operation	Bulga Coal
Name of Operator	Bulga Coal Management Pty Ltd
Development consent / project approval #	Bulga Underground Operations DA 376-8-2003 Bulga Open Cut SSD 4960 Bulga Open Cut DA 41-03-99
Name of holder of development consent / project approval	Bulga Coal Management Pty Ltd
Mining lease #	ML 1494, ML 1547, ML 1674, ML 1717, ML 1788, CL 224, sublease within Mount Thorley Operations (CL 219), AUTH 447, AUTH 450, EL 5277, EL 5461, EL 8315
Name of holder of mining lease	Saxonvale Coal Pty Ltd; Saxonvale Coal Pty Ltd and Nippon Steel Australia Pty Ltd; and Bulga Coal Management Pty Ltd
Water licence #	WAL36221, WAL41543, WAL41544, WAL41545, WAL41546, WAL41687.
Name of holder of water licences	Bulga Coal Management Pty Ltd, Saxonvale Coal Pty Ltd, Beltana Highwall Mining Pty Ltd
MOP/RMP start date	1 July 2020 (Bulga Open Cut) 29 May 2018 (Bulga Underground Operations)
MOP/RMP end date	30 June 2023 (Bulga Open Cut) 31 December 2023 (Bulga Underground Operations)
Annual Review start date	1 January 2022
Annual Review end date	31 December 2022

I, Ralph Northey,

certify that this audit report is a true and accurate record of the compliance status of Bulga Coal for the period 1 January 2022 to 31 December 2022 and that I am authorised to make this statement on behalf of Bulga Coal Management Pty Ltd.

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); sections 307A, 307B and 307C (False or misleading applications/information/documents—maximum penalty 2 years imprisonment or $22,000, or both).

Name of authorised reporting officer	Ralph Northey
Title of authorised reporting officer	Environment and Community Manager
Signature of authorised reporting officer	
Date	29/03/2023

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1.0 Statement of Compliance

The Bulga Coal Complex (Bulga Coal) includes the Bulga Open Cut and the Bulga Underground Operations. During the reporting period Bulga Open Cut operated under development consents DA 41-03-99 and SSD-4960, while Bulga Underground Operations operated under DA 376-8-2003. Both sites operate under Environment Protection Licence (EPL) 563 and several mining and exploration leases. It is noted that Bulga Open Cut consent DA 41-03-99 was surrendered on 31 August 2022.

Table 1 outlines compliance against major approvals. Where non-compliances have been identified, they are listed in **Table 2** and detailed in later sections of this report. **Table 3** describes the status of non-compliance.

Table 1 Summary Statement of Compliance for Major Approvals

Licence	Were all conditions of the Licence complied with?
DA 41-03-99[1]	No
DA SSD-4960	No
DA 376-8-2003	No
EPBC 2002/773	Yes
EPBC 2012/6637	Yes
EPBC 2018/8300	No (Refer to **Appendix A**)
ML 1494	Yes
ML 1547	Yes
ML 1674	Yes
ML 1717	Yes
ML 1788	Yes
EPL 563	No
EL 5277	Yes
EL 5461	Yes
EL 8315	Yes
AUTH 447	Yes
AUTH 450	Yes
CL 224	Yes

[1] On 20 May 2022 Bulga Coal provided DPE with a notice of surrender for DA 41-03-99 and DPE accepted the surrender on 31 August 2022.

Table 2 Summary of Non-Compliances

Approval/ Licence	Condition / Legislative Reference	Condition Summary	Compliance Status	Date	Details of the Non-compliance	Corrective Action/s	Section of this Annual Review
SSD 4960	Schedule 3, Condition 26	Discharges must comply with EPL and *Protection of the Environment Operations Act 1997* (POEO Act).	Non-Compliant	22/02/2022	Discharge of sediment laden water from a dirty water drain into a clean water catchment. The discharge was caused by significant rainfall exceeding the drain design 1 in 20 year 1 hour peak flow rainfall event of 41 mm.	There were no proposed actions taken to prevent future occurrences.	**Section 11.1**
DA 376-8-2003	Schedule 4, Condition 8	The applicant must comply with Section 120 of the POEO Act.					
EPL 563	Condition L1.1	The licensee must comply with Section 120 of the POEO Act.					
SSD 4960	Schedule 3, Condition 26	Discharges must comply with EPL and POEO Act.	Non-Compliant	08/03/2022	Discharge of mine water from a mine dam during a regional flooding event. The C3 dam discharge was caused by significant rainfall during a regional flooding event.	There were no proposed actions taken to prevent future occurrences.	**Section 11.2**
	Schedule 3, Condition 27	Design, install and maintain mine water storage infrastructure to ensure no unlicensed or uncontrolled discharge of mine water off-site.					
DA 376-8-2003	Schedule 4, Condition 8	The applicant must comply with Section 120 of the POEO Act.					
EPL 563	Condition L1.1	The licensee must comply with Section 120 of the POEO Act.					
SSD 4960	Schedule 3, Condition 26	Discharges must comply with EPL and POEO Act.	Non-Compliant	08/03/2022	Discharge of sediment laden water from S2 and S2A dirty water dams during a regional flooding event.	There were no proposed actions taken to prevent future occurrences.	**Section 11.3**
DA 376-8-2003	Schedule 4, Condition 8	The applicant must comply with Section 120 of the POEO Act.					

Approval/ Licence	Condition / Legislative Reference	Condition Summary	Compliance Status	Date	Details of the Non-compliance	Corrective Action/s	Section of this Annual Review
EPL 563	Condition L1.1	The licensee must comply with Section 120 of the POEO Act.			The S2 and S2A discharges were caused by significant rainfall exceeding the dirty water management system Blue Book design rainfall event of 64 mm.		
SSD 4960	Schedule 3, Condition 26	Discharges must comply with EPL and POEO Act.	Non-Compliant	24/05/2022	Discharge of mine water from a pipeline into a clean water tributary of the Nine Mile Creek catchment. The discharge was caused by the disconnection of a temporary mine water pipeline.	The temporary mine water pipeline that discharged has been removed from service. Bulga Coal undertook environmental awareness refresher training to ensure that potential environmental risks are identified in planning for all work. Bulga Coal conducted an audit of all pipelines on site that have the potential to discharge into the clean water environment to ensure the appropriate protective measures are in place and that there are no inappropriate temporary installations.	**Section 11.4**
DA 376-8-2003	Schedule 4, Condition 8	The applicant must comply with Section 120 of the POEO Act.					
EPL 563	Condition L1.1 Condition O1.1 Condition O2.2	The licensee must comply with Section 120 of the POEO Act. Condition requires activities to be carried out in a competent manner. Condition requires all plant and equipment to be used in a proper and efficient manner.					
DA 376-8-2003	Schedule 4, Condition 8	The applicant must comply with Section 120 of the POEO Act.	Non-Compliant	05/07/2022 – 07/07/22	Discharge of sediment laden water from S2 and S2A dirty	There were no proposed actions taken to prevent	**Section 11.5**

Approval/ Licence	Condition / Legislative Reference	Condition Summary	Compliance Status	Date	Details of the Non-compliance	Corrective Action/s	Section of this Annual Review
EPL 563	Condition L1.1	The licensee must comply with Section 120 of the POEO Act.			water dams during a regional flooding event. S3 and S10 dirty water dams were also reported as having spilled, however they did not. The rainfall event (257.5 mm) was significantly greater than the dirty water management system Blue Book design rainfall event of 64 mm (95th percentile 5 day rainfall depth).	future occurrences. regarding the S2 and S2A Dam spills. Regarding the misreporting of S3 and S10 Dam spills, level sensors in sediment dams S3 and S10 were checked and re-calibrated to provide a more accurate indicator of dam water levels.	
SSD 4960	Schedule 3, Condition 26	Discharges must comply with EPL and POEO Act.					
SSD 4960	Schedule 3, Condition 26	Water Discharges. The Applicant must ensure that all surface water discharges from the site comply with the: (a) discharge limits (both volume and quality) set for the development in any EPL; and (b) relevant provisions of the POEO Act or Protection of the Environment Operations (Hunter River Salinity Trading Scheme) Regulation 2002.	Non-Compliant	08/03/2022	Bulga Coal discharged 58 ML from the HRSTS discharge point between 11:00 – 14:00 for Block 67. Bulga Coal were of the understanding that the HRSTS credits had been transferred back from another Mining Complex, after which Bulga commenced discharging. An investigation found that the credits transferred back were for block 69 and not 67.	Bulga Open Cut HRSTS Operating Procedure refresher training was undertaken.	**Section 11.6**
SSD 4960	Schedule 3, Condition 16	Air Quality Monitoring	Non-Compliant	Various	Failure to continuously monitor PM_{10} at air quality monitors D1, D3, D5 and D11.	Causes of the failures were investigated and issues fixed, or power restored.	**Section 11.7.1**
DA 376-8-2003	Schedule 4, Condition 22						

Approval/ Licence	Condition / Legislative Reference	Condition Summary	Compliance Status	Date	Details of the Non-compliance	Corrective Action/s	Section of this Annual Review
DA 41-03-99	Schedule 2, Condition 6.1.2 (c)						
SSD-4960	Schedule 3, Condition 16	Air Quality Monitoring	Non-Compliant	Various	Failure to continuously monitor $PM_{2.5}$ at air quality monitors D2 and D10.	Causes of the failures were investigated and issues fixed, or power restored.	**Section 11.7.1**
DA 376-8-2003	Schedule 4, Condition 22						
DA 41-03-99	Schedule 2, Condition 6.1.2 (c)						
SSD-4960	Appendix 7, Condition 5	Attended noise monitoring	Non-Compliant	Various	Attended noise monitoring contractor accidentally missed BCC1 from May's monitoring. Given the very low levels at all other locations during the night it is expected compliance would have resulted at BCC1 as well.	The requirement to adhere to the monitoring procedure was reinforced with the noise consultant.	**Section 11.7.3**
DA 376-8-2003	Appendix 4, Condition 4						
DA 41-03-99	Schedule 2, Condition 6.3.8						
EPL 563	Condition M2.2	Air Quality Monitoring	Non-Compliant	May 2022	Failure to continuously monitor PM_{10} at air quality monitors EPA Point 9 and EPA Point 10.	Causes of the failures were investigated and issues fixed, or power restored.	**Section 11.7.1**
EPL 563	Condition M4.1	Weather Monitoring	Non-Compliant	Various	Relative humidity data was not monitored continuously at EPA Point 23 – Southern Extension Meteorological Station due to equipment failure.	Failure was investigated and the humidity sensor was replaced.	**Section 11.7.2**

Table 3 Compliance Status Categories

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**	Non-compliance which does not result in any risk of environmental harm

Section 6.0 and **Section 7.0** of this report detail the environmental management and water management performance of Bulga Coal, respectively. Non-compliances are discussed in **Section 11.0**.

2.0 Introduction

2.1 Mine Operations

Bulga Coal is located approximately 12 kilometres (km) southwest of Singleton, and 2 km from the townships of Broke and Bulga in the Upper Hunter Valley of New South Wales (NSW) (refer **Figure 1**). Bulga Coal comprises two coal mining operations, being Bulga Open Cut and Bulga Underground Operations. The Coal Handling and Processing Plant (CHPP) and rail loading facility are located in the eastern side of the site. In May 2018, Bulga Underground Operations ceased mining and the mine was sealed in July 2018.

Bulga Coal is managed by Bulga Coal Management Pty Ltd on behalf of the Bulga Joint Venture. Bulga Coal Management Pty Ltd is owned by Oakbridge Pty Ltd, which is the majority shareholder (87.5%) of the Bulga Joint Venture. Glencore is the majority shareholder of Oakbridge Pty Ltd.

This report details the environmental management performance of Bulga Coal over the period 1 January 2022 to 31 December 2022. It has been prepared in accordance with the *Annual Review Guideline* (DPE, 2015) and satisfies:

- Schedule 6, Condition 4 of Bulga Underground Operations Development Consent DA 376-8-2003;
- Schedule 5, Condition 4 of Bulga Optimisation Project Development Consent SSD-4960; and
- Schedule 5, Condition 4 of Bulga Open Cut Development Consent DA 41-03-99.

2.2 Mine Contacts

The contact details for the personnel responsible for environmental management and community relations at Bulga Coal are provided in **Table 4**.

Table 4 Contacts for Bulga Coal

Contact	Position	Contact Details
Ralph Northey	Bulga Coal Environment and Community Manager	T: 02 6570 2539
		E: Ralph.Northey@glencore.com.au
Murray Gregson	Bulga Coal Operations Manager	T: 02 6570 2400
		E: Murray.Gregson@glencore.com.au

2.2.1 Mining Personnel

As at the end of the reporting period, Bulga Coal employed approximately 919 full time equivalent personnel.

Bulga Coal

FIGURE 1 - Bulga Coal Locality and Licences 2022

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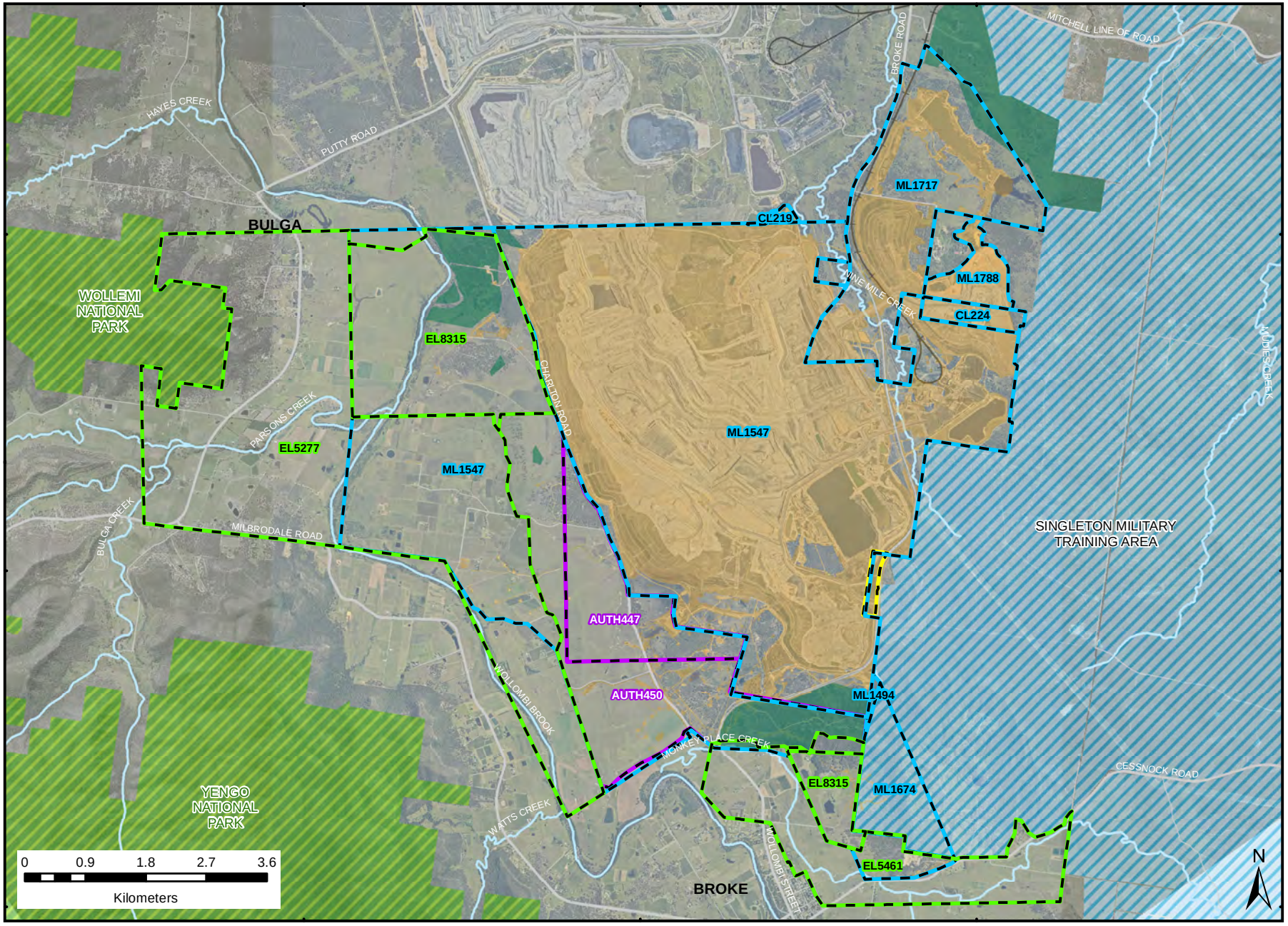

Legend

- Mining Lease
- Exploration Licence
- Exploration Authorisation
- Mining Lease AMA
- Biodiversity Offset Areas
- Disturbance
- Singleton Military Training Area
- National Park Reserve
- Main Roads
- Local Roads
- Watercourse
- Railway

GDA2020

Date Created: 23/03/2023
Map Size: A4 Landscape
Scale: 1:80,356
Map Created By: MPollock
Coordinate System:
GDA2020 MGA Zone 56
Projection: Transverse Mercator
Datum: GDA2020

File Path Ref: L:\03_MXDS\18_Reporting\Annual_Review\2022\20230131_FIGURE_1_AR_Locality_A4_GDA2020.mxd

3.0 Approvals

3.1 Development Consent/s and Commonwealth Approvals

Bulga Coal operates under two development consents: the Bulga Underground Operations DA 376-8-2003 and Bulga Open Cut SSD-4960. SSD-4960 superseded DA 41-03-99 at the granting of the Bulga Optimisation Project approval. On 20 May 2022 Bulga Coal provided DPE with a notice of surrender for DA 41-03-99 and DPE accepted the surrender on 31 August 2022.

In December 2021 Bulga Coal submitted administrative modifications for SSD-4960 (Mod 4) and DA 376-8-2003 (Mod 8). The modifications were approved 24 February 2022 and include amendments to the following conditions:

- Schedule 5 Condition 4 of SSD-4960 and Schedule 6 Condition 4 of DA 376-8-2003 to change the Bulga Coal Annual Review reporting period to a calendar year.
- Schedule 3 Condition 23 and Appendix 7 Condition 1 of SSD-4960, and Schedule 4 Condition 33 and Appendix 4 Condition 1 of DA 376-8-2003 to include the use of the sigma theta method for determining the meteorological stability category as per the *Noise Policy for Industry* (EPA, 2017).

Bulga Coal also operates in accordance with three Commonwealth approvals issued by the Department of Climate Change, Energy, the Environment and Water (DCCEEW) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). For more information regarding compliance with Commonwealth approval conditions refer to **Appendix A**.

Details of the current development consents and Commonwealth approvals are provided in **Table 5**.

Table 5 Development Consents and Commonwealth Approvals

Consent	Details	Expiry Date
DA 376-8-2003	Bulga Coal Continued Underground Operations	23 February 2031
	Mod 1 – Drift relocation (11 April 2006)	
	Mod 2 – Increase CHPP throughput (25 October 2006)	
	Mod 3 – Longwall realignment (1 October 2007)	
	Mod 4 – Methane Abatement and Gas-fired Power Plant (14 July 2010)	
	Mod 5 – Blakefield North Longwall Modification and Gas Fired Power Plant (18 October 2013)	
	Mod 6 – Modification to noise criteria, flora and fauna criteria, and independent auditing (8 December 2016)	
	Mod 7 – Relocation of the 9 MW power station and associated flares (16 July 2020)	
	Mod 8 – Change to Annual Review reporting period and change to sigma theta method for meteorological monitoring (24 February 2022)	

Consent	Details	Expiry Date
SSD-4960	Bulga Optimisation Project (1 December 2014)	31 December 2039
	Mod 1 – Eastern Emplacement Area and Tailings Storage (17 January 2017)	
	Mod 2 – Extend the period for construction of the outer face of the Noise and Visual Bund (30 August 2018)	
	Mod 3 – Extend approval to extract additional 64 Mt from beneath tailings storage (16 July 2020)	
	Mod 4 – Change to Annual Review reporting period and change to sigma theta method for meteorological monitoring (24 February 2022)	
EPBC 2002/773	Commonwealth Land Consent (as varied 25 October 2015)	31 December 2034
	Mod 2002/773 – Commonwealth Land Subsidence Management Plan (SMP) Submission Schedule	
EPBC 2012/6637	Bulga Open Cut (as varied 5 January 2016)	31 December 2036
EPBC 2018/8300	Bulga Open Cut (as varied 9 September 2021)	31 December 2049

3.2 Mining Tenements

Mining operations at Bulga Coal are undertaken within Mining Lease (ML) 1494, ML 1547, ML 1674, ML 1717, ML 1788, Coal Lease (CL) 224 and a sublease within Mount Thorley Operations (CL 219). Bulga Coal has approval to undertake exploration activities in accordance with Exploration Lease (EL) 5277, EL 5461, EL 8315, Authorisation (AUTH) 447 and AUTH 450.

Mining tenements are summarised in Table 6 and are shown on Figure 1.

Table 6 Mining Tenements

Tenement	Details	Expiry Date
ML 1494	Saxonvale Coal Pty Ltd and Nippon Steel and Sumitomo Metal Australia Pty Ltd	20 September 2027
ML 1547	Bulga Coal Management Pty Ltd	4 April 2025
ML 1674	Bulga Coal Management Pty Ltd	22 March 2033
ML 1717	Bulga Coal Management Pty Ltd	15 September 2036
ML 1788	Bulga Coal Management Pty Ltd	19 June 2040
Sublease within CL 219	Sublease to Bulga Coal within the Mount Thorley Operations CL 219	1 June 2025
CL 224	Saxonvale Coal Pty Ltd	23 December 2023[1]
EL 5277	Saxonvale Coal Pty Ltd	7 April 2024
EL 5461	Saxonvale Coal Pty Ltd and Nippon Steel and Sumitomo Metal Australia Pty Ltd	2 April 2018[1]
EL 8315	Saxonvale Coal Pty Ltd	13 October 2027
AUTH 447	Saxonvale Coal Pty Ltd	2 September 2025
AUTH 450	Saxonvale Coal Pty Ltd	30 December 2022[1]

[1] Renewal sought.

3.2.1 Mining Operations Plan Status

From 1 January to 2 July 2022 Bulga Coal operated in accordance with the Bulga Underground Operations Mining Operations Plan: 29 May 2018 – 31 December 2023 and the Bulga Open Cut Mining Operations Plan: 1 July 2020 – 30 June 2023. The Bulga Open Cut Mining Operations Plan: 1 July 2020 – 30 June 2023 Amendment B was approved by the Department of Regional NSW – Resources Regulator (RR) on 6 April 2022, this variation allowed for an increase in disturbance of previously rehabilitated areas in 2022, to enable sealing of underground operations and subsequent continued open cut mining.

The Mining Amendment (Standard Conditions of Mining Leases – Rehabilitation) Regulation 2021 (the Regulation) introduced new standard rehabilitation and reporting conditions on mining leases. The Regulation commenced on 2 July 2021, with a transition period to 2 July 2022. Following the transition period, Mining Operations Plans cease to exist in NSW. To meet the requirements of the Regulation Bulga Coal developed and implemented a Rehabilitation Management Plan, Forward Program and Rehabilitation Outcome Documents (the latter pending RR approval).

3.2.2 Subsidence Management Plan Status

The last underground coal was mined in May 2018 and the relevant Subsidence Management Plan expired in December 2019. Subsidence impact monitoring and mitigation works are now completed in accordance with the *Bulga Underground Operations Post Mining Subsidence Management Plan*.

3.3 Licences

The licences held by Bulga Coal are detailed in **Table 7**. Bulga Coal does not hold any surface water licences for mining purposes. Surface water drawn for mining purposes is supplied from the Mount Thorley Water Supply Joint Venture, operated by Singleton Council. It is also supplied by Yancoal's Mount Thorley Mine through an agreement with Bulga Coal.

Table 7 Bulga Coal Licences

Licence	Details
Environmental Protection Licence (EPL)	
EPL 563	For scheduled activities: Coal works > 5,000,000 t annual handling capacity; Crushing, grinding or separating >100,000–500,000 t annual processing capacity; and Mining for coal >5,000,000 t annual production capacity. Anniversary Date: 20 July.
Water Licences	
WAL41687	Mining: Volume licence limit 500 ML. Sydney Basin-North Coast Groundwater Source.
WAL41546	Mining: Volume licence limit 365 ML. Sydney Basin-North Coast Groundwater Source.
WAL41543	Mining: Volume licence limit 500 ML. Sydney Basin-North Coast Groundwater Source.
WAL41544	Mining: Volume licence limit 500 ML. Sydney Basin-North Coast Groundwater Source.
WAL41545	Mining: Volume licence limit 500 ML. Sydney Basin-North Coast Groundwater Source.
WAL36221	Mining: Wollombi Brook Aquifer leakage to Permian coal measures 300 ML.

Licence	Details
20BL166867	Monitoring (mining bore): GW1 – GW10. Total of 16 bores for monitoring purposes.
20BL167776	Monitoring: P1 – P3, P4A, P4B, P5 – P8 and V3. Licence for total of 9 bores for monitoring purposes.
20BL167777	Monitoring: V1, V2, F1 and F2.
20BL169204	Monitoring: Bore – ACARP Project.
20BL169246	Monitoring: Bore – ACARP Project.
20BL172659	Monitoring: WBR180 and WBR181.
20BL172660	Monitoring: WBR182 and WBR183.
20BL173014	Monitoring: SBD194, SBD196.
20BL173617	Monitoring: Lot 61/755264.
20BL173618	Monitoring: Lot 34/755264.
20BL173619	Monitoring: Lot 33/755264.
20BL173620	Monitoring: Lot 23/755264.
20BL173621	Monitoring: Lot 24/755264.
20BL173640	Monitoring Bore – 25//755264.
20BL173657	Monitoring Bore – 22//755264.
20BL173708	Monitoring Bore – 11//730762.
Radiation/Dangerous Goods Licences	
Radiation Management Licence 5061333	Radiation regulated material ID 8929 – Serial Nos: 054 / 6230GK Radiation regulated material ID 8934 – Serial Nos: 055 / 4421GK Radiation regulated material ID 8935 – Serial Nos: 057 / 4412GK Radiation regulated material ID 8938 – Serial Nos: 056 / 4376GK Radiation regulated material ID 8939 – Serial Nos: 053 / 6218GK Radiation regulated material ID 9581 – Serial Nos: 436-03-07 / OCS519 Radiation regulated material ID 9582 – Serial Nos: 2173 / 0532/06 Radiation regulated material ID 9583 – Serial Nos: 2190 / 0528/07 Radiation regulated material ID 9584 – Serial No: 2187 Radiation regulated material ID 9585 – Serial Nos: 2188 / 0539/07 Radiation regulated material ID 20634 – Serial Nos: S500160113F / BC-1754 Radiation regulated material ID 20635 – Serial Nos: S500170113F / BC-1755 Radiation regulated material ID 20636 – Serial Nos: S500180113 / BC-1756 Radiation regulated material ID 20637 – Serial Nos: S500190113/ BC-1757 Radiation regulated material ID 20638 – Serial Nos: S5001A0113F/ BC-1758 Radiation regulated material ID 20639 – Serial Nos: S5001B0113F/ BC-1759
NDG018992	Hazardous Chemicals Notification for the storage and handling of hazardous chemicals.
XSTR100095	Bulga Open Cut Licence to Store Explosives.

4.0 Operations Summary

Bulga Open Cut mining activities undertaken in 2022 are displayed on **Figure 2**. There were no underground mining activities undertaken in 2022 other than operation of existing gas drainage infrastructure and the gas fired power station.

4.1 Exploration

A total of two (2) exploration holes were drilled during 2022:

- EBR108 and EBR109 were drilled to define the true seam dip at the inflection point of the Mt Thorley Monocline throughout the mine plan.

The locations of the exploration holes are shown on **Figure 2**.

No Bulga Underground prospecting exploration activities occurred in 2022.

4.2 Land Preparation

Land preparation ahead of open cut mining operations involves the construction of erosion and sediment control measures, clearing vegetation, stripping, and stockpiling topsoil. These activities were undertaken in accordance with the *Bulga Coal Biodiversity Management Plan* (BMP), the Bulga Open Cut and Bulga Underground Operations MOP's (until 2 July 2022), and the *Bulga Coal Rehabilitation Management Plan* (RMP).

Grassland, fragmented woodland communities, and previously rehabilitated land is cleared and topsoil stripped ahead of mining. Vegetation and vegetative matter is either mulched and incorporated into topsoil or stockpiled for future use in rehabilitation.

During 2022, 1.83 ha of disturbance was undertaken to allow mining, overburden dumping and construction activities (roads, drains, dams) to commence. There was also 10.75 ha of existing rehabilitation cleared to facilitate infrastructure construction and the southerly extension of mining operations.

Approximately 5,403 m^3 of topsoil was stripped and 2 habitat trees were salvaged from clearing areas in advance of mining.

Clearing and disturbance areas are shown on **Figure 2**.

Bulga Coal

FIGURE 2 - Bulga Open Cut Summary of Operations 2022

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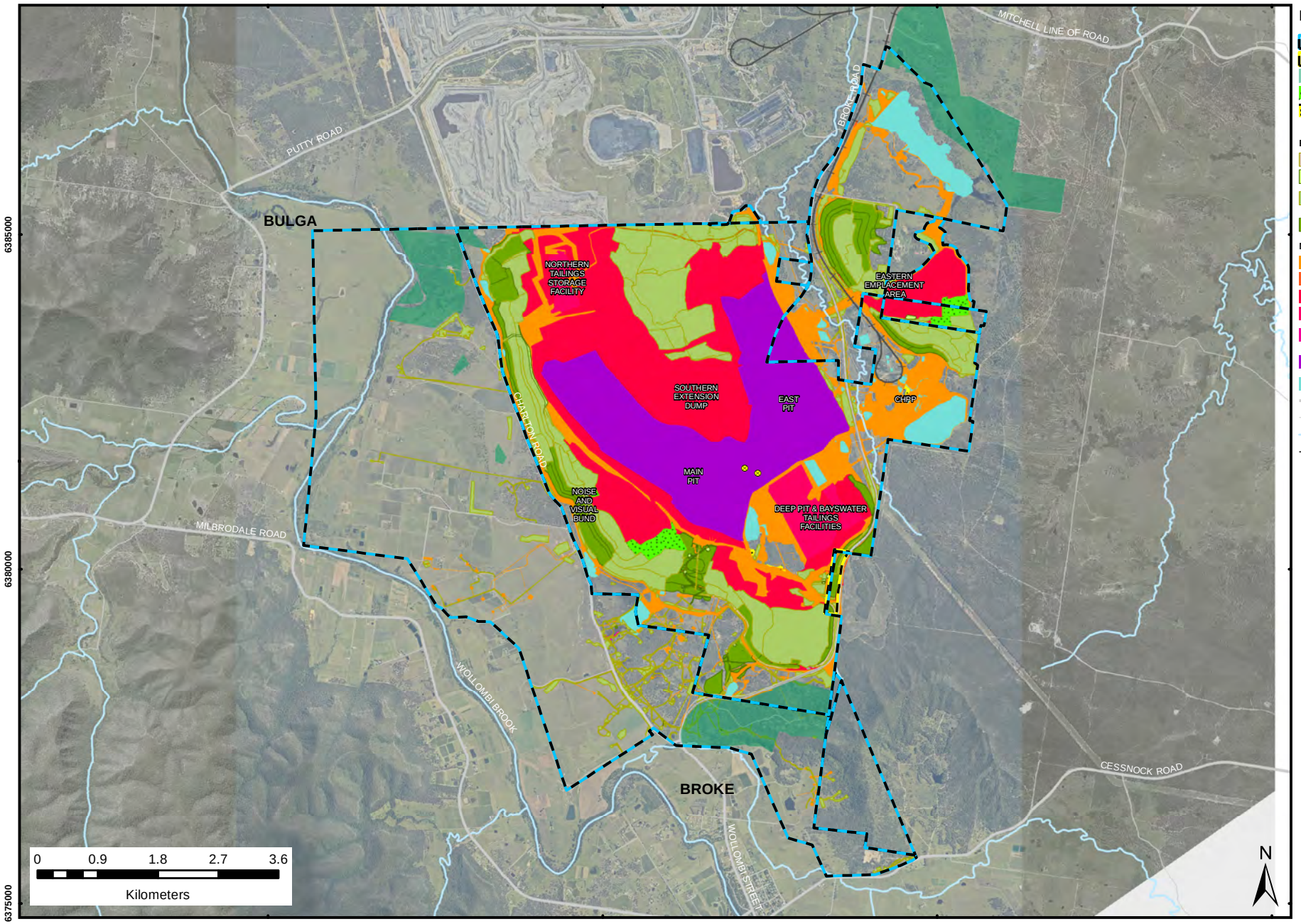

Legend

- Current_Authorisations
- Mining Lease AMA
- Biodiversity Offset Areas
- 2022 Rehabilitation
- 2022 Disturbance
- 2022 Exploration Completed

Rehabilitation Phase

- Decommissioning
- Growth Media Development
- Ecosystem and Land Use Establishment
- Ecosystem and Land Use Development

Mining Domain Type

- Infrastructure Area
- Other
- Overburden Emplacement Area
- Tailings Storage Facility
- Underground Mining Area (SMP)
- Active Mining Area (Open cut void)
- Water Management Area
- Main Roads
- Local Roads
- Watercourse
- Railway

GDA2020

Date Created: 28/03/2023
Map Size: A4 Landscape
Scale: 1:80,283
Map Created By: MPollock
Coordinate System:
GDA2020 MGA Zone 56
Projection: Transverse Mercator
Datum: GDA2020

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4.3 Mining Operations

Bulga Underground Operations

Bulga Underground Operations finished producing coal in May 2018 with all working sealed in July 2018. There were no underground mining activities conducted in 2022 of other than the operation of gas drainage infrastructure in support of the Bulga Open Cut. Grout plugs were also installed in the South Bulga and Blakefield South underground workings in preparation for the Open Cut mining through these workings.

Bulga Open Cut

Bulga Open Cut continued mining coal reserves from the East Pit, Woodlands Hill Pit and Whybrow Wedge in 2022. In the Woodlands Hill Pit, mining progressed in a westerly direction. In the East Pit and Whybrow Wedge, mining progressed in a southerly direction.

Bulga Open Cut placed overburden on the Eastern Emplacement Area and Southern Extension Dump, and undertook in-pit dumping in the Main Pit and East Pit. Overburden was stripped using truck/shovel fleets only. Coal was mined by a fleet of excavators and trucks. ROM coal was transported by dump truck via an overpass on Broke Road to the ROM coal hopper or stockpile at the CHPP.

Five haulage trucks (Cat 793D XQ on hire), one grader (Cat 24) and one dozer (Cat D11R) were acquired in 2022. One Grader (Cat 24H) was removed from the fleet. The total mining fleet as at 31 December 2022 is listed in **Table 8**.

Table 8 Equipment Fleet

Type	Model	Units
Shovels – Electric	P&H4100	1
Shovels – Hydraulic	Hitachi EX8000	1
	Hitachi EX5600	1
	Hitachi EX5500	2
	Hitachi EX3600	1
	Liebherr EX9400	1
	Liebherr EX9250	1
	Liebherr EX9100	2
	Cat 6040	1
Haulage Trucks	Cat 793C XQ	6
	Cat 793D XQ	38 (includes 5 hire trucks)
	Cat 789C XQ	9
	Cat 797F XQ	7
	Cat 789C XQ Water Trucks	4
	Cat 777F Hire Water Cart	1 (hire)
Front End Loaders	LeTourneau L1850	2
	Hitachi ZW370-5	1

Type	Model	Units
	Cat 980M Wheel Loader (Hire)	1 (hire)
Dozers (tracked)	Cat D11T	5
	Cat D11R	6
	Cat D10T	3
	Cat D10T2	5
	Cat 854K	2
Graders	Cat 24 series	1
	Cat 24M	2
	Cat 16H	1
	Cat 16M	1
	Cat 18 Series	1
Fuel Trucks	Cat 773E	2
	Cat 775G	1
Drills	Sandvik D75K	1
	Terex SKS-W	2
	Terex SKF	2

A summary of coal production and waste material (overburden and reject) production for the Bulga Open Cut is provided in **Table 9**.

Table 9 Production and Waste Summary for the Bulga Open Cut

Aspect	Approved Limit SSD-4960	2021 Reporting Period (Actual)	2022 Reporting Period (Actual)	2022 Predictions (Forecast)	2023 Predictions (Forecast)
Waste Rock/ Overburden (bcm)	N/A	62,363,867	56,282,130	53,850,680	60,328,965
ROM Coal (t)	12,200,000	10,986,664	9,749,513	10,349,000	10,404,000
Coarse reject (t)	N/A	3,250,276	3,253,776	3,160,000	2,890,000
Fine Reject (tailings) (t)	N/A	845,700	709,795		
Saleable Product (t)	N/A	7,064,198	6,345,168	6,770,000	7,120,000

Note – Total waste volume predictions do not split the volumes of fine and coarse reject produced per year. All predicted numbers except for ROM Coal (t) are from the current Bulga Complex Forward Program 2022–2024. ROM Coal (t) predicted numbers are from the Bulga Open Cut Mining Operations Plan: 29 May 2018 – 30 June 2023.

4.4 Other Operations

4.4.1 Coal Handling and Preparation Plan

9.75 million tonnes (Mt) of Run of Mine (ROM) coal was washed, producing 6.35 Mt of saleable product coal. The CHPP has approval to wash up to 20 Mt of ROM coal per year. 5.09 Mt of coal was railed to the Port of Newcastle for export and 1.23 Mt of coal was railed for domestic use.

4.4.2 Tailings Management

Deposition of tailings to the Northern Tailings Storage Facility (NTSF) Cell A and Cell B continued for the duration of 2022. A portion of tailings were pumped to assist with the sealing of the Beltana Mine underground workings during the months of March, April and September 2022. This work is being undertaken in preparation for open cut mining through this area.

The dredging of tailings for relocation from the Deep Pit and Bayswater tailings facilities to the NTSF commenced in April 2022. A total of 7,839,613 m^3 of tailings was relocated to the NTSF during 2022.

4.4.3 Construction

Bulga Coal construction works included:

- A CHPP office building was constructed;
- A temporary CHPP projects office building was constructed (on hire);
- Upgrade of CHPP transformer bunds;
- A storage shed was constructed at the Maintenance Workshop (within the Stores area);
- An administration building, bathhouse and crib room were constructed to facilitate the tailings relocation project;
- The tailings dredging infrastructure systems and decant systems were commissioned;
- A skid mounted nitrogen gas generator plant was installed including associated overhead power lines;
- The enlarged S6A Dam was commissioned; and
- The CHPP surface water management system upgrades commenced.

The CHPP was upgraded to improve coal throughput and recovery, and to reduce water usage.
The upgrades included:

- Upgrade of CHPP transformer bunds;
- Power factor correction unit;
- Upgrade of CHPP drive cells;
- Upgrade of flotation plant effluent jet pump and sump; and
- Upgrade of conveyor anti-runbacks.

4.4.4 Demolition

Bulga Coal demolition works included:

- Bulga Open Cut completed demolition of the dragline in 2022.
- Following the cessation of underground mining, Bulga Underground Operations infrastructure has continued to be demolished/decommissioned including:
    - Dismantling of the light towers at the Bulga Underground ROM;
    - Dismantling of the Bulga Underground reclaim conveyor;
    - Dismantling of a portion of the overland conveyor;
    - Scrapping and offsite disposal of decommissioned equipment in the laydown area;
    - Installation of grout plugs within the South Bulga Mine underground workings; and
    - Installation of grout plugs in the Blakefield South Mine underground workings.

Demolition works were carried out by a licensed demolition contractor in accordance with *Australian Standard AS 2601-2001*.

4.4.5 Waste Management

Waste management is undertaken in accordance with the *Bulga Complex Waste Management Plan* and EPL 563. Waste is removed by a licenced contractor and is recycled where possible. Waste removed from site includes batteries, light vehicle tyres, scrap metal, domestic waste, fuel and oil filters, solvent, radiator coolant, wooden pallets, oily rags and hydrocarbon contaminated material from maintenance workshops.

Bulga Coal produced 12,295 t of waste during 2022, which represents a substantial increase from previous years (4,298 t in 2021). The main cause of this increase has been the disposal and recycling of Bulga Underground Operations equipment and demolition of the Dragline (8,949t). As much as was practical equipment and parts have been sold for reuse. 94.1 % of the waste produced by Bulga Coal (11,568 t) was recycled. 9,703 t of scrap steel was recycled during the reporting period. Bulga generated 44 t of Hazardous Waste which included oily rags/ absorbents, contaminated soil and medical/ sanitary waste. Bulga produced 683 t of Non-Hazardous Waste which included mixed solid waste and treated timber. Waste disposed to landfill was 683 t.

294.4 t of recycled gypsum plasterboard was received at the premises for use in rehabilitation.

Waste oil and grease removed from equipment is stored in bunded tanks. Wastewater generated from the workshop areas is treated through hydrocyclone oily water separators. Waste oil, grease and oily water from oil water separators are then removed by an authorised waste contractor for recycling.

The treatment and disposal of sewage at Bulga Open Cut is through an extended aeration sewage treatment plant. Effluent from this plant goes to two maturation ponds before it is returned to the CHPP circuit water. Sewage from the East Pit Muster is treated by an extended aeration sewage treatment plant. Effluent is also treated with ultra-violet (UV) light. Treated water is transferred to a mine water dam for reuse. Deactivated sludge is transported to the Singleton Council Treatment Works Depot.

4.4.5.1 Comparison Against Predictions

The *Bulga Optimisation Project – Environmental Impact Statement* (Umwelt, 2013) predicted waste to be generally consistent with the current operations at the time. Operations in 2012 disposed of 507 tonnes of waste to landfill, 1,978 tonnes of waste (or approximately 80 per cent of waste generated by the Bulga Surface Operations) was recycled or reused.

Waste disposed to landfill was 683 tonnes during 2022 which was above the 507 tonnes outlined/predicted. Bulga Coal recycled 11,568 tonnes of waste (94.1 percent of all waste produced at Bulga Coal).

While the total volume of recycled waste was higher than predictions, the percentage of waste recycled exceeded predictions. Increased waste volumes during 2022 are associated with continued decommissioning activities related to the Bulga Underground, demolition of the Dragline and mining progression as described in **Section 4.4.4**.

4.4.5.2 Long Term Analysis

A summary of waste disposal from 2017 to 2022 is presented in **Figure 3**. The figure shows waste volumes fluctuated, particularly the volumes of recycled waste. The changes in volumes and recycled material during 2022 reflect the staged decommissioning of the underground laydown areas and dragline decommissioning (8,949t).

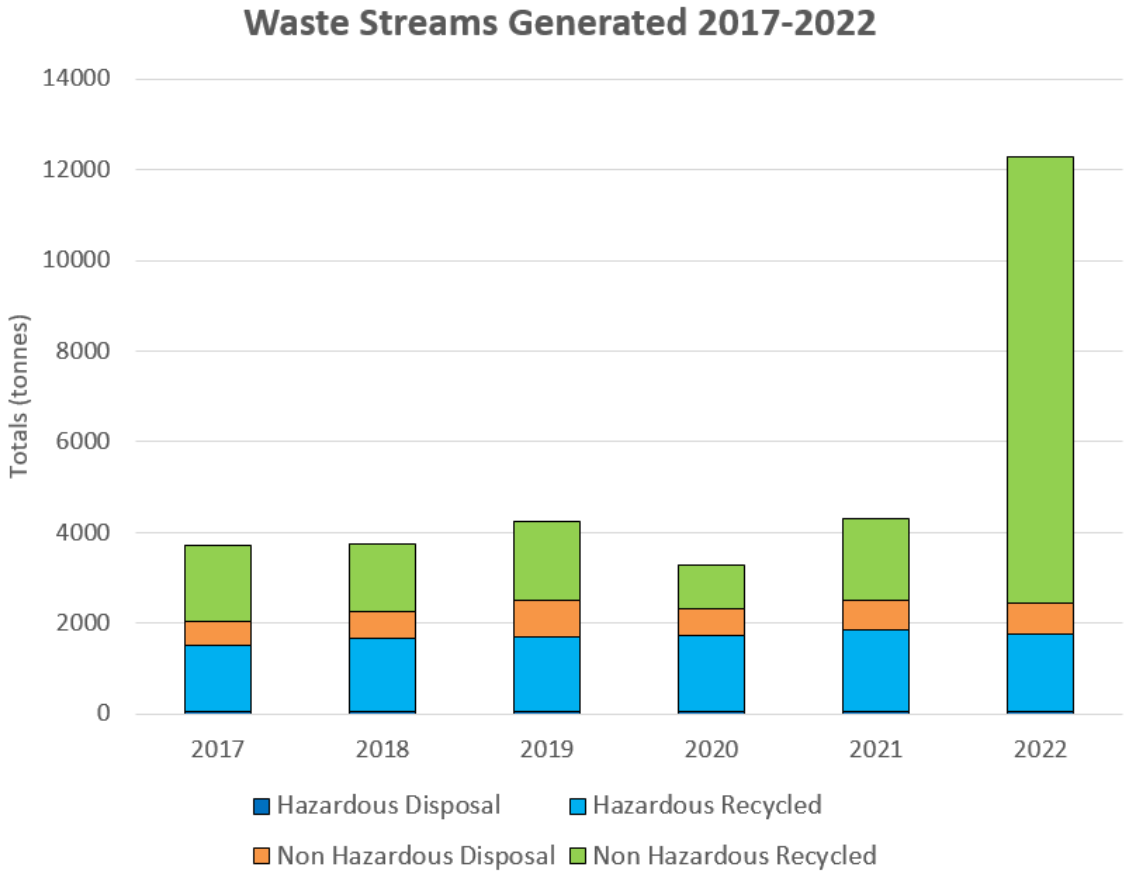


Figure 3 2017–2022 Waste Streams Generated

4.4.6 Hazardous Materials Management

Hazardous and dangerous goods are stored and labelled according to the relevant Australian Standard.

Hazardous materials stored at Bulga Open Cut have been notified to SafeWork NSW (Acknowledgement NDG018992).

Hazardous waste stored at Bulga Open Cut is tracked and transported by a licenced waste transporter and disposed of at a licenced facility.

Explosives are stored in a licenced explosive magazine according to SafeWork NSW requirements. Bulga Coal hold Licence No. XSTR100095 for the storage of explosives at Bulga Open Cut.

4.5 Next Reporting Period

4.5.1 Bulga Underground Operations

Activities proposed in 2023 are generally consistent with DA 376-8-2003. Underground mining activities will include:

- Continued operation of the Blakefield South goaf drainage system, Blakefield North pre drainage system and 9 MW gas fired power station;
- Continued decommissioning and demolition of Bulga Underground Operations infrastructure; and
- Rehabilitation of redundant gas drainage infrastructure, access tracks and pipelines.

4.5.2 Bulga Open Cut

Activities proposed in 2023 are generally consistent with SSD-4960. **Figure 4** illustrates the proposed operations.

Mining operations will continue in the Main Pit, East Pit, Whybrow Wedge and Woodlands Hill Pit. Bulga Open Cut will continue to place overburden on the Eastern Emplacement Area, Southern Extension Dump and in-pit dumping in the Main Pit and East Pit. Dredging (relocation) of tailings from Deep Pit and Bayswater Pit to the in-pit NTSF will continue. This will enable mining of the underlying coal.

Construction and decommissioning activities will include:

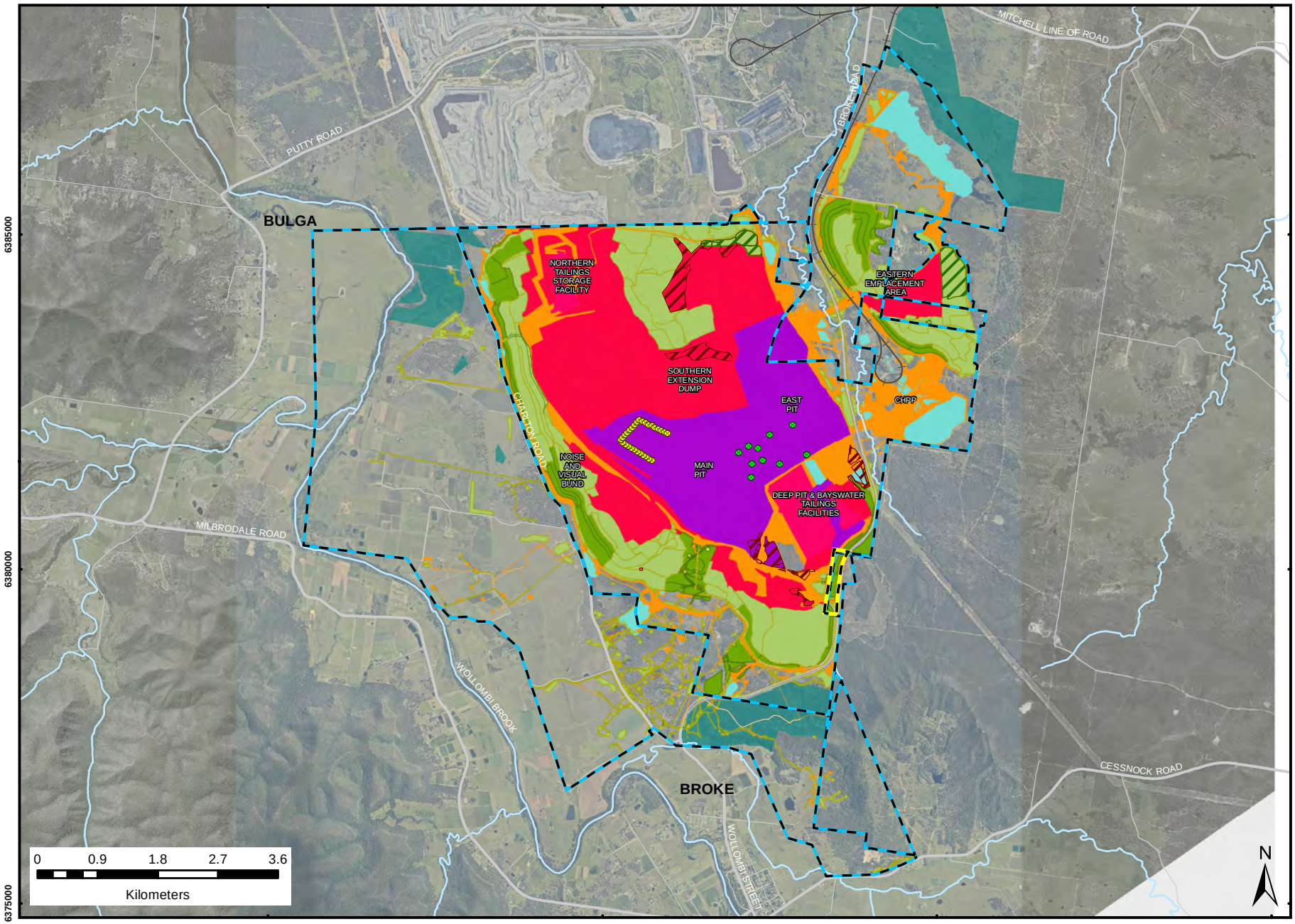
- Commissioning of the Nine Mile Creek clean water management system upgrades and Dam C3A in accordance with the *Bulga Coal Water Management Plan*.
- Drilling ten (10) exploration holes designed to further define the true seam dip at the inflection point of the Mt Thorley Monocline throughout the Main Pit mine plan.
- Installation of Piercefield Seam pre-drainage gas wells and pipelines which will be reticulated to the gas fired power station and associated flares.
- Construction of mine dewatering pump station, associated pipelines and power supply.

- Construction and commissioning Dam S53 and associated pump station, pipelines and drainage.
- Construction of colour bond fencing adjacent to Broke Road.
- Sealing of the East Pit car parking area.
- Relocation of a high voltage substation.
- Modification and upgrades to offices and bath house at the East Pit Offices.
- Construction of a light vehicle workshop at the East Pit Offices.
- Construction of a light vehicle wash bay facility.
- Construction of a bulk fuel facility and decommissioning of the light vehicle bulk fuel facility.
- Relocation of temporary shelter structures (Igloo's) at Mine Infrastructure Area (MIA).
- Construction of a four bay maintenance workshop at the MIA.
- Decommissioning of Dam MW2 and Dam S7.

Bulga Coal

FIGURE 4 - Bulga Open Cut Proposed Operations 2023

GLENCORE



Legend

- Current_Authorisations
- Mining Lease AMA
- Offset Area Boundaries
- 2023 Planned Exploration
- 2023 Planned Gas Wells
- 2023 Planned Rehabilitation
- 2023 Planned Disturbance

Mining Domain Type

- Infrastructure Area
- Overburden Emplacement Area
- Tailings Storage Facility
- Active Mining Area (Open cut void)
- Water Management Area

Rehabilitation Phase

- Decommissioning
- Growth Media Development
- Ecosystem and Land Use Establishment
- Ecosystem and Land Use Development

- Main Roads
- Local Roads
- Watercourse
- Railway

GDA2020

Date Created: 23/03/2023
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Map Created By: MPollock
Coordinate System:
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5.0 Actions Required from Previous Annual Review

The 2021 Annual Review was provided to DPE and RR on 31 March 2022. DPE requested Bulga Coal to submit a revised document that addressed the items as detailed in **Table 10**. The revised 2021 Annual Review was submitted to DPE on 25 August 2022. DPE considered the Annual Review to generally meet the requirements of the approval in relation to reporting and the Annual Review Guideline (DPE, 2015).

Table 10 DPE 2021 Annual Review Information Requested

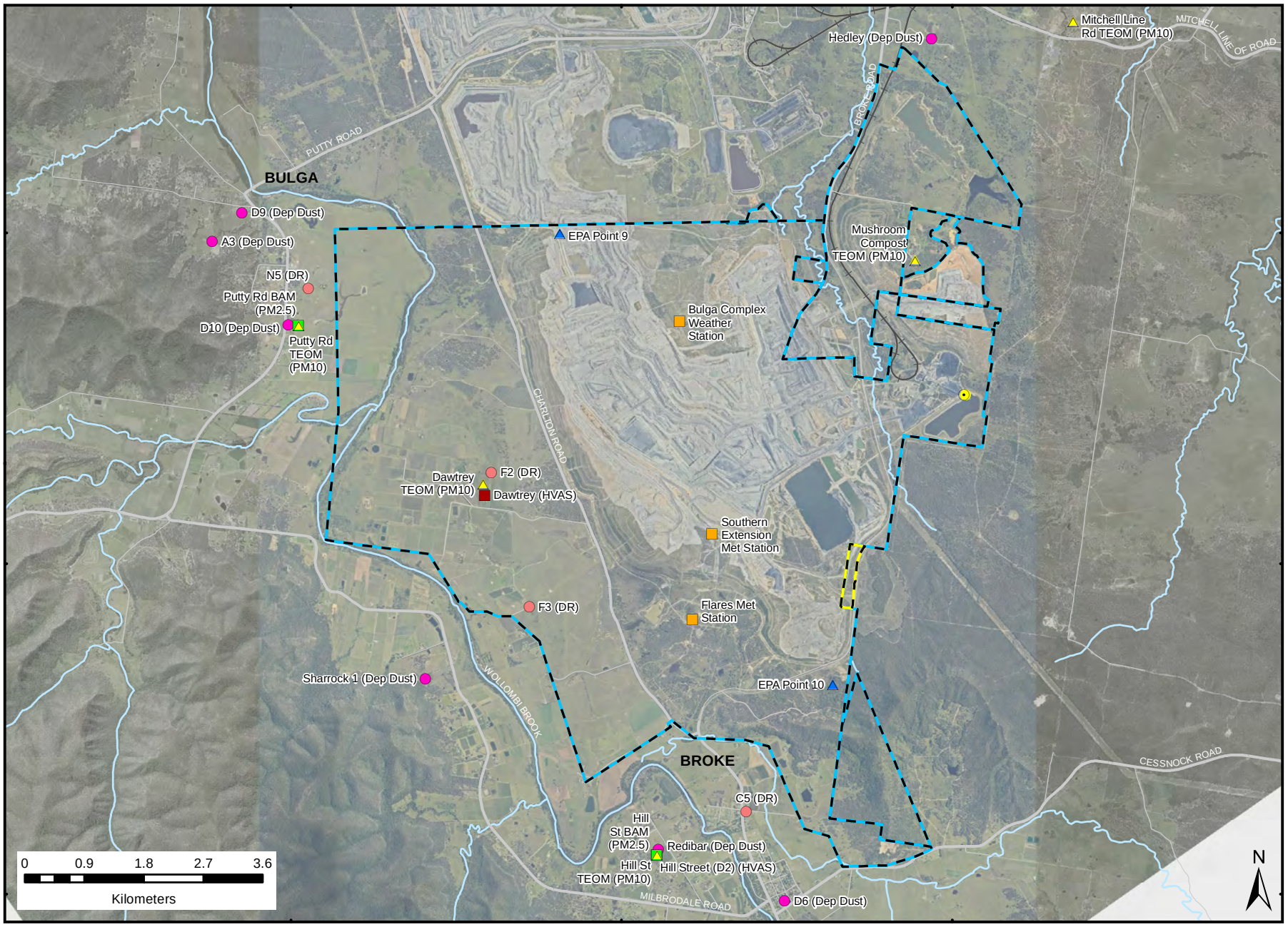
Information Requested from DPE	Section Addressed (in 2021 Annual Review)
Bulga was requested to submit a revised document that addressed the following:	
Section 6.7 Biodiversity – please confirm the biodiversity monitoring of remnant vegetation is consistent with the *Bulga Coal Biodiversity Management Plan* noting that Section 8.1 of BCC BMP describes monitoring of seven sites within the buffer lands surrounding the operations, bird and bat monitoring across 13 locations, photo monitoring and nest box monitoring.	**Section 6.6** of the 2021 Annual Review was updated to demonstrate monitoring has been undertaken in accordance with the Biodiversity Management Plan.
Section 6.10 Visual and Lighting – please include a summary of the results of the independent visual and lighting review	A summary of results was included in **Section 6.10.1** of the 2021 Annual Review, including details of a recommendation for an improvement that was made.
Table 44 Rehabilitation Status – please check that the total mine footprint is equal to the sum of the active disturbance, land being prepared for rehabilitation, and land under active rehabilitation as per the 2015 Annual Review guidelines	Rehabilitation completed in 2021 and included as 'land under active rehabilitation' was also included as 'land being prepared for rehabilitation' in Table 44. Table 44 of the 2021 Annual Review was updated to remove 'land being prepared for rehabilitation' as all areas prepared for rehabilitation in 2021 were seeded.

6.0 Environmental Management Performance

Bulga Coal implements a comprehensive *Environmental Management Strategy* (EMS) that provides a framework for managing environmental and community aspects, and impacts of mining operations. It includes management plans, procedures and standards to minimise the risks of impact to the environment and continually improve the environmental management performance of operations. An extensive environmental monitoring network is in place to monitor the environmental management performance of the site. The environmental monitoring network is shown in **Figure 5**, **Figure 6** and **Figure 7**.

Bulga Coal

FIGURE 5 - Bulga Coal Air and Meteorological Monitoring 2022



Legend

- Mining Lease
- Mining Lease AMA
- Rain Gauge
- High Volume Air Sampler (TSP)
- Depositional Dust Guage
- Directional Depositional Dust Gauge
- Air Quality Early Warning Unit (PM10)
- TEOM (PM10)
- BAM (PM2.5)
- Meteorological
- Main Roads
- Local Roads
- Watercourse
- Railway

GDA2020

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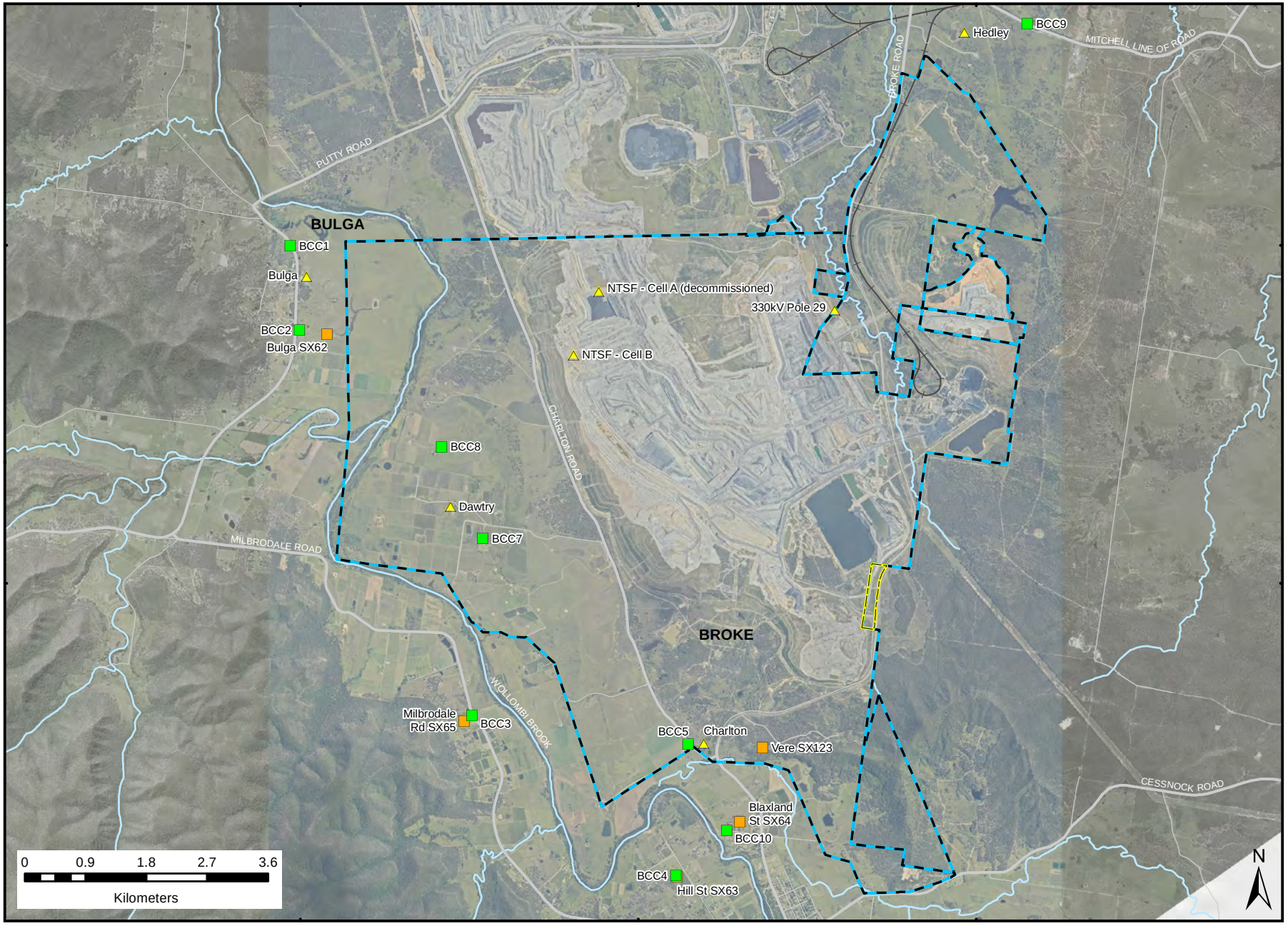
Bulga Coal

FIGURE 6 - Bulga Coal Noise and Blast Monitoring 2022

GLENCORE



Legend

- Mining Lease
- Mining Lease AMA
- Attended Noise Monitoring
- Continuous Noise Monitoring
- Blast Monitoring
- Main Roads
- Local Roads
- Watercourse
- Railway

GDA2020

Date Created: 23/03/2023
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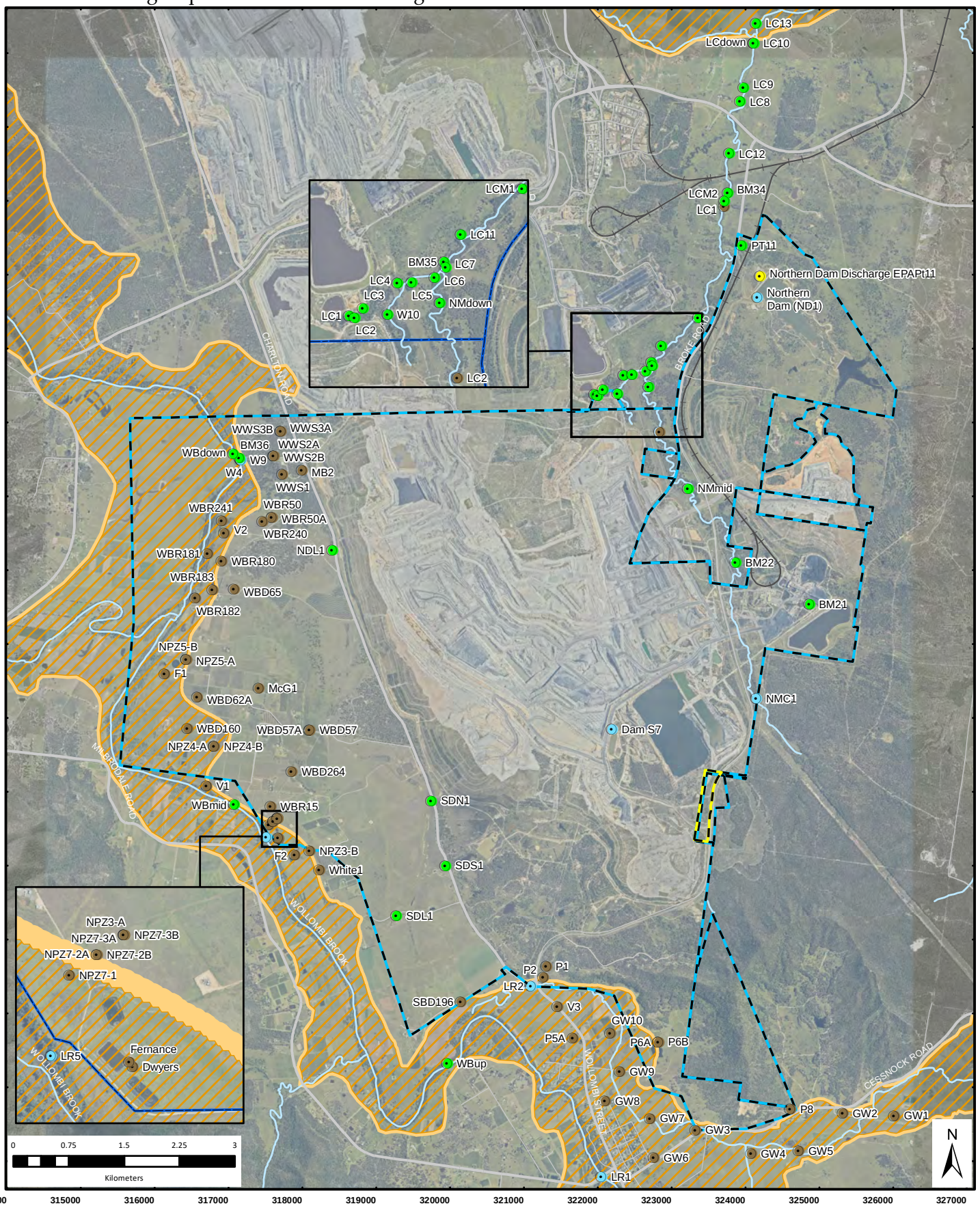
Bulga Coal

FIGURE 7 - Bulga Open Cut Water Monitoring 2022



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Legend

- Mining Lease
- Mining Lease AMA
- Alluvium area
- 40m buffer zone of alluvium
- Groundwater
- Surface Water
- EPL Discharge Point
- Stream Monitoring
- Main Roads
- Local Roads
- Watercourse
- Railway

GDA2020

Date Created: 23/03/2023
Map Size: A4 Portrait
Scale: 1:70,000
Map Created By: MPollock
Coordinate System:
GDA2020 MGA Zone 56
Projection: Transverse Mercator
Datum: GDA2020

6.1 Meteorology

Bulga Coal has three meteorological monitoring sites as shown in **Figure 5**. Meteorological data from the Bulga Complex Meteorological Station is reported in the quarterly environmental monitoring reports available on the Bulga Coal website (https://www.glencore.com.au/operations-and-projects/coal/current-operations/bulga-coal).

In accordance with Schedule 3, Condition 23 of SSD-4960, and Condition M4 of EPL 563, Bulga continued to operate the Bulga Complex Weather Station, Southern Extension Weather Station and the Flares Weather Station.

2022 was a very wet year with total annual rainfall at Bulga Complex Weather Station being 1,224.5 mm which was higher than the 994.5 mm recorded in 2021. The average annual rainfall at Bulga is approximately 670 mm.

A summary of the annual meteorological monitoring is shown in **Table 11** to **Table 17** and **Figure 8** to **Figure 12**. The low rainfall recorded during January, February and March 2022 at the Flares Weather Station was investigated and determined to be caused by a faulty rain gauge switch, which was replaced in early April 2022.

Table 11 Distribution of Monthly Rainfall at Representative Monitoring Stations

	January	February	March	April	May	June	July	August	September	October	November	December	Annual Total
Bulga Complex Weather Station													
Total	58.5	121	350.5	49.5	53	9.5	234.5	58	80	132.5	57.5	20	1,224.5
Southern Extension Weather Station													
Total	37.4	119.4	337.4	45.8	46	8	213.8	42	61.8	92.8	53.4	18.4	1,076.2
Flares Weather Station													
Total	21*	35*	85*	39	57	10	222.5	46	62.5	93	65	18	754*

* Low rainfall recorded during January, February and March at the Flares Weather Station was investigated and determined to be caused by a faulty rain gauge switch. This was replaced in early April 2022.

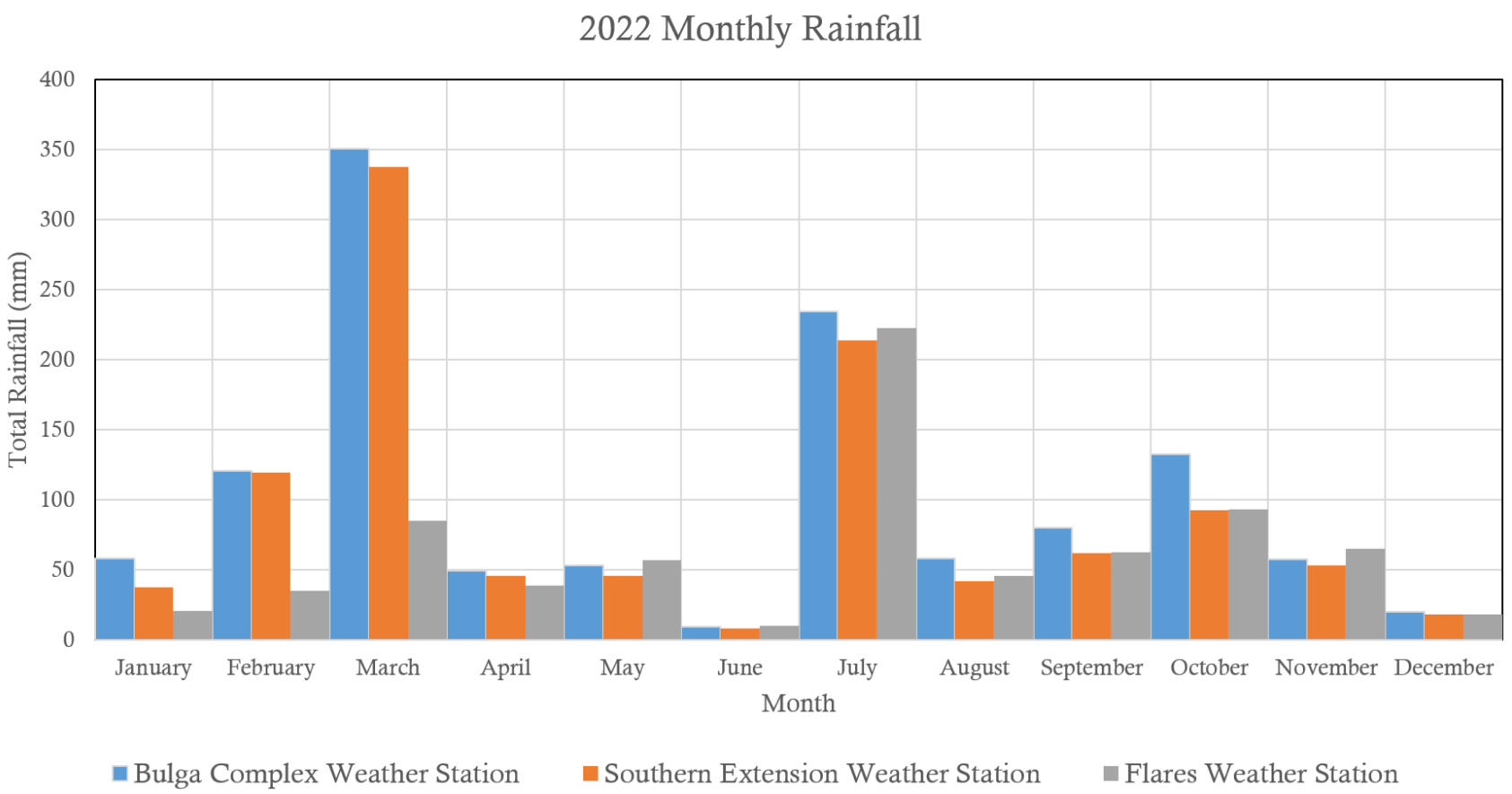


Figure 8 **Distribution of Monthly Rainfall at Representative Monitoring Stations**

As shown in **Table 12** and **Table 13**, the daily minimum and maximum surface level temperatures ranged across Bulga's three monitoring stations at 2 metres and 10 metres above surface level from –1.44°C to 37.61.0°C respectively. Refer to **Table 14** for humidity recorded over the reporting period. Relative humidity was not monitored continuously at the Southern Extension Meteorological Station due to an equipment failure on the relative humidity sensor from late March 2022 to early May 2022, when the sensor was replaced.

Table 12 2022 Temperature 2 m (Degrees Celsius) at Representative Monitoring Stations

Temperature 2 m (degrees Celsius)	Bulga Complex			Flares			Southern Extension		
Month	Minimum	Average	Maximum	Minimum	Average	Maximum	Minimum	Average	Maximum
January	15.16	24.92	37.59	14.79	23.48	34.50	16.22	23.62	34.38
February	15.36	23.41	37.95	12.08	21.81	35.59	14.12	21.97	35.93
March	13.93	21.59	34.68	12.63	20.42	30.85	13.72	20.57	30.57
April	9.59	19.24	31.84	7.22	17.59	28.18	9.19	18.12	28.38
May	4.93	15.67	27.57	2.10	13.76	24.88	4.18	14.66	24.72
June	2.46	11.50	21.52	-1.44	9.03	19.97	2.34	10.73	19.96
July	3.88	13.55	22.88	-0.78	10.50	20.04	1.80	11.25	19.76
August	5.59	15.32	26.88	-0.91	11.73	22.74	2.87	12.82	22.56
September	9.27	17.22	26.52	2.43	13.94	22.77	4.81	14.53	23.04
October	9.49	20.16	31.88	5.82	17.04	28.70	7.07	17.45	29.02
November	8.93	21.39	35.59	4.20	18.07	32.55	6.40	18.58	32.70
December	12.77	23.29	37.61	5.81	19.89	34.24	10.27	20.28	33.17

Table 13 2022 Temperature 10 m/30 m (Degrees Celsius) at Representative Monitoring Stations

Temperature 10 m/30 m (degrees Celsius)	Bulga Complex (10m)			Flares (10m)			Southern Extension (30m)		
Month	Minimum	Average	Maximum	Minimum	Average	Maximum	Minimum	Average	Maximum
January	16.85	24.81	36.50	15.34	23.45	33.90	16.85	23.09	33.20
February	16.35	23.31	37.48	12.65	21.80	35.03	14.68	21.60	34.17
March	15.08	21.71	32.03	12.96	20.49	30.35	15.04	20.33	29.57
April	10.70	19.49	30.85	7.67	17.75	27.86	9.87	18.16	27.56
May	6.21	16.07	26.53	2.34	14.03	24.49	6.43	14.87	23.98
June	4.23	11.99	20.79	-0.74	9.59	19.68	3.69	11.17	19.00
July	3.44	11.98	20.18	-0.37	10.89	19.89	3.77	11.30	19.09
August	5.09	13.79	23.48	-0.47	12.21	22.58	5.31	13.10	21.71
September	8.47	15.47	23.48	2.66	14.19	22.22	7.12	14.49	21.71
October	8.17	18.30	29.25	6.52	17.18	28.45	6.80	17.14	27.96
November	8.25	19.44	33.45	4.57	18.15	31.80	8.10	18.25	31.70
December	12.33	21.17	34.46	6.48	19.91	33.38	10.96	19.90	32.17

Note: Temperature at Bulga Complex and Flares stations is at 10 m. Temperature at 30 m is recorded at Southern Extension.

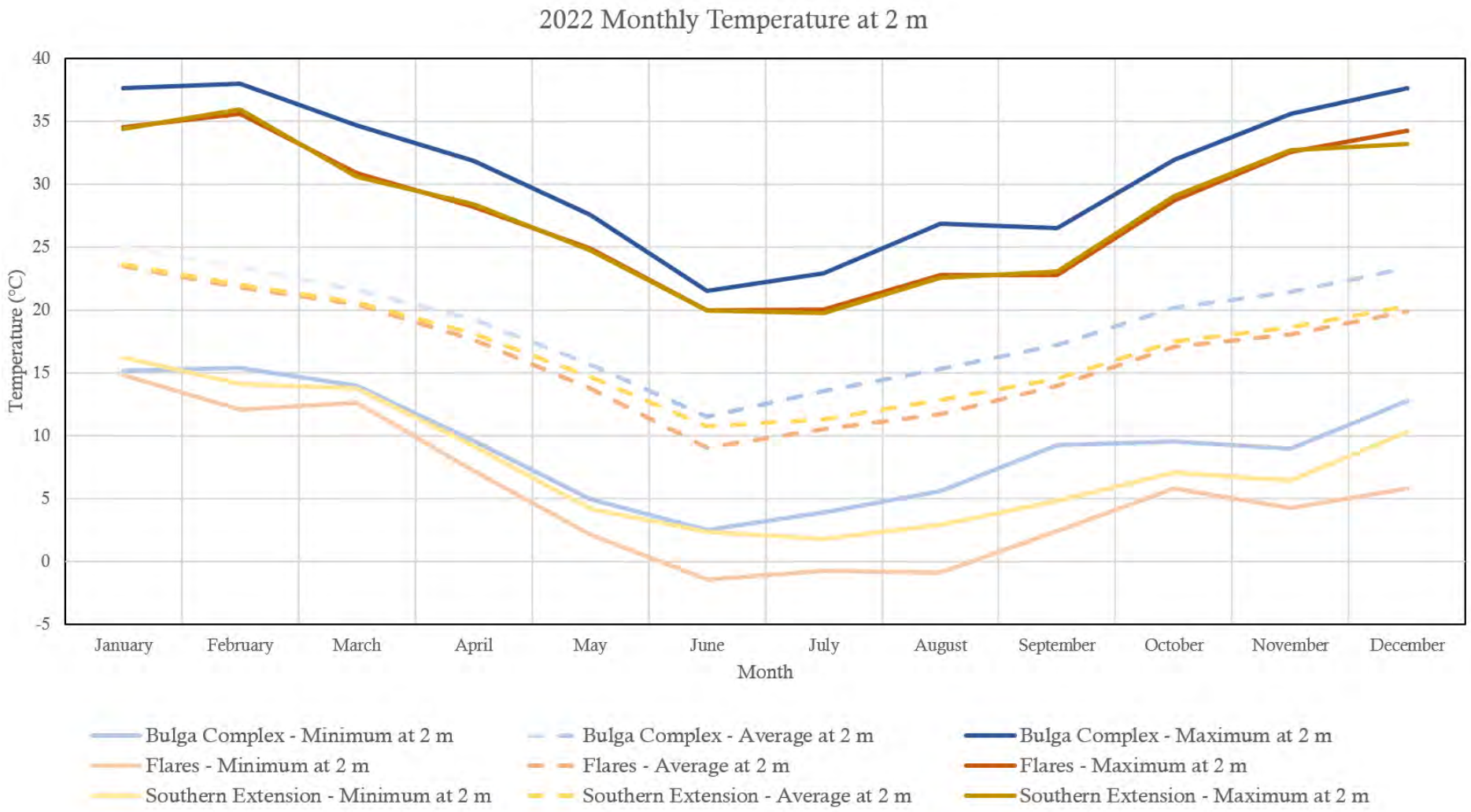


Figure 9 2022 Monthly Temperature 2 m (Degrees Celsius) at Representative Monitoring Stations

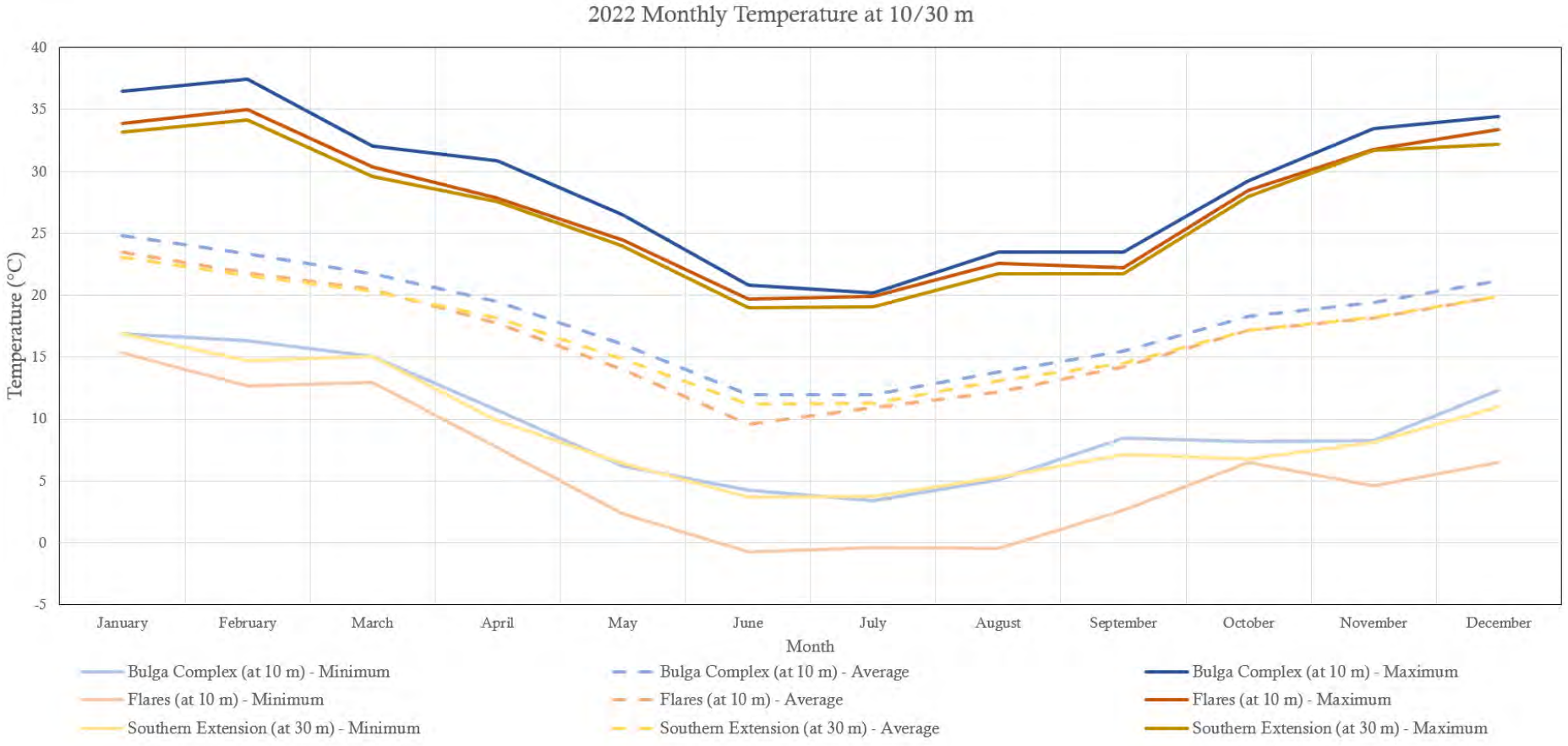


Figure 10 2022 Monthly Temperature 10 m/30 m (Degrees Celsius) at Representative Monitoring Stations

Table 14 2022 Relative Humidity (%) at Representative Monitoring Stations

Relative humidity (%)	Bulga Complex			Flares			Southern Extension		
Month	Minimum	Average	Maximum	Minimum	Average	Maximum	Minimum	Average	Maximum
January	35.1	74.4	99.2	31.4	69.7	95.8	27.3	75.9	102.0
February	22.0	74.7	97.3	19.4	71.2	94.8	15.7	76.1	100.8
March	39.1	82.0	99.3	35.3	78.8	95.8	40.1	80.9	102.1
April	32.9	79.3	99.8	28.8	77.4	96.4	*	*	*
May	27.8	81.0	99.7	22.4	81.1	97.1	36.0	81.0	99.4
June	30.3	71.2	98.3	28.8	73.3	95.2	30.0	71.5	98.5
July	34.5	79.6	100.9	29.4	78.3	96.9	31.8	78.8	99.3
August	29.5	74.1	100.4	26.1	73.2	96.8	28.1	71.6	98.5
September	31.7	75.1	100.7	28.0	73.1	97.7	29.8	72.8	98.6
October	28.4	75.9	101.1	23.7	72.7	98.7	21.2	72.9	99.2
November	23.8	63.2	100.2	20.2	61.1	98.0	19.6	60.5	98.5
December	16.0	62.8	98.0	10.7	59.9	96.5	11.6	60.2	95.9

* Relative humidity was not monitored continuously at the Southern Extension Meteorological Station due to an equipment failure on the relative humidity sensor from March 2022 to May 2022, when the sensor was replaced.

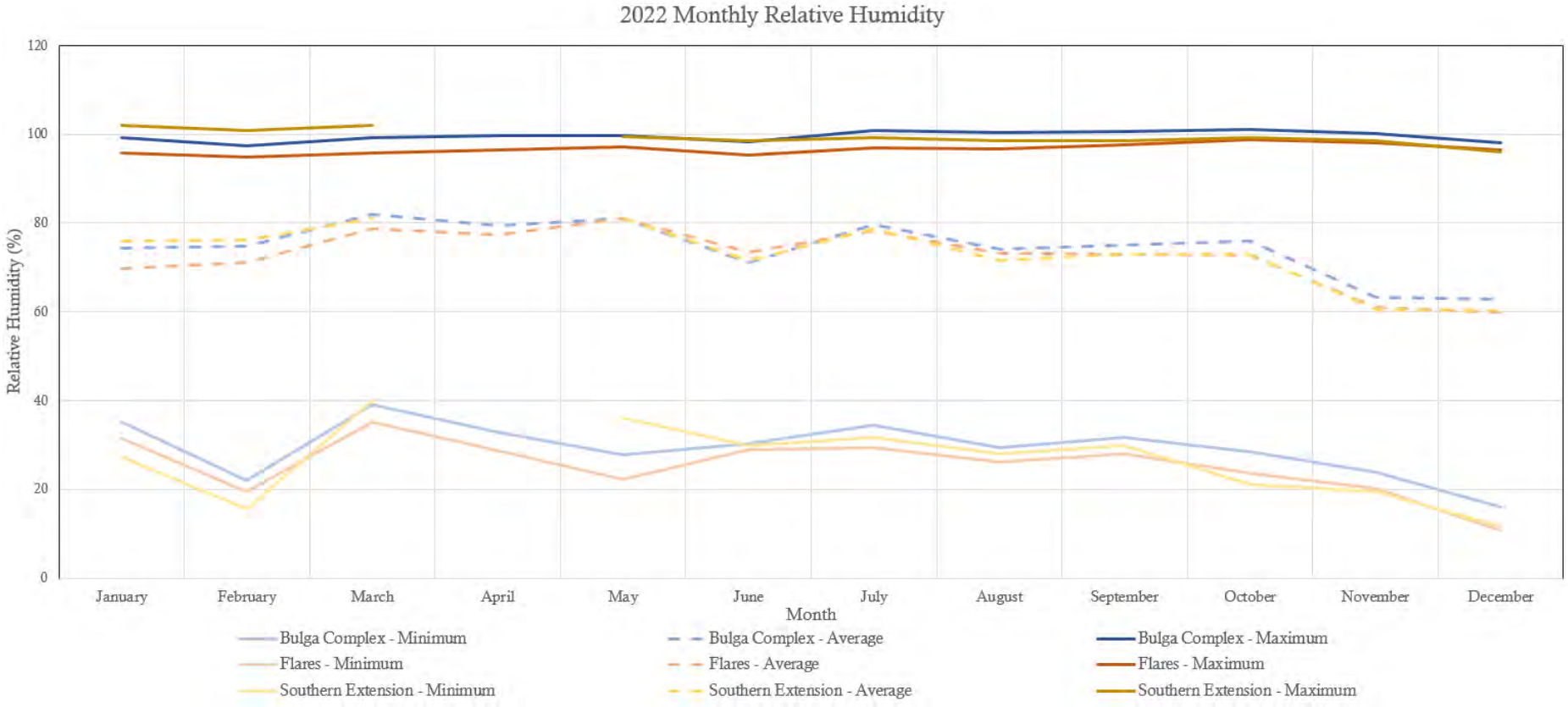


Figure 11 2022 Relative Humidity (%) at Representative Monitoring Stations

Table 15 2022 Wind Speed at Representative Monitoring Stations

Wind speed (m/s)	Bulga Complex			Flares			Southern Extension		
Month	Minimum	Average	Maximum	Minimum	Average	Maximum	Minimum	Average	Maximum
January	0.0	2.8	11.3	0.0	1.7	6.4	0.5	4.4	11.5
February	0.0	3.0	11.9	0.0	1.7	6.5	0.2	4.6	13.8
March	0.0	2.8	9.9	0.0	1.4	5.2	0.1	4.3	11.9
April	0.0	2.4	8.7	0.0	1.2	5.8	0.3	3.8	10.5
May	0.1	2.4	11.5	0.0	1.1	9.4	0.2	3.6	13.1
June	0.0	2.8	8.4	0.0	1.4	8.5	0.2	4.2	14.3
July	0.0	2.7	11.7	0.0	1.3	7.1	0.2	4.2	15.9
August	0.0	2.7	9.2	0.0	1.5	8.5	0.2	3.9	14.1
September	0.0	2.9	9.9	0.0	1.5	7.8	0.2	4.2	12.6
October	0.0	2.5	9.4	0.0	1.5	9.3	0.3	4.1	14.2
November	0.0	3.0	9.2	0.0	1.8	9.7	0.2	4.7	14.9
December	0.0	2.9	9.0	0.0	1.6	9.6	0.2	4.5	16.1

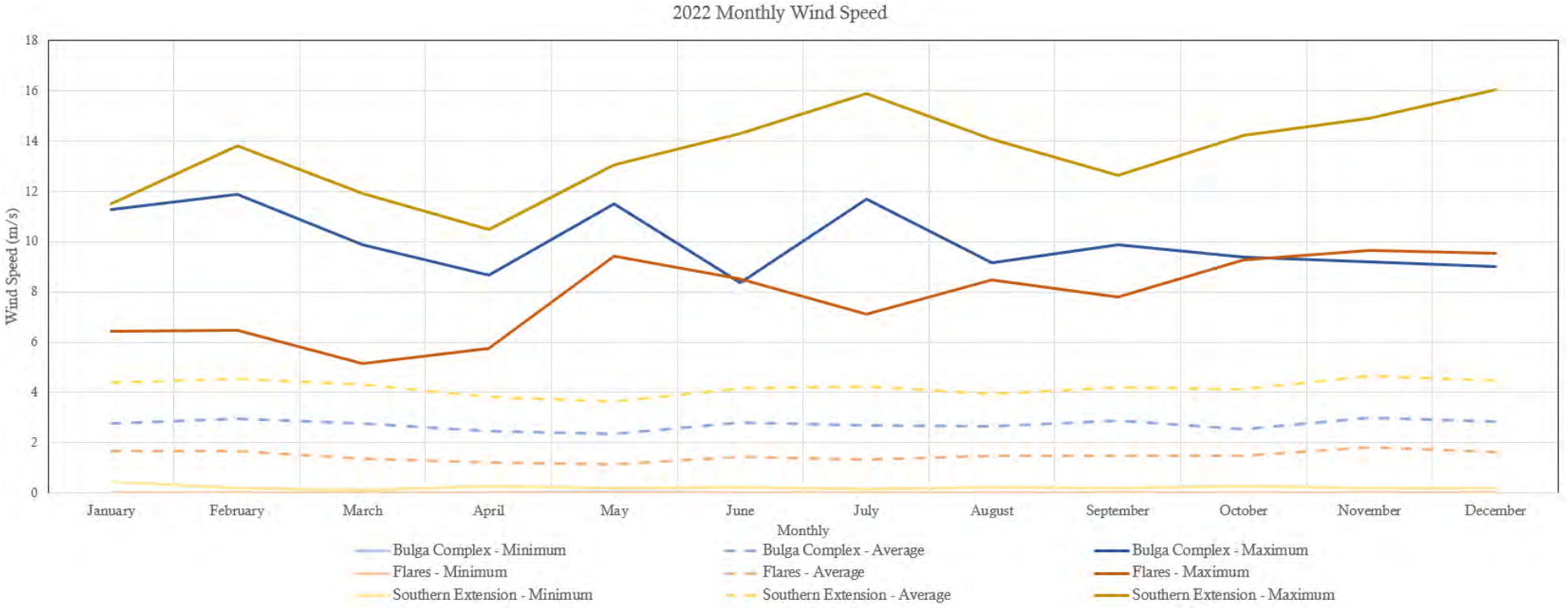


Figure 12 2022 Wind Speed at Representative Monitoring Stations

Table 16 2022 Wind Direction at Representative Monitoring Stations

Wind direction (degrees)	Bulga Complex			Flares			Southern Extension		
Month	Minimum	Average	Maximum	Minimum	Average	Maximum	Minimum	Average	Maximum
January	0.0	145.8	359.5	0.0	146.3	359.9	0.1	151.4	359.6
February	0.7	165.3	359.7	0.0	155.6	359.8	0.1	166.6	359.9
March	0.0	166.4	359.7	0.0	159.6	359.9	0.2	169.4	358.5
April	0.0	199.6	359.9	0.0	169.8	359.9	0.0	194.7	360.0
May	0.0	223.7	359.8	0.0	175.4	359.9	0.4	216.9	360.0
June	0.0	279.5	359.9	0.0	207.2	359.8	0.0	269.2	359.9
July	0.0	236.0	360.0	0.0	190.3	359.9	0.1	224.1	359.8
August	0.1	247.3	359.8	0.0	209.0	360.0	0.1	235.1	359.8
September	0.0	212.4	359.8	0.0	186.9	359.6	0.0	204.6	359.9
October	0.0	187.5	359.8	0.0	167.4	359.8	0.3	185.2	359.9
November	0.0	202.1	359.8	0.0	177.1	359.9	0.1	196.7	360.0
December	0.4	181.8	359.7	0.0	162.4	360.0	0.6	180.6	359.6

Table 17 2022 Sigma Theta at Representative Monitoring Stations

Sigma theta (degrees)	Bulga Complex			Flares			Southern Extension		
Month	Minimum	Average	Maximum	Minimum	Average	Maximum	Minimum	Average	Maximum
January	0.0	18.9	94.6	0.0	26.3	98.2	1.6	13.5	97.5
February	0.0	17.4	80.0	0.0	25.8	99.4	1.7	12.6	97.5
March	0.0	15.4	85.7	0.0	24.6	87.3	1.3	11.6	96.4
April	0.0	15.6	79.5	0.0	20.3	92.8	1.0	12.6	99.9
May	0.8	15.1	77.3	0.0	18.5	80.3	1.0	12.4	95.9
June	0.0	15.0	80.3	0.0	16.0	91.4	0.0	11.1	89.2
July	0.0	14.5	77.1	0.0	23.5	92.9	1.0	11.3	92.1
August	0.3	15.7	87.6	0.0	21.7	96.3	1.2	13.2	97.3
September	0.0	16.9	99.1	0.0	23.0	97.4	1.5	13.2	87.2
October	0.0	18.3	95.4	0.0	21.2	91.0	0.9	13.5	98.4
November	0.0	19.5	88.5	0.0	22.7	90.3	1.1	14.4	100.1
December	2.9	19.7	93.0	0.0	24.3	91.1	1.2	14.0	100.7

Wind Speed and Direction

Wind speed and direction at Bulga during 2022 has been summarised in **Figure 13** to **Figure 16**.

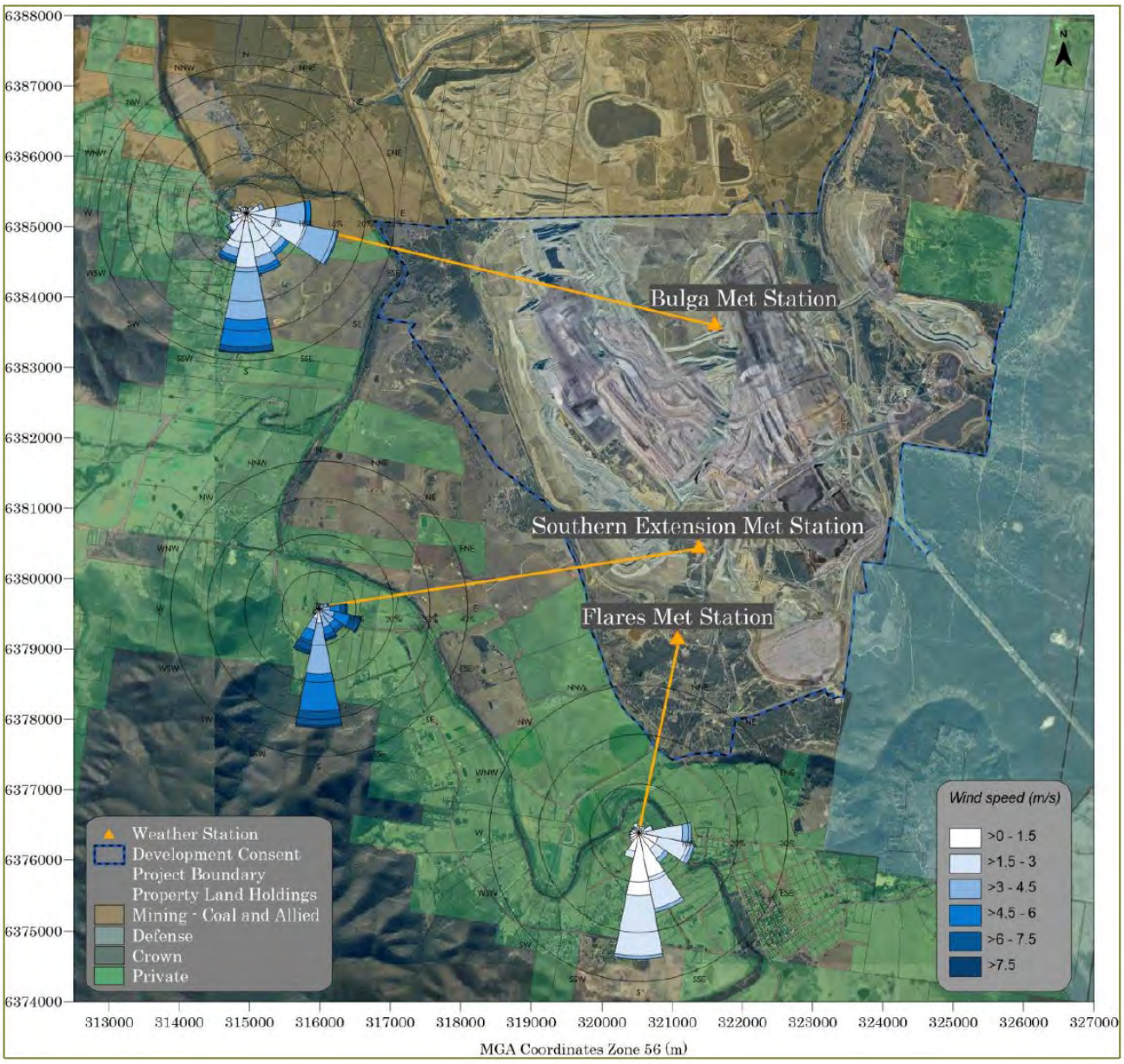


Figure 13 Wind Speed and Direction Quarter 1

The Bulga Meteorological Station, Southern Extension station and Flares station predominantly recorded winds originating from the south in Q1 2022. The calms recorded at the Flares Meteorological station were most likely due to sheltering from vegetation.

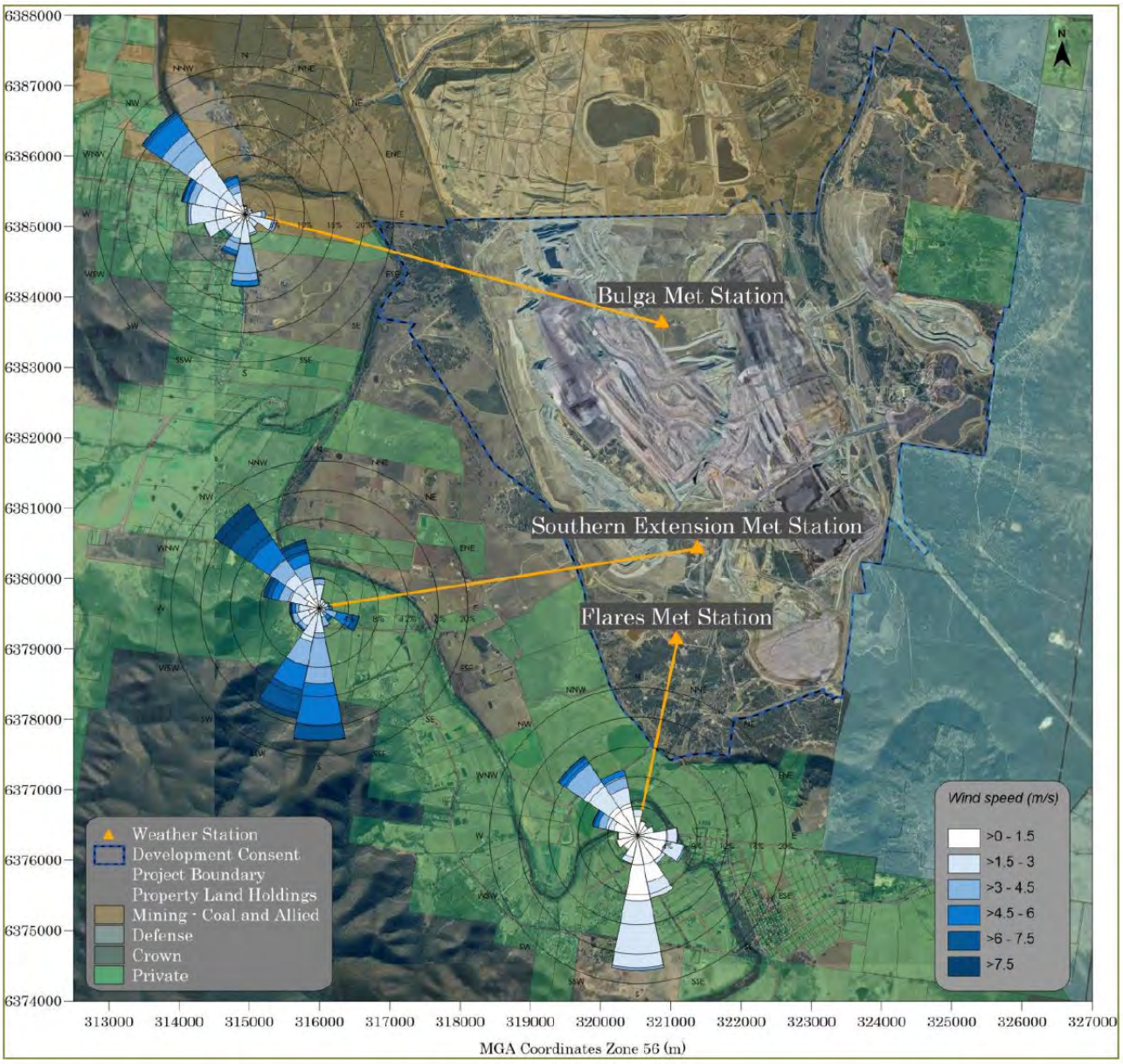


Figure 14 Wind Speed and Direction Quarter 2

The Bulga Meteorological Station predominantly recorded winds originating from the northwest, the Southern Extension station predominantly recorded winds from the northwest, south and south-southwest and the Flares station predominantly recorded winds from the south in Q2 2022. The calms recorded at the Flares Meteorological Station were most likely due to sheltering from vegetation.

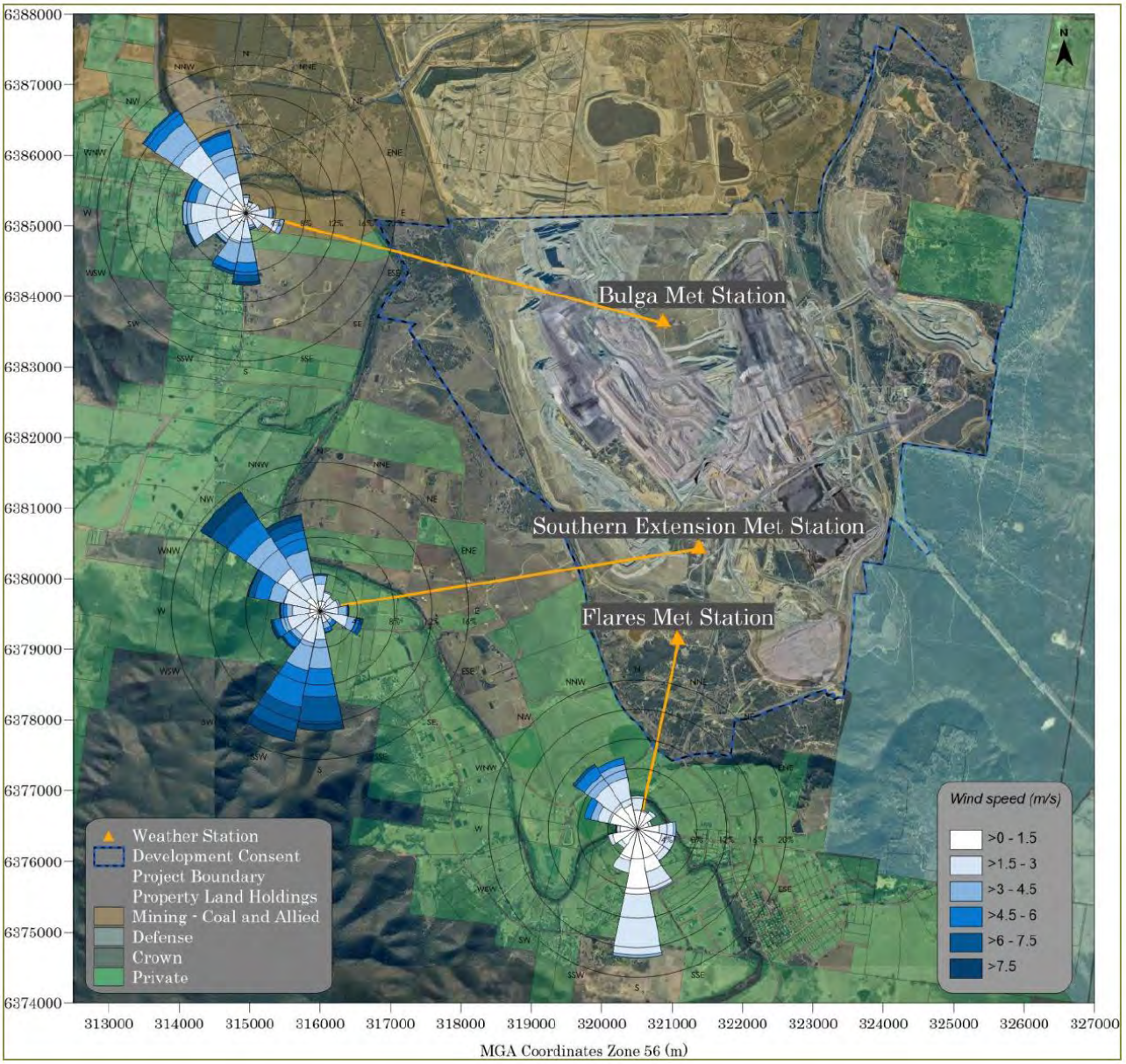


Figure 15 Wind Speed and Direction Quarter 3

The Bulga Meteorological Station predominantly recorded winds originating from the northwest, the Southern Extension station predominantly recorded winds originating from the northwest and south-southwest. The Flares station predominantly recorded winds from the south in Q3 2022. The calms recorded at the Flares Meteorological Station were most likely due to sheltering from vegetation.

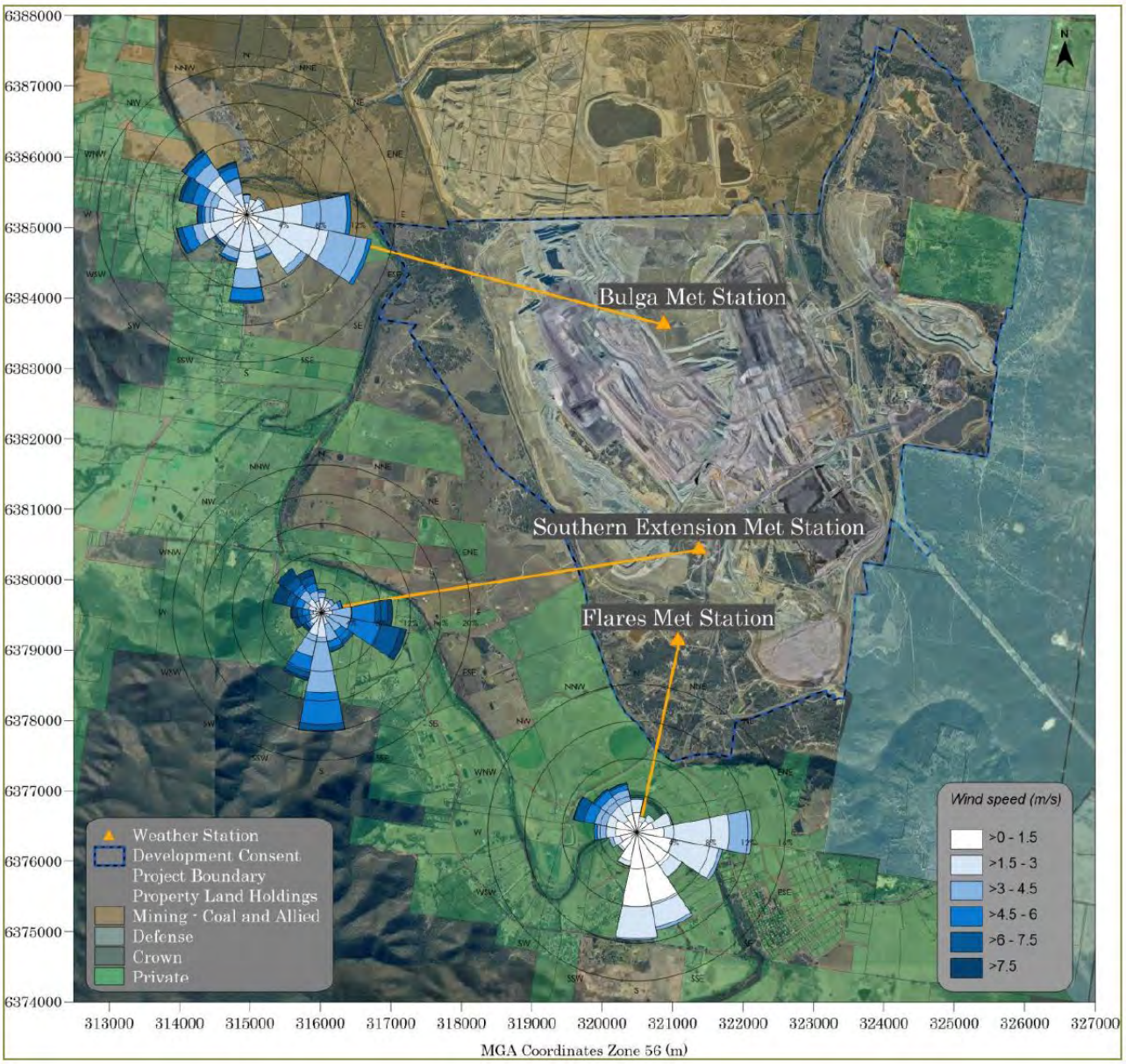


Figure 16 Wind Speed and Direction Quarter 4

The Bulga Meteorological Station, Southern Extension station and Flares station recorded variable wind directions with the highest proportions being from the east, east-southeast and south and with fewer winds originating from the north to east-northeast in Q4 2022. The calms recorded at the Flares station were most likely due to sheltering from vegetation.

6.2 Noise

6.2.1 Environmental Management

Noise monitoring is undertaken in accordance with the *Bulga Coal Noise Management Plan*.

The location of noise monitoring sites is shown on **Figure 6**. The monitoring program includes:

- Monthly attended night-time monitoring at nine locations;
- Real-time monitoring at four locations;
- Sound power testing of a representative sample of the open cut fleet; and
- Additional monitoring as initiated by alarms or in response to community concerns.

The real-time monitoring network assists with the management of noise impacts from mining operations. Monitors are operated at locations representative of Broke, Fordwich, Milbrodale and Bulga. Data is recorded continuously and reported real-time to the Bulga Open Cut control room via an internal website. Dispatch is notified of noise levels that are approaching or exceeding the Development Consent noise criteria. Return to work alarms are implemented to alert Dispatch to a change to non-noise enhancing weather conditions. Dispatch and Open Cut Examiners (OCE) investigate noise sources and make changes to reduce noise, where required. The noise criteria is found in Appendix 6 of SSD-4960 and shown in **Table 18**. Compliance with this criteria was assessed in attended monitoring during 2022.

Sound power testing involves testing a representative sample of the open cut fleet annually. Every item of mobile equipment is tested at least once every three years. Measured sound power levels are compared to levels included in the *Bulga Surface Operations Eastern Emplacement Area Modification Statement of Environmental Effects* (SEE) dated July 2016, including the *Bulga Surface Operations Eastern Emplacement Area Modification Response to Submissions* (RTS) dated December 2016. Individual items that exceed specified levels by 3 dB or more are investigated to assess the cause of the exceedance. Defects are rectified as soon as practicable.

The total measured fleet-wide (logarithmic) averages of mobile plant for the current sound power testing campaign are calculated annually. The total measured fleet averages should remain equal to or less than 2 dB of the relevant modelled fleet averages.

6.2.2 Environmental Performance

Attended Noise Monitoring

A summary of attended noise monitoring data for each monitoring location (**Figure 6**) is shown in **Table 18**. Results are presented as the maximum noise levels from Bulga Coal at each location during 2022. A detailed discussion of monitoring results is provided in monthly noise monitoring reports available on the Bulga Coal website (https://www.glencore.com.au/operations-and-projects/coal/current-operations/bulga-coal/monitoring-documents). Bulga Coal were compliant with the Noise Management Plan.

Table 18 Summary of Attended Noise Monitoring Data – 2022

Location	Bulga Coal Noise Monitoring Results – dBA (Max)		Bulga Coal Project Specific Noise Criteria – dBA	
	LAeq(15minute)	LA1(1minute)	LAeq(15minute)	LA1(1minute)
BCC1 (Bulga Village)	32	41	35	45
BCC2 (2241 Putty Road)	34	42	35	
BCC3 (803 Milbrodale Road)	31	36	35	
BCC4 (115 Hill Street)	31	39	35	
BCC5 (Broke Cemetery)	33	44	35	
BCC7 (179 Cobcroft Road)	34	44	36	
BCC8 (154 Cobcroft Road)	**40**	**52**	36	
BCC9 (Mitchell Line Road)	**37**	29	35	
BCC10 (Blaxland Steet)	30	35	35	

Exceedances recorded during the attended noise monitoring included:

- BCC8 – 154 Cobcroft Road:
  - A 3 dB exceedance of the LA1(1 minute) noise criterion and a 4 dB exceedance of the LAeq noise criterion was recorded on 20 July 2022. This was mainly caused by engine/exhaust continuum and dozer track noise. Dispatch was notified and a follow up noise measurement was undertaken. Noise levels were compliant during the follow up measurement.
  - A 1 dB exceedance of the LAeq noise criterion and a 7 dB exceedance of the LA1(1 minute) noise criterion was recorded on the 17 August 2022. This was mainly caused by the mining continuum and impact noise. Dispatch was notified and a follow up noise measurement was undertaken. Noise levels were compliant during the follow up measurement.
- BCC9 – Mitchell Line Road:
  - A 2 dB exceedance of the LAeq noise criterion was recorded on the 18 August 2022, after applying a low frequency modifying factor of +2 dB. This was mainly caused by the mining continuum. Dispatch was notified and a follow up noise measurement was undertaken. Noise levels were compliant during the follow up measurement.

On one occasion during the attended noise monitoring in May 2022, monitoring point BCC1 (Bulga Village) was accidentally omitted from the monitoring. Given the very low noise levels recorded at all other monitoring points during that night it is expected that the location would also be compliant. Results from the May noise attended monitoring are presented in **Table 19**. The requirement to adhere to the monitoring procedure was reinforced with the noise consultant.

Table 19 $L_{Aeq, 15min}$ and $L_{A1, 1 min}$ Generated by Bulga Coal against Impact Assessment Criteria

Location	Start Date and Time	$L_{Aeq, 15 min}$ dB		$L_{A1, 1 min}$ dB	
		Criterion	Bulga Coal	Criterion	Bulga Coal
BCC2	17/05/2022 – 23:30	35	<25	45	<25
BCC3	18/05/2022 – 00:00	35	<25	45	25
BCC4	18/05/2022 – 00:31	35	IA*	45	IA*
BCC5	17/05/2022 – 23:24	35	28	45	32
BCC7	17/05/2022 – 22:57	36	IA*	45	IA*
BCC8	17/05/2022 – 22:27	36	IA*	45	IA*
BCC9	18/05/2022 – 00:12	35	IA*	45	IA*
BCC10	18/05/2022 – 00:00	35	<25	45	27

* IA: Inaudible, no site noise was audible at the monitoring location.

Mobile Plant Sound Power Testing

2022 was the first year of the new three-year testing cycle (2022 – 2024). During the reporting period 2022 sound power testing was undertaken by Global Acoustics (now EMM Consulting Pty Ltd) (EMM, 2023). During 2022 measurements were taken on 34 items of mobile plant, which corresponds to 33% of the entire fleet.

Average sound power levels across the make/model mobile plant tested in 2022 were within 2 dB of the noise targets, except for the larger Hitachi and CAT excavators; the larger excavators fleet average was +4 dB (L_w) and +1 dBA (L_{WA}) above modelled levels; individual items that did not meet the targets will be inspected. Total sound power will be calculated at the conclusion of the three-yearly testing campaign.

Sound attenuation packages on trucks are inspected every three to four weeks and replaced every four years. Some variation across the fleet is expected as individual units will be at different stages of their build cycle.

Individual items of plant that did not meet the targets by more than 3 dB will be inspected and defects fixed, where required. Corrective actions for plant that exceeded the sound power targets by 3 dB or more are listed below:

- The D11T to be inspected and defects fixed, if required;
- The Hitachi EX5600 is planned to be inspected and defects fixed;
- A number of components on the 793C/D haul trucks will be inspected and replaced; and
- A number of components on the 789D haul trucks will be inspected and replaced.

6.2.3 Comparison Against Predictions

The *Noise Impact Assessment for the Bulga Optimisation Project – Eastern Emplacement Area Development Consent Modification* (Global Acoustics, 2016) predicted Bulga Coal only noise levels from reasonable worst-case operating conditions throughout the life of the open cut mine. Modelling was done for Year 4 of the Bulga Optimisation Project. *The Bulga Extension Project Noise Impact Assessment* (Global Acoustics, 2019) and the *Bulga Extension Project Noise Impact Assessment* (Global Acoustics, 2019b) (for Modification 3) stated the modification would comply with approved noise limits at all receptor locations throughout the mining progression with an appropriate level of noise mitigation applied during periods of adverse meteorological conditions. Therefore, the existing predictions remain the same.

As noted in **Section 6.2.2**, attended monitoring results in 2022 were compliant with SSD-4960 noise criteria. Five exceedances did occur during 2022 which were deemed within criteria after follow-up measurements had been taken (refer **Section 6.2.2**). This shows that measured noise levels were managed in accordance with the Noise Management Plan and generally below reasonable worst-case night-time predictions made for the Bulga Optimisation Project.

6.2.4 Long Term Analysis

Table 20 shows the number of noise criteria exceedances recorded by Bulga Coal during the period from 2011 to 2022.

Table 20 Summary of Exceedances by Noise Monitoring Location 2011-2022

Location	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Total
BCC1	0	1	0	0	0	0	0	0	0	0	0	0	1
BCC2	0	0	0	0	0	0	0	0	0	0	0	0	0
BCC3	0	0	0	0	0	0	0	1	0	0	0	0	1
BCC4	0	0	0	0	0	0	0	1	0	0	0	0	1
BCC5	0	0	0	0	1	0	1	2	0	0	2	0	6
BCC6	0	0	0	0	0	1	0	-[1]	-[1]	-[1]	-[1]	-[1]	1
BCC7	0	1	0	0	0	4	0	1	0	0	0	0	6
BCC8	0	0	0	0	0	0	0	0	0	0	0	4	4
BCC9	-[1]	-[1]	-[1]	-[1]	-[1]	-[1]	0	0	0	0	0	1	1
BCC10	-[1]	-[1]	-[1]	-[1]	-[1]	-[1]	-[1]	1	0	0	0	0	1
Total	0	2	0	0	1	5	1	6	0	0	2	5	21

[1] Noise levels not monitored at this location.

As indicated in **Table 20**, occasional exceedances of the Bulga Coal noise criteria have been recorded during the period from 2011 to 2022, with a slight increase observed in 2021/2022. However, the results show that very few noise exceedances attributable to Bulga Coal have occurred over the period 2011 to 2022, indicating that noise impacts from Bulga Coal are well managed.

6.2.5 Implemented/Proposed Improvements

The *Noise Management Plan* was revised in February 2022 and was approved on 9 March 2022 by DPE.

Changes to Noise Monitoring or Management

Changes to the Noise Management Plan and Noise Management Procedure during 2022 included:

- SX64 real-time noise monitor moved from Fordwich to Blaxland Street;
- Change to the alarm period from two 15 minute periods to six 5 minute periods. The change to polling and displaying data at shorter intervals was to provide more immediate noise results to Dispatch; and
- The removal of SX123 real-time noise monitor.

Continuous Improvement

Continuous improvement to noise management during 2022 included:

- Dual skin exhaust was trialled on two 793D trucks. Preliminary results indicate that the exhaust system had minimal effect on the sound power levels;
- Individual items of plants that did not meet the targets by more than 3dB will be inspected and defects fixed, if required; and
- Introduction to site of Komatsu 930E haul trucks which have sound power levels of approximately 113 dBA which is approximately 2 dB less than the Cat 793 trucks they are replacing.

6.3 Blasting

6.3.1 Environmental Management

Blasting is undertaken in accordance with the *Blast Management Plan*. Monitoring is carried out to assess air blast overpressure and ground vibration impacts to the nearest privately owned residents.

Private property blast impact assessment criteria are provided in **Table 21**. The criteria compliance monitoring locations (Dawtrey, Bulga, Charlton and Hedley) are shown in **Figure 6**.

Table 21 Private Property Amenity Impact Assessment Criteria

Airblast Overpressure Level (dB(Lin Peak))	Ground Vibration Peak Particle Velocity (ppv)	Allowable Exceedance
115	5 mm/s	5% of the total number of blasts over a period of 12 months
120	10 mm/s	0%

Blasting is managed to minimise ground vibration at public infrastructure. Infrastructure impact assessment criteria are provided in **Table 22**. Vibration monitoring is undertaken when the predictions from the scaled distance model are greater than or equal to 80% of the criteria. During the year, monitoring was undertaken at Pole 29 of the 330 kV powerline as shown in **Figure 6**.

Table 22 Infrastructure Impact Assessment Criteria

Infrastructure	Ground Vibration peak particle velocity (ppv)	Allowable Exceedance
330 kV Suspension Towers, Private Irrigation District (PID) Pipeline and public roads	100 mm/s	0%
Declared dams	50 mm/s	0%
All other public infrastructure	50 mm/s (Unless the Planning Secretary has agreed to an alternative a specific limit determined in accordance with the structural design methodology in AS2187.2-2006, or its latest version)	0%

Heritage blast vibration impact assessment criteria are listed in **Table 23**. The Bulga, Charlton and Dawtrey blast monitors shown in **Figure 6** are used to assess compliance.

Table 23 Heritage Impact Assessment Criteria

Heritage Site	Ground vibration ppv	Allowable Exceedance
'Mt Leonard Homestead', **BH14 – 'Charlton',** **B13 – Stone Wall alongside Monkey Place Creek,** **St Andrews Anglican Church,** **BH6 – Broke Cemetery,** **Murinbin House Group.**	5 mm/s	0%

6.3.2 Environmental Performance

179 blasts from Bulga Open Cut were recorded during 2022. Monitoring data is available on the Bulga Coal website, with a summary provided in **Table 24** to **Table 26**. During 2022 no blast exceeded the overpressure or ground vibration exceedance criteria.

Table 24 2022 Private Property Overpressure and Vibration Monitoring Results

Monitoring Location	Airblast Overpressure Level dBL (Lin Peak)				Ground Vibration ppv (mm/s)			
	Average	Max	Results >115 dBL	Results >120 dBL	Average	Max	Results >10 mm/s	Results >5 mm/s
Bulga	94.4	114.5	0 (0%)	0 (0%)	0.2	1.95	0 (0%)	0 (0%)
Charlton	91.8	113.6	0 (0%)	0 (0%)	0.3	2.08	0 (0%)	0 (0%)
Dawtrey	94.8	114.7	0 (0%)	0 (0%)	0.3	2.91	0 (0%)	0 (0%)
Hedley	92.5	111.1	0 (0%)	0 (0%)	0.1	0.37	0 (0%)	0 (0%)

Table 25 2022 Infrastructure Vibration Monitoring Results

Monitoring Location	Ground Vibration ppv (mm/s)		
	Average	Max	Results > 100 mm/s
330 kV Pole 29	1.02	10.96	0 (0%)

Table 26 2022 Declared Dam (Northern Tailings Storage Facility) Vibration Monitoring Results

Monitoring Location	Ground Vibration ppv (mm/s)		
	Average	Max	Results > 50 mm/s
Northern Tailings Storage Facility – Cell A	0.42	2.61	0 (0%)
Portable Blast NTSF – Cell B	0.23	2.17	0 (0%)

The Northern Tailings Storage Facility – Cell A wall monitor (location shown on **Figure 6**) was decommissioned is September 2022. The intent of the Cell A monitor was to monitor vibration along the internal NTSF Cell A wall; with progression of the tailings deposition the wall was soon to be covered and the monitor no longer required. Monitoring of Cell B will continue.

6.3.3 Comparison Against Predictions

A *Blasting Noise and Vibration Impact Assessment* (Wilkinson Murray, 2012) was undertaken as part of the Bulga Optimisation Project EIS. The assessment noted that blasting would be managed to meet the amenity air blast and vibration criteria identified for inclusion in the Development Consent and EPL. The results are consistent with predictions.

6.3.4 Implemented/Proposed Improvements

In 2022 Bulga Open Cut completed a minor review of the blast impact assessment in the blast design sheet to account for the change in blasting locations over time and the southerly progression of the mining operations. Changes to monitoring included the decommissioning of the NTSF – Cell A monitor, to allow continued emplacement of tailings in the facility.

6.4 Air Quality

6.4.1 Environmental Management

Bulga Coal implements controls to mitigate air quality impacts in accordance with the Eastern Emplacement Area Management Framework (EEAMF) and the Air Quality and Greenhouse Gas Management Plan. The Air Quality and Greenhouse Gas Management Plan was revised in 2020 for SSD-4960 Modification 3 and DA 376-8-2003 Modification 7 and was approved by DPE on 9 May 2022.

Bulga Coal operates a monitoring network to assess air quality impacts on surrounding communities. The monitoring network (refer **Figure 5**) consists of:

- Air quality monitors required by the relevant consents:
  - Eleven Dust Deposition Gauges (DDGs) (four of which are directional) used for monitoring of larger dust particles (typically >50 micrometres [µm]). DDGs are sampled monthly (+/- 2 days) and results include the insoluble (mineralogical) matter (IM) and ash residue (organic);
  - Three High Volume Air Samplers (HVAS) that monitor Total Suspended Particulates (TSP) over a 24-hour period every sixth day, known as D10, Dawtrey and Hill Street monitors;
  - Five Tapered Element Oscillating Microbalance (TEOM) continuous air quality monitors that measure the concentration of PM_{10}, located at Putty Road (D3), Dawtrey (D5), Hill Street (D1), Mitchell Line Road (D11) and the Mushroom Composting Facility (D4); and
  - Two Beta Attenuation Monitors (BAM) located at Hill Street (D2) and Putty Road (D10) that measure the concentration of particulate matter less than 2.5µm in diameter ($PM_{2.5}$).
- Air quality monitors required by EPL 563:
  - Two E-BAM monitors continuously measuring PM_{10}, at EPL Point 9 and EPL Point 10 at the north-west and south-east of the EPL premises, respectively.

6.4.2 Environmental Performance

The environmental performance presented below includes the data from the Bulga Coal monitors including DDGs, HVAS, TEOMs, BAMs and E-BAMs.

Table 27 presents the SSD-4960 Mod 3 air quality criteria.

Table 27 Air Quality Criteria SSD-4960 Mod 3

Pollutant	Averaging Period	Criterion	
Particulate Matter <10 µm (PM_{10})	Annual	[a,c] 25 µg/m³	
	24-hour	[b] 50 µg/m³	
Particulate Matter <2.5 µm ($PM_{2.5}$)	Annual	[a,c] 8 µg/m³	
	24-hour	[b] 25 µg/m³	
Total Suspended Particulates (TSP)	Annual	[a,c] 90 µg/m³	
[d] Deposited Dust	Annual	[b] 2 g/m²/month	[a] 4 g/m²/month

[a] Total impact (i.e. incremental increase in concentrations due to the development plus background concentrations due to all other sources).

[b] Incremental impact (i.e. incremental increase in concentrations due to the development on its own).

[c] Excludes extraordinary events such as bushfires, prescribed burning, dust storms, fire incidents or any other activity agreed to by the Planning Secretary.

[d] Deposited dust is to be assessed as insoluble solids as defined by Standards Australia, AS/NZS 3580.10.1:2003: Methods for Sampling and Analysis of Ambient Air – Determination of Particulate Matter – Deposited Matter – Gravimetric Method.

In 2022, there were no days declared as "extraordinary air quality events" by DPE.

Depositional Dust Monitoring

Depositional dust monitoring results are summarised in **Table 28**. Monitoring results are available on the Bulga Coal website.

Table 28 Summary of Dust Deposition Monitoring Results – 2022 Annual Average

Offsite Gauge		IM Deposited ($g/m^2/mth$)	Ash Residue ($g/m^2/mth$)	Adopted Consent Criteria ($g/m^2/mth$)
Code	General Location			
A3	Inlet Road	0.8	0.5	4.0
C5 (DR[1])	Mount Eyre Vineyard	0.5	0.3	
D6	Howe Street	1.5	0.9	
D9	Inlet Road	0.6	0.4	
D10	Putty Road	1.5[2]	0.7	
F3 (DR[1])	Fordwich	1.3	0.8	
N5 (DR[1])	Putty Road	0.7	0.5	
Redibar	Redibar	1.1	0.6	
Sharrock 1	Sharrock	0.6	0.2	
Hedley	Mitchell Line Road	1.1	0.7	
F2 (DR[1])	Cobcroft Rd	0.6	0.3	

[1] Indicates Directional Depositional Dust Monitor.

[2] One monthly sample invalid due to damaged funnel. Three monthly samples deemed to be contaminated from excessive bird droppings.

There were no exceedances of the depositional dust criteria during 2022. There was a decrease in the monthly deposited dust levels across most sites during 2022 compared with previous years, likely due to the wetter conditions experienced throughout 2022.

High Volume Air Sampling

Table 29 presents a summary of monitoring results and compares annual averages for TSP against consent criteria. Results include dust from mine (including neighbouring operations) and non-mine sources and are not attributable to Bulga Coal only.

Annual averages were below the relevant criteria at all locations in 2022.

Table 29 Summary of 2022 HVAS Annual Average Results

Gauge	Annual Average (µg/m3) (excluding extraordinary events)
	TSP ($\mu g/m^3$)
Consent Criteria	90
Dawtrey	15.3
Putty Road (D10)	17.2
Hill Street (D2)	13.4

Continuous Monitoring

A summary of the recorded PM_{10} levels at the TEOM units is presented in **Table 30**.

The annual PM_{10} averages were below the criterion of 25 µg/m³ at all monitoring locations, Hill St (D1), Putty Rd (D3), Dawtrey (D5) and Mitchell Line Rd (D11).

The maximum 24-hour PM_{10} were generally lower than 2021 at all sites which can likely be attributed to the wetter conditions in 2022. No days recorded an exceedance of the criterion.

Table 30 Summary of TEOM 2022 Monitoring Results

Gauge	Annual Average PM_{10} (µg/m³)		Maximum 24-hour Average PM_{10} (µg/m³)	
	PM_{10} (µg/m³) [1]	Number of days exceeding criterion	PM_{10} (µg/m³) [1]	Number of days exceeding criterion
Consent Criteria	25	-	50	-
Hill Street (D1)	9.3	-	38.2	-
Putty Road (D3)	10.7	-	27.4	-
Dawtrey (D5)	10.3	-	31.2	-
Mitchell Line Road (D11)	12.1	-	34.9	-

[1] Excluding extraordinary events.

Table 31 presents a summary of the recorded $PM_{2.5}$ levels at the BAM monitors.

The D2 monitor (Hill St) did not record valid data from the start of the reporting period to 29 April 2022. Considerable efforts were made to identify what was causing the recorded data to be invalid. Investigations concluded that the heater and temperature sensor cable were faulty and were replaced on the 29 April 2022. The annual average was calculated using the valid data. Given the low PM_{10} annual average results recorded at the adjacent monitor (D1 – Hill St), it is not expected for the D2 annual average to be different from that calculated.

The annual $PM_{2.5}$ averages were below the relevant criterion of 8 µg/m³ at D2 (Hill St) and D10 (Putty Rd).

The maximum 24-hour $PM_{2.5}$ averages were below the relevant criterion of 25 µg/m³ during 2022.

Table 31 Summary of BAM 2022 Monitoring Results

Gauge	Annual average $PM_{2.5}$ (µg/m³)		Maximum 24 hour average $PM_{2.5}$ (µg/m³)	
	$PM_{2.5}$ (µg/m³)	Number of days exceeding criterion	$PM_{2.5}$ (µg/m³)	Number of days exceeding criterion
Consent Criteria	8	-	25	-
Putty Road (D10)	3.4	-	12.3	-
Hill Street (D2)	2.8 (66%) *	-	9.1	-

* Recorded data.

Onsite EPL Monitors

In accordance with the requirements of EPL 563, Bulga Coal operated two E-BAM type continuous air quality (PM_{10}) monitors close to the EPL premises boundary.

The data is analysed with wind speed and wind direction data to estimate the Bulga Coal PM_{10} contribution at each location. The monitors are not used to assess compliance with the air quality criteria in the Development Consent; they inform the Bulga Open Cut Air Quality Trigger Action Response Plan (TARP). Alarms are generated in the control room when elevated PM_{10} levels occur. Actions to minimise dust are taken in response to alarms, where required.

Figure 17 and **Figure 18** present the pollution roses for EPA Point 9 and EPA Point 10 monitors, respectively. The figures show that there is a slight effect on dust levels from the direction of Bulga Coal. Some high levels occur in the direction of Bulga Coal at the EPA Point 9 (D9) monitor given the location is close to mining activities, however the monitor recorded a greater proportion of high levels when winds were from the northwest quadrant which is upwind of Bulga Coal.

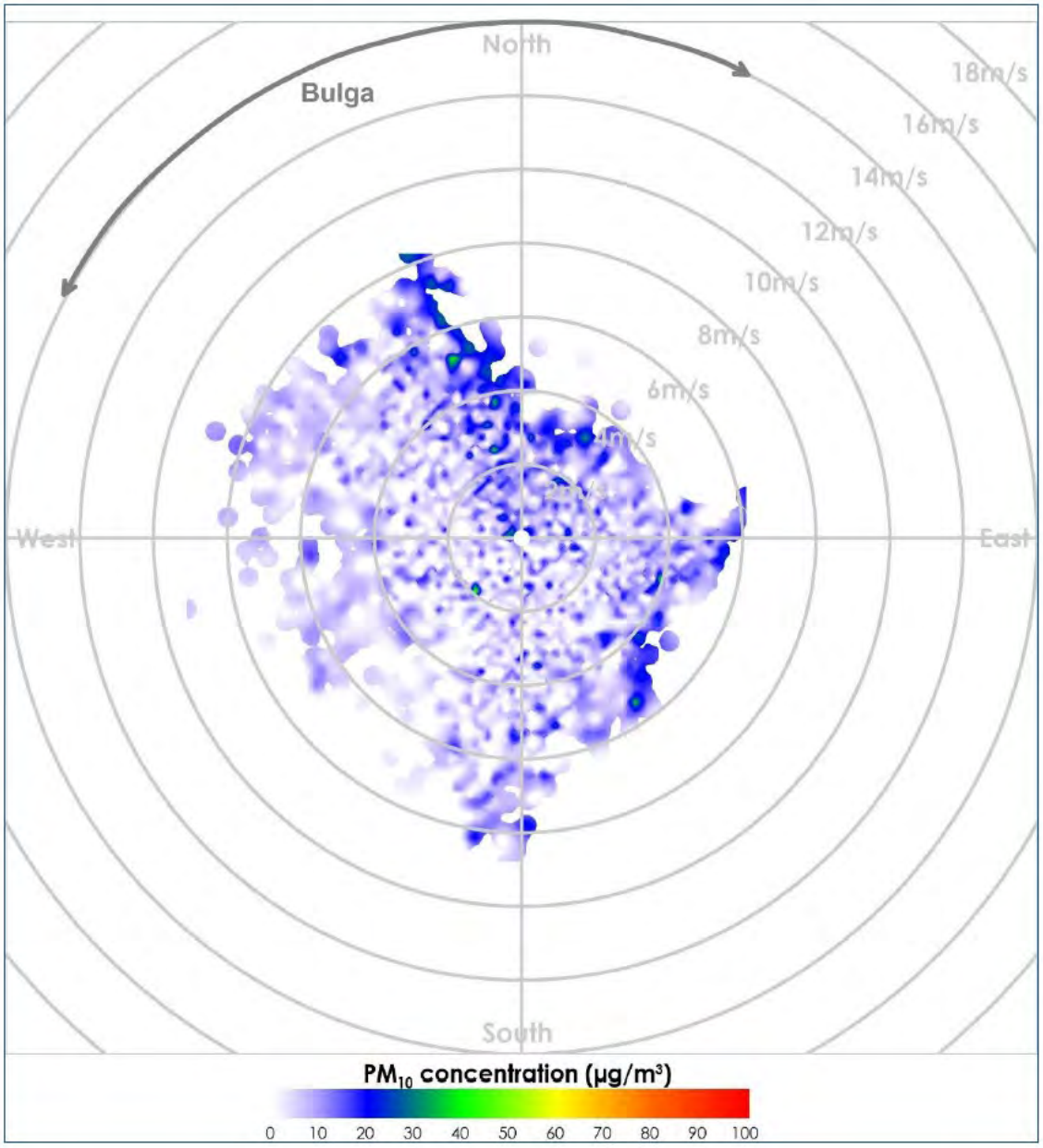


Figure 17 2022 Pollution Rose[1] for EPA Point 10, PM_{10} Data (Todoroski Air Sciences (2022))

[1] How to read a pollution rose:

- The colour indicates the pollutant concentration measured at the monitor.
- The position of pollutant concentration markings along the 360° axis indicates the corresponding direction from which pollutants arise from.
- The position of pollutant concentration markings relative to the banded rings indicates the wind speed for the corresponding hourly concentration.
- The arc labelled "Bulga" indicates the relative direction of Bulga Complex from the monitor.

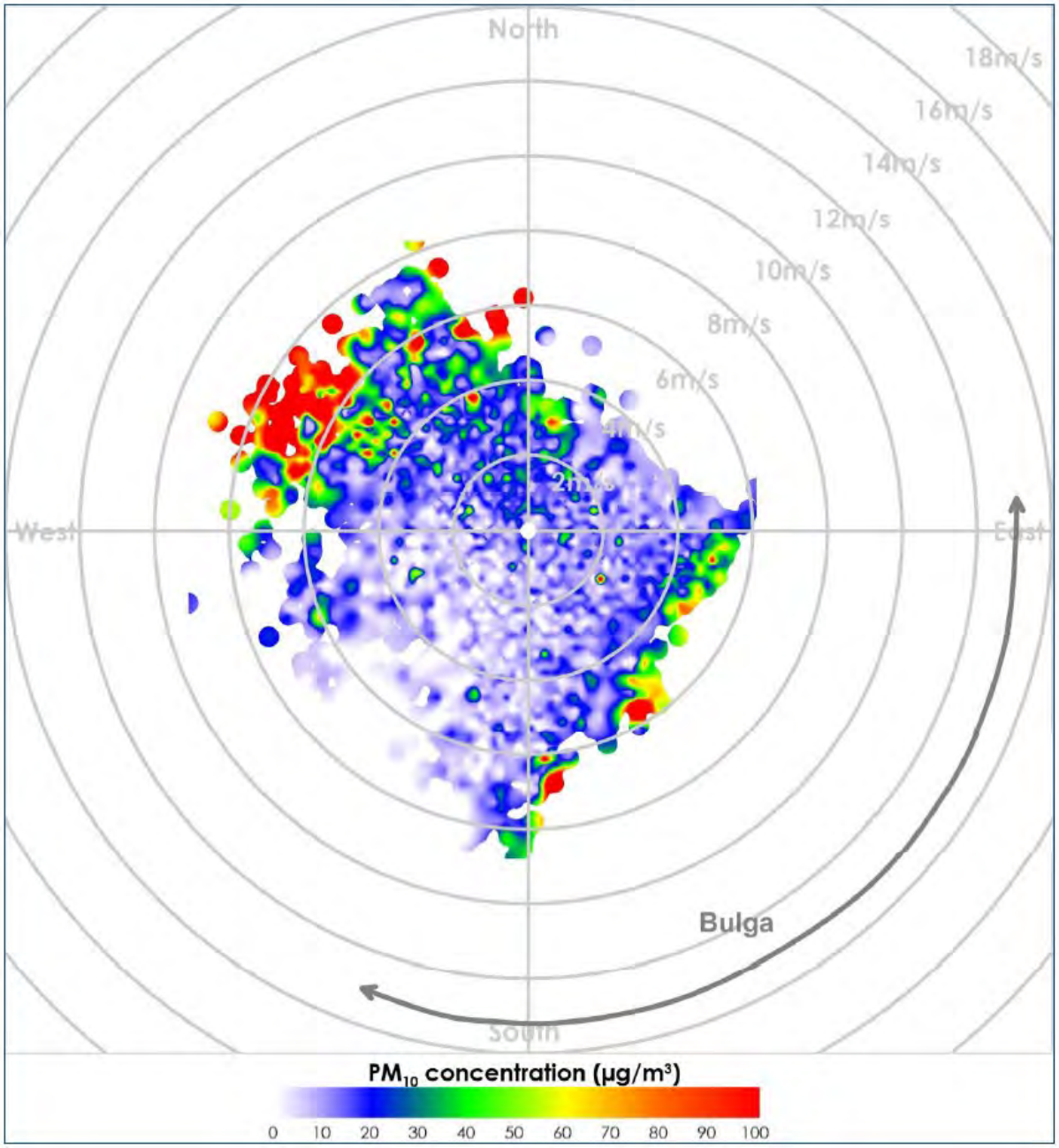


Figure 18 2022 Pollution Rose[2] for EPA Point 9, PM_{10} Data (Todoroski Air Sciences (2022))

[2] How to read a pollution rose:

- The colour indicates the pollutant concentration measured at the monitor.
- The position of pollutant concentration markings along the 360° axis indicates the corresponding direction from which pollutants arise from.
- The position of pollutant concentration markings relative to the banded rings indicates the wind speed for the corresponding hourly concentration.
- The arc labelled "Bulga" indicates the relative direction of Bulga Complex from the monitor.

Mushroom Composting Facility

Figure 19 presents the PM_{10} 13-hour average measured at the Mushroom Composting Facility (D4 TEOM monitor) against the 13-hour average Assessment Level of 91 µg/m³. The Assessment Level only applies during the approved operating hours of the Mushroom Composting Facility. These are between 6:00 am and 7:00 pm Monday to Friday, and any additional operating hours of the Mushroom Composting Facility, provided that:

- Such operating hours do not exceed 6:00 am to 12:00 pm on weekends.
- The Mushroom Composting Facility has given Bulga Coal at least one month advance notice of the intention to operate during those additional operating hours.

As shown in **Figure 19**, there were no occasions where levels were above the assessment level of 91 µg/m³.

Increase in 13-hour average on 21 November 2022 was mainly caused by strong west-northwest winds; contribution from the direction of Bulga Mine over the 24 hour period was predicted to be 1.7 µg/m³. 13-hour average PM_{10} concentrations were below the assessment level of 91 ug/m³.

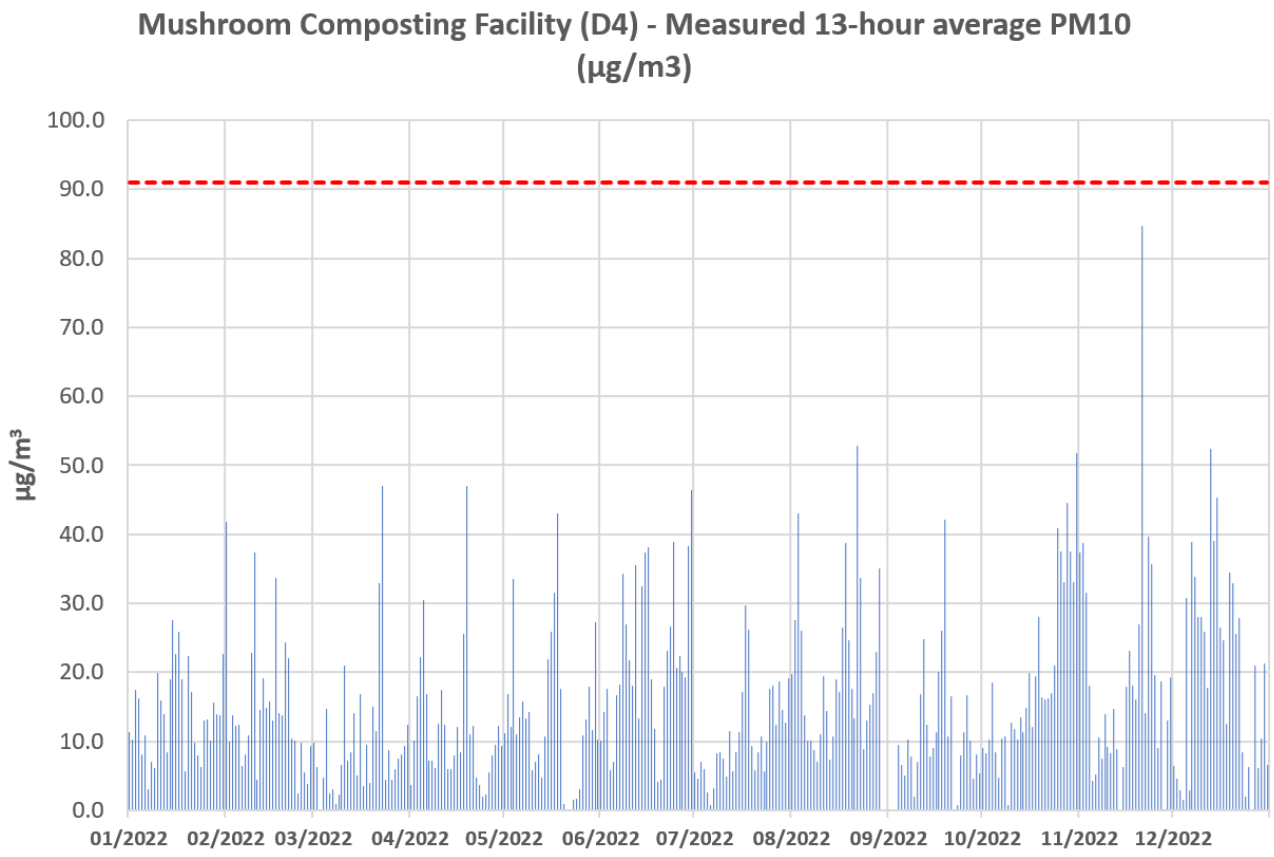


Figure 19 Mushroom Composting Facility (D4 Sampling Results 2022 – 13-hour PM_{10} Averages

6.4.3 Comparison Against Predictions

A comparison of 2022 dust monitoring data with the modelled predictions made in the *Bulga Coal Complex Modification 3 Air Quality Impact Assessment* (Jacobs, 2019) (Year 22) was undertaken by Todoroski Air Sciences (2023) (attached as **Appendix B**). The analysis shows that the annual average measured levels in 2022 were lower than the predictions for the representative modelling scenario. In general, it is considered that 2022 was a relatively cool and wet year for NSW which may have contributed to lower dust levels being measured in 2022.

6.4.4 Long Term Analysis

An assessment of long-term trends over the life of Bulga Coal operations was undertaken by Todoroski Air Sciences (2023) (**Appendix B**). Annual average levels were generally lower than previous years, likely due to more rainfall and a significant reduction in the frequency of extraordinary events (bushfires and dust storms). The trends in air quality reflect the prevailing meteorological conditions and not the mining activity.

6.4.5 Implemented/Proposed Improvements

Following submission of the *Air Quality and Greenhouse Gas Management* Plan in September 2020, changes were made in 2022 following a request for more information received from DPE in March 2022. Changes included:

- Evidence of consultation with the Technical Review Committee has been included in Appendix E;
- Section 6.10 has been updated with a hyperlink to the EEAMF and A.1 in Appendix A has been updated to reference Section 6.10;
- Appendix C (DPE approval letter) was removed; and
- The draft version was updated to version 3 and Table 10-3 (Change information) was updated to reflect this.

6.5 Mine Subsidence

6.5.1 Environmental Management

Subsidence impact monitoring and mitigation works are now completed in accordance with the Bulga Underground Operations Post Mining Subsidence Management Plan.

6.5.1.1 Monitoring Results

Repairs to surface subsidence cracking identified during monitoring activities for previously mined areas continued to be undertaken during the reporting period. The observed impacts caused by subsidence are summarised in **Table 32**.

Table 32 Observed Subsidence Impacts

Feature	Impact Performance Measures	Observed Impacts
Surface Cracking	Always safe. Stable, non-polluting post mining landform.	No adverse impacts reported. Continue to monitor and repair as required
Telecommunications & powerlines	Always safe. Serviceability should be maintained wherever practicable.	No adverse impacts identified to public or internal infrastructure
Pipelines and tanks	Always safe. Serviceability should be maintained wherever practicable.	No adverse impacts identified to public or internal infrastructure.
Roads and gates	Always safe. Serviceability should be maintained wherever practicable.	No adverse impacts identified to public or internal infrastructure.
Fences	Always safe. Serviceability should be maintained wherever practicable.	No adverse impacts identified to public or internal infrastructure.
Buildings	Always safe. Serviceability should be maintained wherever practicable.	No adverse impacts identified to public or internal infrastructure.
Archaeology sites and vegetation	Stable, non-polluting post mining Landform.	No adverse impacts reported.

6.5.2 Comparison Against Predictions

A comparison against predictions was not applicable considering underground mining did not occur during 2022.

6.5.3 Implemented/Proposed Improvements

As noted above, Bulga Underground Operations have continued to progressively complete repairs to surface subsidence cracking identified from monitoring. Monitoring of previously mined areas will continue in 2023. Any required mitigation works will be completed in accordance with the *Bulga Underground Operations Subsidence Mapping and Repair Procedure* and the *Bulga Underground Operations Post Mining Subsidence Management Plan*.

6.6 Biodiversity and Offsets

Bulga Coal implements management activities and conducts annual ecological monitoring in remnant vegetation areas located within the mine site, Biodiversity Offset Areas (BOAs) and mine rehabilitation areas. The activities and monitoring programs implemented during 2022 can be found in the following sections:

- Remnant vegetation around the mine site (**Section 6.6.1**);
- Offset areas (**Section 6.6.2**); and
- Mine rehabilitation (**Section 8.6**).

Despite the wet weather conditions during 2022, the biodiversity and offset monitoring programs were completed successfully with the exception of Reedy Valley Offset area, where access was not safe. In general monitoring results showed a constant to slightly increasing trend in both flora and fauna, and species diversity and abundance.

6.6.1 Remnant Vegetation

6.6.1.1 Environmental Management

Flora and fauna monitoring is conducted around the mining operations in accordance with the *Biodiversity Management Plan* (BMP). The locations of ecological monitoring sites are shown in **Figure 20**.
The ecological monitoring of mine rehabilitation is covered in **Section 8.6**.

6.6.1.2 Annual Ecological Monitoring Program – Flora

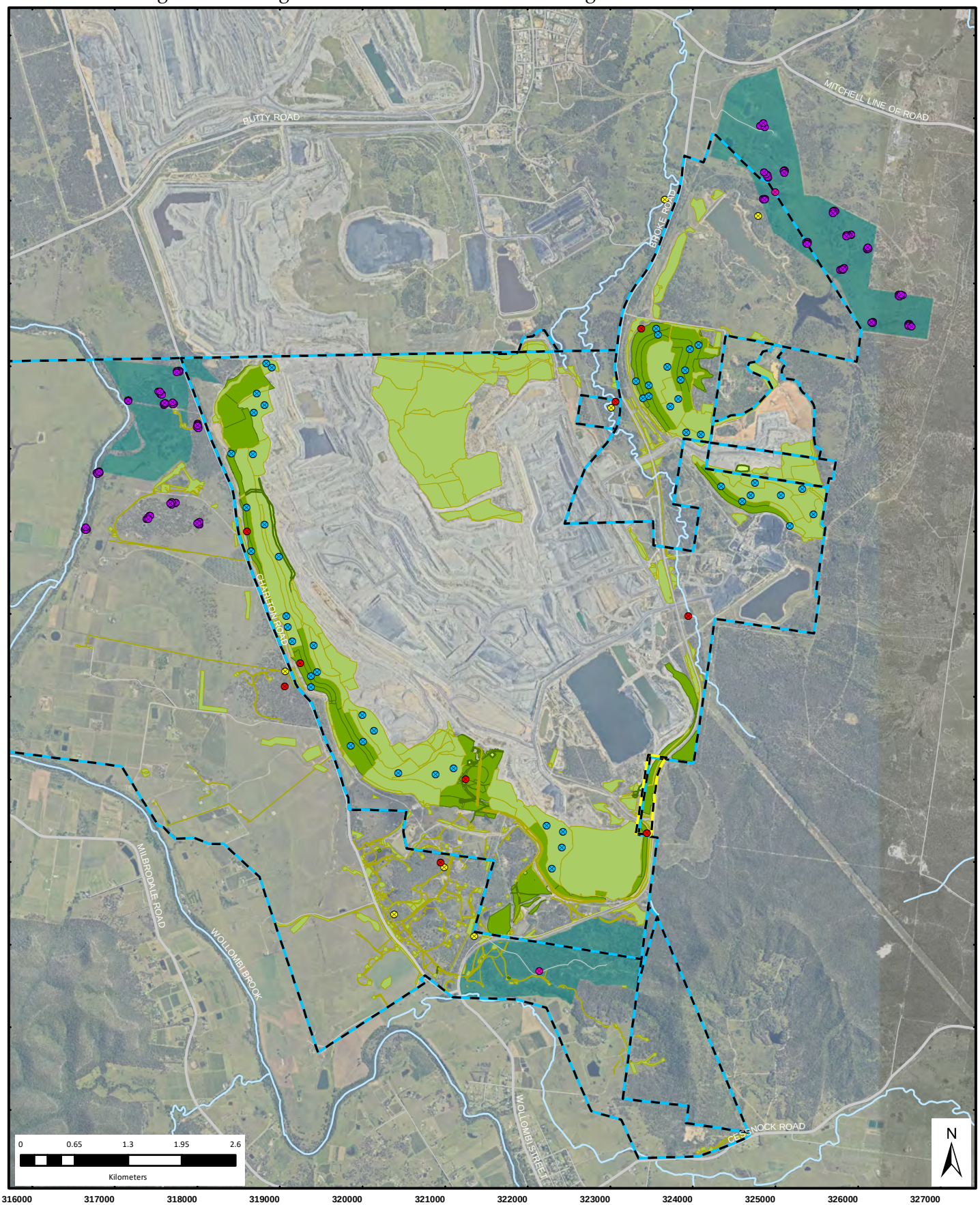
The annual ecological monitoring program for remnant vegetation was undertaken by Koru Environmental in 2022 with a summary of the results presented in **Section 6.6.1.4**.

The long-term remnant vegetation monitoring program utilises the Biodiversity Assessment Methodology (BAM) to compare rehabilitation areas with biometric scores from the targeted vegetation communities.

The primary objective of the monitoring program is to assess the health and condition of remnant vegetation at Bulga Coal. The BAM was adopted during 2018 to be consistent with the Biodiversity Conservation Division (BCD) (formerly the Office of Environment and Heritage (OEH)) requirements and to match the methodology used at rehabilitation sites. The BAM involves assessing vegetation condition based on the compositional, structural and functional attributes of a site (OEH 2018).

Bulga Coal

FIGURE 20 - Bulga Coal Ecological and Rehabilitation Monitoring 2022



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Legend

- Current_Authorisations
- Mining Lease AMA
- Offset Area Boundaries
- Main Roads
- Local Roads
- Watercourse

Rehabilitation Phase

- Decommissioning
- Growth Media Development
- Ecosystem and Land Use Establishment
- Ecosystem and Land Use Development

- Fauna Monitoring
- Nest Box Monitoring
- Remnant Vegetation Monitoring
- Rehabilitation Monitoring
- Reference Monitoring

GDA2020

Date Created: 23/03/2023
Map Size: A4 Portrait
Scale: 1:62,500
Map Created By: MPollock
Coordinate System: GDA2020 MGA Zone 56
Projection: Transverse Mercator
Datum: GDA2020

6.6.1.3 Annual Ecological Monitoring Program – Fauna

Ecological monitoring for fauna was completed by Forest Fauna Surveys (2022) and results provided in the 2022 Annual Fauna Monitoring Report which is available on the Bulga Coal website (https://www.glencore.com.au/operations-and-projects/coal/current-operations/bulga-coal/monitoring-documents). A summary of results is provided in **Section 6.6.1.4**. The methodology includes targeted surveys of birds, bats, reptiles and amphibians, owl call-playback, fauna spotlighting and opportunistic fauna surveying.

The program is designed to check if there have been any impacts on the surrounding terrestrial and aquatic habitats (outside of approved disturbance areas) as a result of mining operations and to monitor the habitat condition of rehabilitation areas.

6.6.1.4 Environmental Performance

6.6.1.5 Flora Monitoring

In accordance with the Bulga Complex Biodiversity Management Plan ecological and photo monitoring of remnant flora was conducted at seven monitoring sites in 2022 located within the following vegetation communities:

- PCT 1603 – Central Hunter Grey Box – Ironbark Woodland Endangered Ecological Community (EEC);
- PCT 1604 – Central Hunter Ironbark – Spotted Gum – Grey Box Forest EEC; and
- PCT 1731 – Swamp Oak Forest.

Native remnant vegetation in the buffer zones remained variable in condition. Riparian vegetation along creek lines generally showed higher degrees of degradation than areas of native woodland, especially in terms of native biodiversity levels. Weed infestations (particularly Lantana) continued to be the main issue affecting vegetation integrity and several sites may or will require active management inputs. However, results from 2022 showed no further deterioration in overall vegetation quality and integrity compared to previous years.

6.6.1.6 Fauna Monitoring

Fauna monitoring was undertaken at ten sites in areas of remnant vegetation and rehabilitation across the project area:

- Remnant Woodland and Riparian Vegetation Sites – BM04, BM10, BM18 and BM23; and
- Mine Rehabilitation Sites – BM07a, BM18a, BM19a, BM27a and BM28.

Diurnal census surveys for birds recorded 58 species, which is less than 71 species recorded in 2021. One new species was recorded in rehabilitation areas in 2022, the Brush Turkey, being detected by field camera at Site BM23. Three threatened bird species were detected in rehabilitation areas including the Little Lorikeet, Grey-crowned Babbler and Speckled Warbler. The Grey-crowned Babbler was located in remnant woodland site (BM04), with no evidence of the species in newly established rehabilitation areas. Similarly, the Speckled Warbler was also located at this remnant site, although both species are known to utilise newly established, or natural regeneration vegetation for foraging and nesting. The Little Lorikeet were foraging in flowering Grey Gum Eucalyptus punctata trees near site BM04, and a small flock of 10 birds was observed flying overhead at Rehabilitation Site BM19a in December 2022.

Field cameras were installed at 3 monitoring sites (BM04, BM23 and BM18) over the period 1 August to 17 November for a period of 109 consecutive nights. A total of 7,689 images were recorded, however, many were false positives due to movement of vegetation by strong winds, or shadows cast across the camera field of view. A total of eight native and four introduced mammal species were detected, including the short-beaked echidna, bare-nosed wombat, spotted-tail quoll, northern brown bandicoot and the eastern grey kangaroo.

Seven bat species were recorded in the rehabilitation areas in 2022 by echolocation call recordings. A total of 171 calls were recorded from all rehabilitation monitoring sites across nine sites and two sampling periods. This compares to 12 species and 538 calls recorded in 2021. Factors responsible for the reduction in bat activity in 2022 compared to 2021 is unknown, but the Spring 2022 period experienced relatively mild weather conditions, and above average rainfall was recorded over the period. Nocturnal spotlight searches did not detect significant activity by flying insects, suggesting foraging resources were less abundant during the monitoring surveys. For several monitoring sites, there was no microbat activity recorded. No evidence of the threatened Grey-headed Flying-fox was recorded in 2022, possibly attributed to the low abundance of flowering eucalypt and other tree species. For the newly established rehabilitation areas less than 10 years old, the young age of the trees would limit the abundance of pollen and nectar for flying-fox species.

Reptile microhabitat is limited at several rehabilitation and revegetation sites. The combination of dense growth of sapling trees and absence of ground microhabitat in parts, limits the value of new rehabilitation areas for reptiles. However, with time natural dieback of trees and increase in canopy height will open the canopy layer to increase solar penetration to ground level, which will improve reptile microhabitat. Where areas of rock piles have been created in new rehabilitation areas, only those locations with high solar radiation provide suitable basking sites for reptiles.

Three threatened bird species and three threatened mammal species were detected in rehabilitation areas in 2022. The Little Lorikeet, Grey-crowned Babbler, Speckled Warbler, and two threatened microbats, the Little Bentwinged-bat and Eastern Coastal Freetailed-bat, have all been previously recorded in the rehabilitation monitoring areas. The Spotted-tail Quoll was detected by field camera at one location, BM23 off Broke Road in 2022. This is the first record of the species at Bulga Coal, despite monitoring over the period 2003 to 2021.

During surveys in 2022, pig activity was observed to be widespread in parts of the mine rehabilitation areas. The above average rainfall in 2022 resulted in wet soil conditions, providing ideal foraging conditions for feral pigs. Ongoing control of pigs is regularly undertaken in Bulga Coal landholdings by trapping and poisoning, refer to **Section 6.6.2** and **Section 6.7** for a summary of pig control undertaken across Bulga Coal landholdings.

A small population of the feral cat has been recorded at monitoring site BM23 for two consecutive years (2021, 2022). Management of this species may require conducting periodic trapping surveys to reduce the abundance of this predator from the offset and rehabilitation areas.

Nest box monitoring was also undertaken in areas of remnant vegetation, refer to **Section 6.6.2**.

6.6.1.7 Implemented/Proposed Improvements

Recommendations from monitoring reports, where appropriate, will be implemented in 2023. These recommendations focus on land management practices to improve the health of vegetation and quality of habitat in surrounding vegetation.

Land management activities to be implemented in 2023 to action issues across remnant vegetation areas include: ongoing weed management (particularly focussing on Lantana (*Lantana montevidensis*). Pest animal management will include dog baiting and opportunistic kangaroo culling, feral cat trapping and pig trapping in response to sightings or evidence of presence.

Extended monitoring by field cameras is also recommended, this methodology, used in 2021 and 2022, greatly increases the detection of cryptic and rare species, particularly those listed as threatened under State and Commonwealth legislation.

As Bulga continues to clear remnant vegetation to allow for the progression of mining activities, habitat resources (logs, rocks, and tree hollows) will be salvaged for re-use in rehabilitation and where feasible, remnant vegetation areas.

Due to mining progression some remnant vegetation monitoring sites will be disturbed, or will become part of the Vere Biodiversity Offset area under a Biodiversity Stewardship Agreement. During the next revision, Bulga Coal will update the Biodiversity Management Plan to reflect changes to the ecological monitoring program.

6.6.2 Biodiversity Offsets

Schedule 3, Condition 29 of SSD-4960 requires Bulga Coal to establish and maintain five Biodiversity Offset Areas (BOAs). Condition 9 of EPBC 2012/6637 and Condition 12 of EPBC 2018/8300 requires an annual report including implementation of the associated management plans (see **Section 6.6.2.1** to **Section 6.6.2.4**) and detailing compliance with the conditions of the approval (see **Appendix A**). The BOAs were established in agreement with the NSW Office of Environment and Heritage (OEH) and its performance is currently overseen by the Biodiversity Conservation Trust (BCT). Bulga Coal currently manages the BOAs presented in **Table 33**.

Table 33 Bulga Coal Biodiversity Offset Areas

Biodiversity offset area	Area (ha)	Conservation agreement date
Broke Road BOA	251	9 May 2019
Condran	50	7 May 2019
Reedy Valley	1,486	7 May 2019
Wollombi Brook Conservation Area (WBCA)	65 (BOA) 51 (Aboriginal heritage conservation)	7 May 2019
Vere	153.8	Not yet approved

The Broke Road BOA and WBCA are located in the north-eastern and north-western corners of Bulga Coal, respectively. The Reedy Valley and Condran BOAs are located further from Bulga Coal and are approximately 30 km north-west and 10 km south-east of Muswellbrook, respectively. In addition, Bulga Coal committed to establishing two Weeping Myall Management Areas in the Bulga Optimisation Project EIS. These were established in 2015. **Figure 21** shows the general location of the Biodiversity Offsets and Management Areas.

In accordance with Schedule 3, Condition 33A of SSD-4960 Bulga Coal has committed to establishing and managing the Vere Biodiversity Offset Area (153.7 ha) located to the south of Bulga Coal (**Figure 21**) within two years of the commencement of development approved under SSD-4960 Mod 3. Development approved under Mod 3 commenced in September 2020. An extension of time for establishment the Vere Biodiversity Stewardship agreement was granted by the DPE on 21 November 2022 to the 30 June 2023. Bulga Coal submitted the Vere Biodiversity Stewardship Agreement application to the Credit Supply Taskforce on 2 February 2023.

At each BOA, monitoring is undertaken to assess performance against defined indicators as specified by the conservation agreements. Monitoring transects are 50 m in length, with each comprising ten quadrats 5 m x 5 m in size, positioned along alternate sides of the centre line. Within each quadrat, data on species diversity, age and structure of the canopy, and shrub strata are collected. For comparative purposes, replicated transects within adjacent regenerating grassland areas were also established to monitor the return of woodland to these areas. In effect, pairs of 50 m transects (i.e. 100 m transects of 20 quadrats) were positioned end-to-end across grassland-woodland boundaries so that restoration progress can be tracked over successive monitoring seasons. With the change to biometric monitoring in 2017, additional data on vegetation condition and habitat is also collected within a 20 m x 20 m quadrat positioned within these transects. In addition, fauna and habitat usage monitoring is conducted annually and every three years, respectively.

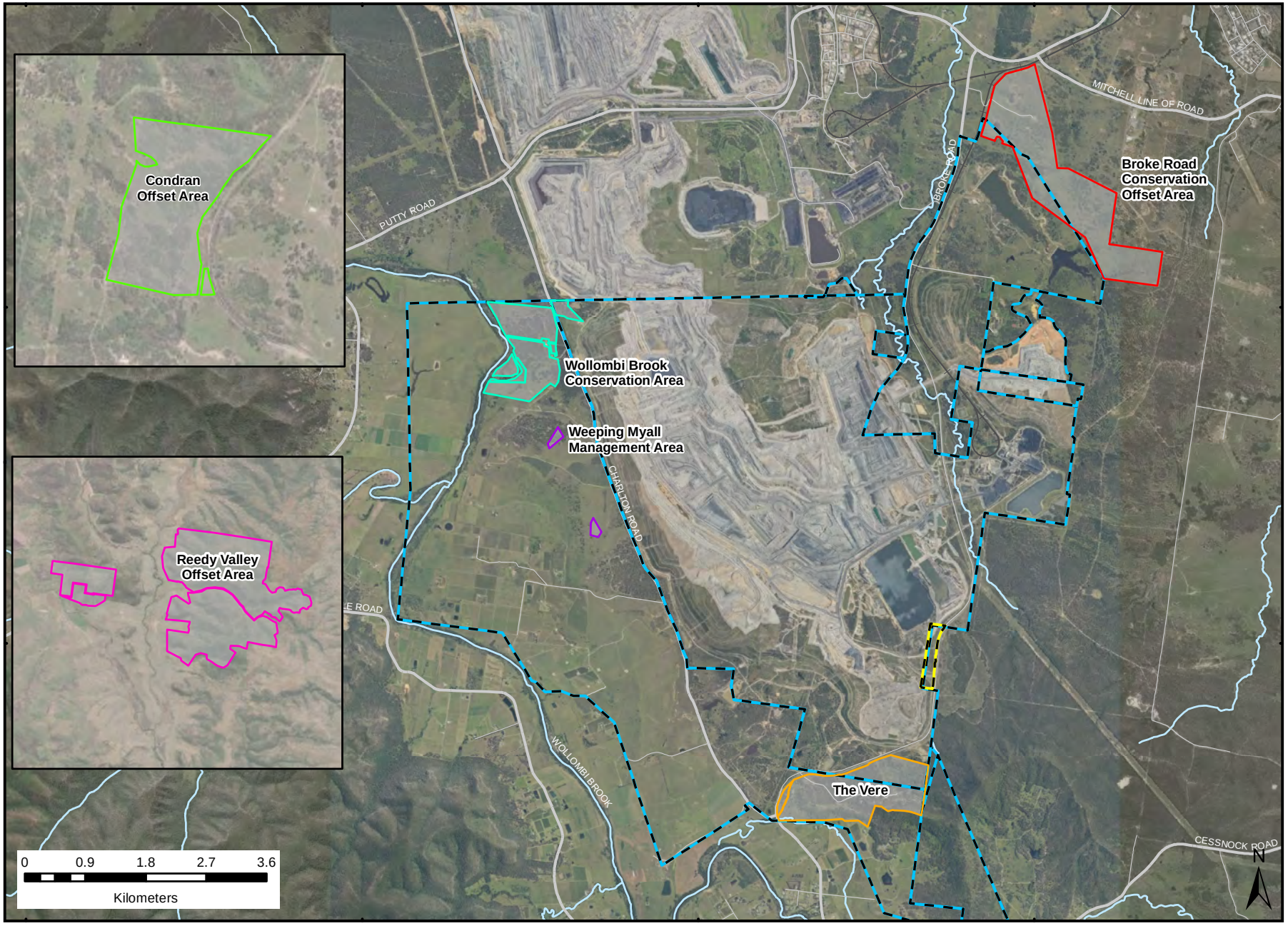
Progress against 2022 performance indicators for Broke Road, Condran, Reed Valley and Wollombi Brook BOA's, as detailed in BOMP is shown in **Appendix C**.

Appendix E includes a summary of the Annual Audit completed by the Biodiversity Conservation Trust (BCT) in 2022 against the conservation area agreements for the Broke Road, Condran, Reed Valley and Wollombi Brook BOA's.

Bulga Coal

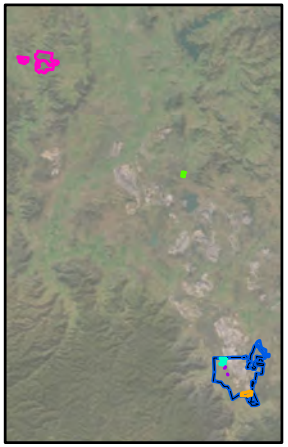
FIGURE 21 - Bulga Coal Biodiversity Offsets and Management Areas

GLENCORE



Legend

- Current_Authorisations
- Mining Lease AMA
- Broke Road Conservation Offset Area
- Condran Offset Area
- Reedy Valley Offset Area
- The Vere Offset Area
- Weeping Myall Management Area
- Wollombi Brook Conservation Area
- Main Roads
- Local Roads
- Watercourse
- Railway



GDA2020

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Datum: GDA2020

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6.6.2.1 Broke Road BOA

Environmental Management

Environmental management activities undertaken at the Broke Road BOA in 2022 included:

- Weed control works focussing in particular on Lantana (*Lantana montevidensis*), St John's Wort (*Hypericum perforatum*), Cotton Bush (*Gomphocarpus fruticosus*), Fireweed (*Senecio madagascariensis*), Verbena (*Verbena bonariensis*), Juncus (*Juncus acutus*) and Oleander (*Nerium oleander*);
- Bushfire firebreak slashing along tracks and fence lines;
- Wild dog and fox baiting program during autumn and spring months resulted in 8 wild dogs, 11 Fox and 10 feral pigs takes;
- 5 feral pigs controlled;
- Revegetation planting of 25.8 Ha (25,000 stems) of Central Hunter Grey Box Ironbark Woodland EEC;
- Six monthly inspections;
- Ongoing ecological monitoring program; and
- Regeneration assessment.

Monitoring Results

The annual monitoring program is generally completed during spring and autumn in the Broke Road BOA. 2022 monitoring program included fauna, flora, revegetation assessment and nest boxes. Flora monitoring showed an increase in native species diversity and a decrease in weed species diversity across the various plots in 2022. The increase in plant species and structure diversity provide a wider range of habitat for native fauna including threatened species. Additionally, the habitat augmentation program had showed an increase of usage of nest boxes during the monitoring period.

Flora

Monitoring in 2022 at the Broke Road BOA continued with the nine permanent monitoring transects established in 2015 and the three additional temporary revegetation plots established in 2018. Broke Road BOA flora monitoring transects are described in the Biodiversity Offset Monitoring Report which is available on the Bulga Coal website (). Overall, 139 plant species were recorded within the 12 transects at the Broke Road BOA in 2022 compared to 93 plant species recorded in 2021 within the original 9 monitoring transects. Of this total, 59 are weeds, predominantly herbaceous or grassy species typical of former grazing lands a slight decrease compared to 2021 in which 61 weed species were recorded in the 9 monitoring transects.

Threatened Species

- A single clump of *Cymbidium canaliculatum* (tiger orchard) continues to flourish and comprises part of the Endangered Population of this species within the Hunter catchment.
- Monitoring of the vulnerable *Eucalyptus glaucina* (slaty red gum) in 2022 showed continuing persistence of regeneration within two permanent plots and across the wider landscape. There have been some minor losses through macropod grazing, and the dense grass growth (and Lantana in Plot 1) in plots may have also affected detection of seedlings.

Fauna

Surveys were conducted at nine sites over four monitoring periods, two in winter and two in spring of 2022. During these periods, a total of 46 bird species, 17 mammal species (includes 12 microbat species), four reptile and three frog species were recorded.

Birds

In 2022, a total of 46 bird species were recorded by census surveys at Broke Road BOA, a decrease compared to 52 bird species recorded in 2021. Total bird species diversity, based on surveys spanning the monitoring period 2015–2022, combined with previous records of the Bulga Coal Optimisation project (Umwelt 2013), is 130 native and two introduced bird species.

One threatened bird species was recorded at *Broke Road BOA* in 2022, the Grey-crowned Babbler. Previous threatened birds recorded at *Broke Road BOA*, but not recorded in 2022, include Swift Parrot, Little Eagle, Little Lorikeet, Masked Owl, Brown Treecreeper, Speckled Warbler, Varied Sittella, Dusky Woodswallow and Diamond Firetail. The absence of a significant flowering event over the winter and early spring 2022 period may have influenced the diversity and abundance of nectivorous bird species.

Mammals

11 micro-chiropteran bat species were recorded at *Broke Road BOA* in 2022, this is also a decrease compared to 14 species recorded in 2021. Four threatened microbats were recorded in 2022, the Eastern Bentwing-bat, Little Bentwing-bat, Large-eared Pied Bat and East-coast Freetail-bat.

One arboreal mammal species was recorded by spotlight searches, the Common Brushtail Possum. No evidence of the threatened Squirrel Glider was observed during spotlight searches and camera monitoring at *Broke Road BOA* in 2022.

Reptiles

Three reptile species, Red-bellied Black Snake, Striped Skink and Lace Monitor were observed in *Broke Road BOA* in 2022, a decrease compared to 6 recorded in 2021. Due to the above average rainfall in 2022, frog species were abundant in Broke Road BOA with five frog species recorded, including Common Eastern Froglet, Spotted Grass Frog, Eastern Dwarf Tree Frog, Peron's Tree Frog and Broad-palmed Frog.

A detailed list and location of fauna species recorded can be found in the Biodiversity Offset Monitoring Report which is available on the Bulga Coal website (https://www.glencore.com.au/operations-and-projects/coal/current-operations/bulga-coal/monitoring-documents).

Nest Boxes

120 nest boxes were installed in the *Broke Road BOA* in October 2018. **Figure 20** shows the location and distribution of the six different designs installed in the BOA. This monitoring program meets the Habitat Augmentation requirements outlined in Section 3.6 of the Broke Road BOMP. The monitoring program commenced in December 2019 and it is conducted every three years. The most recent program was completed in December 2022.The monitoring program showed that 76 (63%) of the 120 nest boxes had evidence of usage. This indicates an increase of 16% in usage from the 2019 monitoring program, which registered 47% nest boxes showing evidence of usage.

Table 34 Bulga Coal Nest Boxes usage at Broke Road BOA in 2022

Nest Box Design	Total Number of Boxes	Evidence of Usage	Diversity and Abundance (Species Using the Box)
Bat	20	2 (1%)	Antechinus x 1
			Lace Monitor x 1
Feathertail Glider	20	2 (1%)	Antechinus x 2
Parrot/Rosella	20	19 (95%)	Brushtail Possum x 8
			Rosella x 6
			Glider x 2
			Owlet Nightjar x 2
			Lace Monitor x 1
Rear Entry Glider	20	15 (75%)	Glider x 12
			Brushtail Possum x 3
Ringtail Possum/ Sugar Glider	20	20 (100%)	Rosella x 7
			Owlet Nightjar x 1
			Brushtail Possum x 5
			Glider x 7
Treecreeper	20	19 (95%)	Rosella x 18
			Brushtail Possum x 1
Total	**120**	**76 (63%)**	**6 Species**

Revegetation and Regeneration assessment

An assessment of completed revegetation works and of natural regeneration across the Broke Road BOA was undertaken by Koru Environmental in December 2022. Results included:

- With localised exceptions, the approximately 42.8 ha of Central Hunter Grey Box Ironbark Woodland EEC planting, undertaken in 2018 across the northern section of the offset presented excellent shrub and tree establishment and growth;
- The 20.2 ha of Central Hunter Grey Box Ironbark Woodland EEC seeded in 2019 in the central section of the offset has showed limited establishment of native shrubs and trees;

- The 25.8 ha of Central Hunter Grey Box Ironbark Woodland EEC planted in 2022 across the northern and central sections of the offset showed variable tubestock survival rates and some areas may require infill supplementary plantings. However, plantings remained very recent at the time of inspection, and ground visibility was often hindered by the presence of taller vegetation (i.e. small tubestocks may have been present but difficult to see). It was recommended for these areas to be re-assessed in one or two years to ascertain plantings success with increased confidence;
- The 2021 tubestock planting areas to the south of the offset (24.0 ha) were overall successful with adequate survival and establishment rates; and
- Of the areas of the offset not yet planted/revegetated, positive signs of active natural regeneration were observed in many locations particularly along the fringes of remnant vegetation and within smaller clearings/openings surrounded by remnant vegetation (i.e. facilitated by edge effect ecological processes), and it is likely that requirements for active revegetation will be reduced. However, several large clearings remained which showed no or very limited evidence of regeneration and can be potentially assisted revegetation areas.

Key findings from the Broke Road BOA assessment are summarised in **Table 35**.

Table 35 Bulga Coal Regeneration Assessment Summary at Broke Road BOA

Type	Cumulative area (ha)	Recommended action
Planted areas – Successful	37.0	Nil action required
Planted areas – Partially successful	5.5	Supplementary infill plantings
Planted areas – Unsuccessful	23.8	Rework / revegetate
Planted areas – Trending	49.4	Monitor and re-assess in 1-2 years
Natural regeneration – Active (high)	40.5	Unlikely to require active revegetation
Natural regeneration – Active (moderate)	7.8	Infill plantings at reduced planting effort
Natural regeneration – Limited to absent	29.4	Broadscale active revegetation / plantings

Performance against Criteria

During 2022, 15 of the 17 performance indicators were met and two failed to achieve the specific criteria (**Appendix C**).

Implemented/Proposed Improvements

Weed Management

The 2023 weed management strategy for Broke Road BOA will focus on the management of priority species identified in the 2022 monitoring and inspection programs including; Creeping Lantana (*Lantana montevidensis*), St John's Wort (*Hypericum perforatum*), African Olive (*Olea europea subsp. cuspidata*) and African Boxthorn (*Lycium ferocissimum*), Galenia (*Galenia Pubescens*), Spiny Rush (*Juncus acutus*) and control of annual weeds including Saffron Thistle (*Carthamnus lanatus*) and Cotton Bush (*Gomphocarpus fruticosus*).

Pest Management

Surveys and control activities undertaken in 2022 indicate that favourable weather conditions had maintained the feral pig numbers during 2022. Wild Dog and Fox take increased slightly during the 2022 baiting programs.

Pest fauna present are contiguous with the wider landscape, and effective management for control requires a coordinated approach with neighbouring landholders (particularly the neighbouring Department of Defence) to ensure the wider source populations are controlled to reasonable levels. The monitoring to date indicates pest species do not require any additional control efforts over those already prescribed in the BOMP and current management practices.

In 2023 pest control activities will continue to be implemented with additional opportunistic management also undertaken in response to sightings or evidence of pest species presence. Planned pest management activities include wild dog and fox baiting in collaboration with Local Land Services to maximise the effectiveness of the program.

Habitat Augmentation & Revegetation

Habitat augmentation features are prioritised to the following threatened fauna species, the Regent Honeyeater, Swift Parrot and Large-eared Pied Bat. The Large-eared Pied Bat is a cave roosting microbat that would forage on the Broke Road BOA site as part of its larger foraging range. This species was detected at Broke Road BOA by surveys in 2022, with only 1 call recorded. No roosting habitat features occurred, or could be constructed on the Broke Road site for the species.

Habitat augmentation measures were observed throughout the BOA in 2022 as result of the removal of internal barbed wire fencing in previous years.

In 2023 revegetation works will continue at the Broke Road BOA with planting of 26.2 Ha (26,200 stems) of Central Hunter Grey Box Ironbark Woodland EEC.

General Management

Slashing, removal of redundant internal fences, and annual weed management will be undertaken where feasible to minimise both bushfire risk and further spread of annual weeds.

Fence repairs and track maintenance will be undertaken on an as needs basis, as identified through inspection programs.

6.6.2.2 Condran BOA

Environmental Management

Activities undertaken at the Condran BOA in 2022 included:

- Weed controls works, focusing on Sweet Briar (*Rosa rubiginosa*), African Love Grass, (*Eragrostis curvula*), and Blue Heliotrope (*Heliotropium amplexicaule*);
- Wild dog and fox baiting program during autumn and spring months resulted in two wild dogs and nine Fox takes;
- Six monthly inspections;

- Continuation of the ecological monitoring program established in 2013; and
- Regeneration assessment.

Monitoring Results

The annual monitoring program is generally completed during spring and autumn in the Condran BOA. The 2022 monitoring program included fauna, flora and revegetation assessment. During the 2022 flora monitoring period, 90 native and 38 weed species were detected; showing a decreasing trend in species diversity of native species and weeds compared to 2021 period. The fauna monitoring conducted in 2022 recorded an abundance in bird species diversity, one new bird species and the presence of the threatened Squirrel Glider.

Flora

Monitoring in 2022 at the Condran BOA continued with the eight transects, consisting of six permanent monitoring transects established in 2013 and the two additional temporary revegetation plots established in 2018. The Condran BOA flora monitoring transects are described in the Biodiversity Offset Monitoring Report which is available on the Bulga Coal website (https://www.glencore.com.au/operations-and-projects/coal/current-operations/bulga-coal/monitoring-documents).

From the 2022 monitoring, 128 plant species were recorded within the eight transects at the Condran BOA, a decrease from the 146 recorded in 2021. 38 species (30%) were weeds, predominantly herbaceous or grassy species typical of former grazing lands. Previous control of Coolatai Grass (*Hyparrhina hirta*) has made some impact, but continual follow up spraying will be required, as new infestations continue to be evident. No new problematic woody weeds species were noted within the BOA, and fences remain in good condition. The old orchard area on the creek flat still supports some remnant Mulberry (*Morus alba*) and Peach (*Prunus persica*) trees which should be removed, although they are not invasive.

Threatened Species

Monitoring of the threatened *Diuris tricolor* population within Condran BOA continued in 2022. No new colonies were found during the single day search of the entire BOA at peak flowering. Demographic monitoring of the main population continued in 2022, with all 78 tagged individuals inspected fortnightly over 16 weeks from early August 2022. Tagged individuals of the co-occurring *Diuris sulphurea* were also monitored to enable comparisons between a common and threatened *Diuris* subject to the same threats.

In 2022, only 19 of 78 (24%) known and tagged *Diuris tricolor* emerged, compared to 20 of 31 (65%) of tagged *Diuris sulphurea*. Although inflorescences developed in both species, no flowering or capsule development occurred in *Diuris tricolor* due to withering or grazing. In contrast, 3 of 7 flowering *Diuris sulphurea* developed capsules, but all of these withered or were grazed prior to seed release. The 2022 season was, therefore, a poor one for flowering and seed release in both species. Re-fencing along the access trail which runs through this population was also undertaken in 2022.

Fauna

The monitoring program includes an assessment of ongoing management and improvement strategies at Condran BOA. The preliminary long-term management targets for Condran BOA are to improve the existing biodiversity values of the remnant native forest communities. During the 2022 monitoring program, a total of 35 bird species, 7 native mammals, 9 microbat species, 4 reptile and 5 frog species were recorded; showing an increase in the number of individuals registered during the 2020 and 2021 periods.

Birds

Bird census surveys were conducted at three sites over four monitoring periods, two winter and two in spring. In 2022, a total of 35 bird species were recorded by census surveys at Condran BOA, an increase from 30 recorded in 2021. Total bird species diversity, based on surveys spanning the monitoring period 2013–2022, is 83 native and two introduced bird species.

Two threatened bird species were recorded at Condran BOA in 2022, the Grey-crowned Babbler and Speckled Warbler. Previous threatened birds recorded at Condran BOA, but not recorded in 2022, include Square-tailed Kite, Little Lorikeet, Masked Owl, Brown Treecreeper, Speckled Warbler, Hooded Robin, Varied Sittella and Dusky Woodswallow.

Mammals

Three larger macropod species were recorded at Condran BOA in 2022, Eastern Grey Kangaroo, Red-necked Wallaby and Common Wallaroo. The Common Brushtail Possum and the threatened Squirrel Glider were recorded by spotlight search in Spring 2022.

Six bat species were recorded in 2022, with a total of nine call sequences at Site ConFA1, and 32 calls at Site ConFA2. The Condran BOA annually records low microbat species diversity and abundance of echolocation calls. Weather conditions for microbat monitoring were not ideal; as relatively cool to cold nights, despite being conducted in November 2022, which may have reduced the microbat activity.

The most commonly recorded species was the Gould's Wattled Bat (*Chalinolobus gouldii*) with 27 calls. By comparison, several additional species detected less than 10 echolocation call recordings. Two cave roosting bat species were recorded at Condran BOA in 2022, the Eastern Horseshoe Bat and Eastern Bent-wing Bat.

Reptile species diversity was higher in 2022 compared to previous monitoring years, with 4 species recorded. Several reptile and frog species were associated with aquatic habitats at several small to large pools or creek lines.

Threatened species

Four threatened species were recorded during the 2022 monitoring surveys: the Speckled Warbler, Grey-crowned Babbler, Eastern Bentwing-bat and Squirrel Glider. The record of Squirrel Glider is the first for the species at Condran BOA since commencement of monitoring in 2013.

A detailed list and location of fauna species recorded can be found in the Biodiversity Offset Monitoring Report which is available on the Bulga Coal website (https://www.glencore.com.au/operations-and-projects/coal/current-operations/bulga-coal/monitoring-documents).

Nest Boxes

16 nest boxes were installed in the Condran BOA in October 2022. The monitoring program will commence in 2023 and will be conducted every three years. This monitoring program meets the Habitat Augmentation requirements outlined in the Condran BOMP.

Revegetation and Regeneration Assessment

An assessment of completed revegetation works and of natural regeneration across the Condran BOA was undertaken by Koru Environmental in December 2022, with the following key findings:

- With very localised exceptions, all revegetation works completed in 2016 and 2018 (approximately 6.5 ha) have been very successful, with good survival rates and excellent vegetation establishment and growth achieved;
- Signs of active natural regeneration were observed in several locations, particularly in smaller clearings/openings surrounded by remnant mature vegetation (i.e. facilitated by edge effect ecological processes); and
- Two large clearings remained within the offset (approximately 3.0 ha) with very limited signs of natural regeneration occurring at the time (some shrubs were recruiting but no canopy tree species).

Key findings from the Condran BOA assessment are summarised in **Table 36**.

Table 36 Bulga Coal Regeneration Assessment Summary at Condran BOA

Type	Cumulative area (ha)	Recommended action
Planted areas – Successful	5.8	Nil action required
Planted areas – Partially successful	0.7	Nil action required
Natural regeneration – Active (slight to moderate)	3.7	Nil action required
Natural regeneration – Limited to absent	2.5	Active revegetation / plantings, as required

Performance against Criteria

During 2022, 15 of the 16 performance indicators were met and one failed to achieve the specific criteria (**Appendix C**).

Implemented/Proposed Improvements

Weed Management

During 2023 weed control in Condran BOA will focus on targeting Coolatai grass (*Hyparrhenia hirta*), Sweet Briar, Red Natal Grass (*Melinis repens*), African Love Grass (*Eragrostis curvula*), Whisky Grass (*Andropogon Virginicus*) and Spiny Rush (*Juncus acutus*).

Pest Management

Based on long-term monitoring of the Condran BOA by field cameras, the presence of introduced pest animals is considered low. Pest species that do occur at the Condran BOA are part of the wider surrounding landscape and will require a co-operative approach with input from several stakeholders to manage effectively. It is not considered that the pest species present are adversely affecting the quality of the existing or regenerating vegetation, or native fauna populations at the Condran BOA.

During 2023 Bulga will aim to align timing of wild dog and fox baiting programs at Condran with the Local Land Services aerial baiting program for neighbouring landholders to maximise the effectiveness of the program. Other pest species will be controlled on an as needs basis, based on inspection and monitoring outcomes.

6.6.2.3 Reedy Valley BOA

Environmental Management

The activities undertaken at the Reedy Valley BOA in 2022 included:

- Weed control works focussing in particular on St John's Wort (*Hypericum perforatum*);
- Feral animal control continued in conjunction with the wider program being completed by Local Land Services and surrounding property owners. The wild dog and fox baiting program during autumn and spring months resulted in 16 wild dogs, 45 fox and seven feral pig takes;
- 44 feral pigs controlled;
- Revegetation planting of 10.5 Ha (11,600 stems) of Central Hunter Grey Box Ironbark Woodland EEC, and 1.9 Ha (5,000 stems) of White Box – Yellow Box – Blakely's Red Gum Woodland CEEC;
- One six-monthly inspection was completed in 2022 with the second inspection unable to be undertaken due to high rainfall and flooding preventing access; and
- Track maintenance was completed in March 2022 to regain access to the BOA, after the rain events in January and February 2022. However, as wet weather conditions continued, creek crossings were flooded and internal tracks deteriorated preventing safe access to the BOA.

It is noted that the ongoing ecological monitoring program at Reedy Valley BOA could not be completed in 2022 due to high rainfall and flooding preventing safe access. Wybong and Cuan Creeks have to be crossed to access the BOA; these two creeks flooded repetitively throughout the year and limited the access to the BOA. Moreover, internal tracks were saturated and weathered, presenting hazardous driving conditions.

Monitoring Results

The annual monitoring program is generally completed during spring and autumn in the Reedy Valley BOA; however, due to the weather conditions impacting the tracks preventing safe access, the 2022 monitoring program at the BOA was rescheduled for 2023.

Implemented/Proposed Improvements

<u>Weed Management</u>

During 2023 weed management will focus on priority weeds as identified during previous monitoring and inspection programs including African Boxthorn (*Lycium ferocissimum*), African Olive (*Olea europea subsp. cuspidata*), St John's Wort (*Hypericum perforatum*), Coolatai Grass (*Hyparrhenia hirta*) and Sweet Briar (*Rosa rubiginosa*), with follow up treatment of Prickly Pear (*Opuntia spp.*) and Tiger Pear (*Opuntia aurantiaca*).

Pest Management

Bulga Coal will aim to align timing of wild dog and fox baiting programs at Reedy Valley BOA with the Local Land Services aerial baiting program in 2023 to maximise the effectiveness of the program. Ongoing inspections and monitoring will determine if cattle and other pest species persist, including feral pigs, deer, fox and goat which have been sighted at elevated and riparian parts of the BOA.

Management of some of these pests, particularly in the rocky outcrop parts of the site will be difficult due to the terrain and abundance of source populations in adjoining properties.

Habitat Augmentation & Revegetation

In 2023 revegetation works will continue at the Reedy Valley BOA with planting of 14 Ha (14,000 stems) of White Box – Yellow Box – Blakely's Red Gum Woodland, and 7 Ha (7,000 stems) of Central Hunter Grey Box Ironbark Woodland EEC.

General Management

Due to significant rainfall and flooding tracks have become eroded and overgrown. During 2023 works will be undertaken to restore existing access tracks throughout the BOA.

Slashing of boundary fencing, tracks and annual weed infestations will be undertaken where feasible to minimise both bushfire risk and further spread of weeds. Additionally, fence repairs will be undertaken on an as needs basis, as identified through inspection programs.

6.6.2.4 Wollombi Brook Conservation Area

Environmental Management

The activities undertaken at the WBCA in 2022 included:

- Weed control works focussing on: African Love Grass (*Eragrostis curvula*), Red Natal (*Melinis repens*), *G. pubescens*, *H. amplexicaule*, Guinea Grass (*Megathyrsus maximus*), Green Cestrum (*Cestrum parqui*), Balloon Vine (*Cardiospermum grandiflorum*), Moth Vine (*Araujia sericifera*), Pink pavonia (*Pavonia hastata*), Blue Heliotrope (*Heliotropium amplexicaule*), Ink Weed (Phytolacca octandra), Spearleaf Swampmallow (*Pavonia hastata*), Turkey rhubarb (*Rumex sagittatus*), Noogoora Burr (*Xanthium occidentale*) and Fleabane (*Conyza bonariensis*);
- Monitoring of trial plots to establish the effectiveness of thinning bulloak (*Allocasuaina luehmannii*) and tea-tree (*Leptospermum polyanthum*) species;
- Wild dog and fox baiting program during autumn and spring months resulted in five wild dogs and three fox takes;
- One feral pig controlled;
- Firebreak slashing along tracks and fence lines;
- Opening of the Teaching Keeping Place facility for community and training events;
- Wild dog and fox baiting autumn and spring months (five wild dogs, one Fox take);

- Revegetation planting of 5.1 ha (5,000 stems) of Central Hunter Grey Box Ironbark Woodland EEC and 3.6 ha (3,500 stems) of Warkworth Sands Woodland EEC;
- Six-monthly inspections;
- Ongoing ecological monitoring; and
- Regeneration assessment.

Monitoring Results

The annual monitoring program was completed during spring and winter in the WBCA. The 2022 monitoring program included fauna, flora, revegetation assessment and nest boxes.

Flora

Monitoring in 2022 at the WBCA continued within the eight transects, consisting of six permanent monitoring transects established in 2015 and two new temporary revegetation plots established in 2019, as described in the Biodiversity Offset Monitoring Report which is available on the Bulga Coal website (https://www.glencore.com.au/operations-and-projects/coal/current-operations/bulga-coal/monitoring-documents).

In total 125 plant species were recorded within transects at the WBCA in 2022, an increase compared to 109 recorded in 2021. Of this total, 49 are weeds, predominantly herbaceous or grassy species typical of former grazing lands, and many of these appeared after the ripping of grassland for tubestock planting in 2019. A few weedy grasses and herbs, including Red Natal Grass (*Melinis repens*), African Love Grass (*Eragrostis curvula*), Mexican Clover (*Richardia brasiliensis, R. stellaris*), and Couch (*Cynodon dactylon*) dominate the grassland and regenerating areas of Warkworth Sands Woodland. Coolatai Grass (*Hyparrhenia hirta*) was recorded at low density in transect WOL04R and should be eradicated as soon as possible before it spreads.

Monitoring of the Bulloak (Allocasuar*ina luehm*annii) and Tea-tree (*Leptospermum polyanthem*) thinning trial plots continued in 2022. Species diversity, both natives and weeds, continues to increase from the low of 2019, and for the past three years native species diversity within Bulloak and Tea-tree plots have remained above baseline data collected prior to thinning commenced in 2016. Further thinning of areas around treatment plots was conducted in 2022. This should result in further growth and colonisation by native species due to increased light levels and is being aided by non-drought conditions.

As a separate but related project, baseline floristic data was collected from seven new fire monitoring plots established within the WBCA in August-September 2022. These plots, 5 m x 5 m in size, were placed to facilitate monitoring of a proposed cultural burning program to be undertaken in the BOA. This burn did not proceed due to wet weather conditions.

Fauna

The fauna monitoring sites are located within the existing flora monitoring sites outlined in the Wollombi Brook Biodiversity Conservation Area Management Plan (Glencore 2022) and the 2019 Conservation Agreement. In 2022, the fauna monitoring program included surveys for diurnal birds, nocturnal spotlight searches, Anabat recording for microbats and habitat assessment for EPBC Act listed species.

Birds

Bird census surveys were conducted at four sites over four monitoring periods, two in winter and two in spring 2022. A total of 51 bird species were detected by census surveys, this is a decrease compared to 57 bird species recorded in 2021. Bird species diversity recorded by census survey was comparable at three sites to previous monitoring years, although Site WOL03 (remnant woodland) recorded an above average score in 2022.

Two threatened bird species were recorded in 2022, the Grey-crowned Babbler and Speckled Warbler (both Vulnerable). No evidence of the Critically Endangered Swift Parrot and Regent Honeyeater was recorded at WBCA in 2022.

Mammals

11 microchiropteran bat species were recorded at WBCA in 2022, this is consistent with the 2021 monitoring results. Several sites scored low numbers of bat calls, despite surveys being conducted in favourable weather and seasonal conditions.

Four threatened microbats were recorded, the Eastern Bent-wing Bat (4 calls), Little Bent-winged Bat (2 calls), Eastern Coastal Freetail-bat (8 calls), Large-eared Pied Bat (9 calls).

One mammal was recorded by spotlight searches, the Common Brushtail Possum. Additional large mammal species detected by field cameras include the Bare-nosed Wombat, Eastern Grey Kangaroo and Red-necked Wallaby.

A detailed list and location of fauna species recorded can be found in the Biodiversity Offset Monitoring Report which is available on the Bulga Coal website (https://www.glencore.com.au/operations-and-projects/coal/current-operations/bulga-coal/monitoring-documents).

Nest Boxes

116 nest boxes were installed in the WBCA from December 2015 to February 2016. This monitoring program meets the Habitat Augmentation requirements outlined in Wollombi Brook Biodiversity Conservation Area Management Plan. The monitoring program commenced in December 2016 and it is conducted every three years. The most recent program was completed in December 2022.The monitoring program showed that 53 (46%) of the 116 nest boxes had evidence of usage, with a summary presented in **Table 37**. 2022 observations indicated a consistent usage from previous monitoring programs, 47% in 2019 and 40% in 2016.

Table 37 Bulga Coal Nest Boxes usage at Wollombi Brook Conservation Area and Adjoining Remnant Vegetation in 2022

Nest Box Design	Total Number of Boxes	Evidence of Usage	Diversity and Abundance (Species Using the Box)
Duck	11	7 (64%)	Brushtail Possum x 7
Owl	8	8 (100%)	Brushtail Possum x 8
Large Parrot	1	1 (100%)	Glider x 1
Rosella	15	12 (80%)	Glider x 9
			Rosella x 3

Nest Box Design	Total Number of Boxes	Evidence of Usage	Diversity and Abundance (Species Using the Box)
Lorikeet	17	6 (35%)	Brushtail Possum x 1
			Glider x 3
			Antechinus x 1
			Rosella x 1
Pardalote	16	11 (69%)	Pardalote x 1
			Glider x 7
			Antechinus x 1
			Rat x 2
Brushtail Possum	13	7 (54%)	Brushtail Possum x 7
Ringtail Possum	19	10 (53%)	Brushtail Possum x 2
			Glider x 6
			Rosella x 2
Micro-bat	16	0 (0%)	-
Total	**116**	**53 (46%)**	**6 species**

Revegetation and Regeneration Assessment

An assessment of completed revegetation works and natural regeneration across the WBCA was undertaken by Koru Environmental in November 2022, with the following findings:

- Areas planted to Warkworth Sands Woodland EEC in 2019 (7.1 ha) and 2022 (3.6 ha) showed very variable success and included areas of generally satisfactory outcomes, areas of moderate success where follow-up infill plantings will be required and areas where revegetation efforts appeared to have failed and will need rework;
- The 2021 revegetation works to the Central Hunter Grey Box Ironbark Woodland EEC in the north of the WBCA (4.9 ha) showed great success with excellent tubestock survival and growth observed at the time of inspection;
- Some localised areas particularly across the northern half of the WBCA showed positive signs of active natural regeneration, particularly in areas previously cleared but where scattered (but frequent) paddock trees remained; and
- Most of the south-western and southernmost sections of the WBCA are largely cleared and highly degraded in condition, showing clear symptoms of previous grazing including compacted ground and typically high weeds diversity/abundance. Natural regeneration processes were altogether absent from these locations, which will be suitable for broadscale revegetation works targeting the Central Hunter Grey Box Ironbark Woodland EEC.

Key findings from the WBCA assessment are summarised in **Table 38**.

Table 38 Bulga Coal Regeneration Assessment Summary at Wollombi Brook Conservation Area

Type	Cumulative area (ha)	Recommended action
Planted areas – Successful	7.3	Nil action required
Planted areas – Partially successful	3.6	Supplementary infill plantings
Planted areas – Unsuccessful	8.2	Rework / revegetate
Planted areas – Trending	1.2	Monitor and re-assess in 1-2 years
Natural regeneration – Active (slight to moderate)	4.2	Improve with infill tubestock plantings if deemed necessary
Natural regeneration – Limited to absent	27.6	Broadscale active revegetation / plantings, as required

Performance against Criteria

During 2022, 16 of the 17 performance indicators were met and one failed to achieve the specific criteria (**Appendix C**).

Implemented/Proposed Improvements

Weed Management

The 2023 weed management program will focus on four key invasive species Coolatai Grass (*Hyparrhenia hirta*) Weeping Lovegrass (*Eragrostis curvula*), Natal Grass (*Melinis repens*), Eastern prickly pear (*Opuntia humifusa*) and Blue Heliotrope (*Heliotropium amplexicaule*), Balloon Vine (*Cardiospermum grandiflorum*) as a priority. With additional management and monitoring of exotic herbs to ensure their persistence and spread is prevented.

An ecological and cultural cool burn will be trialled at WBCA in 2023, the program will incorporate pre and post ecological monitoring to document the effect the trial has on native vegetation and weed suppression. Following the trial Bulga plans to refine the methodology and broaden the scope to utilise cool burns at other offset properties.

Pest Management

During surveys in 2022, evidence of feral pigs was widespread within WBCA. A fox was recorded by field cameras in WBCA and would likely be widespread across the landscape. In 2023 pest control activities will continue to be implemented with additional opportunistic management also undertaken in response to sightings or evidence of pest species presence. Planned pest management activities include wild dog and fox baiting in collaboration with Local Land Services to maximise the effectiveness of the program and kangaroo culling.

Habitat Augmentation & Revegetation

In 2023 revegetation works will continue at the WBCA with planting of 6.4 ha (6,400 stems) of Central Hunter Grey Box Ironbark Woodland EEC.

General Management

Slashing of boundary fencing, tracks and annual weed infestations will be undertaken where feasible to minimise both bushfire risk and further spread of weeds.

Fence repairs will be undertaken on an as needs basis, as identified through inspection programs.

6.6.2.5 Weeping Myall Management Areas

The weeping myall (*Acacia pendula*) management areas are located on the western side of Bulga Coal, west of Charlton Road. These two stands are marked on **Figure 21** and are referred to as Weeping Myall Management Areas 1 and 2. These Management Areas will be protected and managed by BCC; however, do not form part of a formal biodiversity offset.

The weeping myall (*Acacia pendula*) is an endangered population within the Hunter catchment, listed under the NSW *Biodiversity Conservation Act 2016* (BC Act). Management areas contain mature and juvenile weeping myall trees, the northern stand (WMMA # 1) supported relatively young trees and the southern stand (WMMA # 2) comprised very mature trees with no young plants Management Areas contain mature and juvenile (Umwelt 2013).

Environmental Management

The activities that were undertaken within the two Weeping Myall Management Areas (WMMAs) during 2022 included:

- Six-monthly inspections; and
- Ongoing ecological monitoring.

Monitoring Results

Monitoring of the WMMA commenced in 2015. Initial surveys involved the counting of all individual plants and ramets of Weeping Myall (*Acacia pendula*) within WMMA #1 and WMMA #2, as well as the recording of associated plant species within two permanent plots. In 2018, 12 new 5 m x 5 m growth plots were established across WMMA #1 (where most plants occur) to document the rate at which these root suckers developed and affected associated habitat. Additionally, a general inspection of the health and vigour of plants is also undertaken. Monitoring of floristic changes evident in the two 20 m x 20 m plots has continued since 2015, with one plot in each WMMA.

Monitoring of growth plots in 2022 has shown continuing increases in height of the tallest individuals of *Acacia pendula* across all plots, although the number of stems fluctuates across the three treatment areas. Overall, there has been an ongoing decreasing trend in the number of stems since the peak in 2020 in grassy woodland plots, but in grassland and bare woodland plot numbers have increased or remained steady. Dense grass growth has compromised counts of young ramets in some plots, such as plot BW02PEN in bare woodland where a marked decrease in stem numbers has occurred.

In 2022, the two floristic survey plots recorded 62 plant species (19 weed species) in WMMA #1, and 56 species (23 weeds) in WMMA #2. Both plots have maintained a steady number of both weed and native species since the breaking of the 2017-2019 drought. All weeds are typical of former grazing lands in the Hunter Valley, with African Olive (*Olea europaea subsp. cuspidata*) being the only woody species. The newly recorded weed species *Senecio jacobaea* (Ragwort) may require targeted control in coming years.

Implemented/Proposed Improvements

Bulga Coal will continue to monitor the WMMAs to address the general health of Weeping Myall plants, together with annual re-surveying of the floristic composition within the two monitoring plots, and counts of *Acacia pendula* stems and floristic composition within the twelve growth monitoring plots. Additionally, the following recommendations will be implemented:

- Monitor prevalence of *Senecio jacobaea* (Ragwort) management as necessary;
- Continue to informally monitor for flowering on individual Acacia pendula trees, in the event that a repeat flowering event occurs over the next twelve months;
- Continue to informally monitor the impact of mistletoes on older individuals of *Acacia pendula* within WMMA # 2; and
- Monitor activity by feral pigs within the WMMAs, and trap or bait where appropriate.

6.6.2.6 Vere Offset

The Vere BOA currently supports 153.8 ha of the Central Hunter Valley Eucalypt Forest and Woodland Critically Endangered Ecological Community (CEEC), listed under the EPBC Act. Active restoration management actions are proposed that will restore 37.7 ha of the site to CEEC condition. The conservation area also contains one recorded European heritage value site.

Environmental Management

During November 2022 a land management inspection was conducted at the proposed Vere BOA to establish future actions at the site including weed management, pest management and maintenance.

Key recommendations from The Vere Offset Area Property Inspection Report (Enright Land Management, 2022) include:

- Repair and install new fences;
- Treat weeds including Golden Wreath Wattle (*Acacia Saligna*), Lantana (*Lantana montevidensis*), Prickly Pear (*Cylindropuntia species*), Arborescent prickly pear (*Opuntia leucotricha*), Bitou Bush (*Chrysanthemoides monilifera*), Gooseberry (*Physalis sp*.), Blue Heliotrope (*Heliotropium amplexicaule*), Galenia (*Heliotropium amplexicaule*), African Olive (*Olea europaea*), Balloon Vine (*Cardiospermum grandiflorum*), and general seasonal weeds;
- Wild dog and fox baiting program during autumn and spring months resulted in two wild dogs (*Canis lupus familiarise*), two fox (*Vulpes vulpes*) and four feral pig (*Sus scrofa*) takes;
- 10 feral pigs (Sus scrofa) controlled;
- Track maintenance;
- Monitoring of erosion in gullies and dams on the property; and
- Regeneration assessment.

Monitoring Results

The Vere is a new BOA added to Bulga Coal, with monitoring commencing in 2022. A large proportion of the Vere BOA currently comprises native vegetation and derived native grasslands of moderate to good condition, therefore the BOMP focusses on regeneration and revegetation strategies to enhance existing communities and establish further native vegetation in degraded areas. These works will focus specifically on the Central Hunter Valley Eucalypt Forest and Woodland CEEC.

The offset monitoring program is outlined the BOMP, requiring annual systematic ecological monitoring for the first 10 years (2022–2031), then every 3 years for the following 15 years.

Flora

Seventeen new flora monitoring plots were established within the Vere BOA in 2022, positioned at or very close to existing plot locations as detailed in the Biodiversity Stewardship Site Assessment Report (BSSAR) prepared by Umwelt in 2022. The description and location of the monitoring points can be found in the Biodiversity Offset Monitoring Report which is available on the Bulga Coal website (https://www.glencore.com.au/operations-and-projects/coal/current-operations/bulga-coal/monitoring-documents).

During baseline surveys in 2022, 245 plant species were recorded within these 17 monitoring plots, including 175 natives and 70 weeds. A number of species present are planted stock within restored areas (e.g. *Eucalyptus albens, Eucalyptus cladocalyx, Eucalyptus sideroxylon*). Most weed species are herbs and grasses typical of former grazing lands in the Hunter Valley. Sugar Gum (*Eucalyptus cladocalyx*) is a South Australian species no present naturally in NSW, and plantings of this species should be progressively removed and replaced with local endemic eucalypts. Other planted eucalypts including White Box (*Eucalyptus albens*) and Mugga Ironbark (*Eucalyptus sideroxylon*) should also be replaced as they do not naturally occur in the Broke locality.

Recommendations

Some of the pre-determined monitoring plot locations may not sample the intended vegetation zones as outlined in the BSSAR. A review of plot locations should be undertaken to ensure suitability for ongoing monitoring.

Fauna

This section outlines the main findings during the 2022 fauna monitoring program. This program included surveys for diurnal birds, nocturnal spotlight searches and Anabat recording for microbats under the BOMP.

Birds

Bird census surveys are conducted at nine sites over four monitoring periods, two in winter and two in spring 2022. A total of 67 bird species were detected by census surveys, with a number of additional bird species either observed indirectly, or known to occur based on previous monitoring surveys of the BOA. Three threatened bird species were recorded in 2022, the Grey-crowned Babbler, Varied Sittella and Speckled Warbler (all Vulnerable under the BC Act). No evidence of the Critically Endangered Swift Parrot or Regent Honeyeater was recorded at the Vere BOA in 2022.

Mammals

Ten microchiropteran bat species were recorded at the Vere BOA in 2022. Several sites scored very low numbers of bat calls, despite surveys being conducted in favourable weather and seasonal conditions.

Three threatened microbats were recorded, the Eastern Bent-wing Bat (39 calls), Eastern Coastal Freetail-bat (78 calls), Large-eared Pied Bat (30 calls).

Five mammals were recorded by spotlight searches, the common wombat, common brushtail possum, squirrel glider, eastern grey kangaroo, red-necked wallaby. Additional mammal species detected by field cameras included a swamp wallaby.

A detailed list and location of fauna species recorded can be found in the Biodiversity Offset Monitoring Report which is available on the Bulga Coal website (https://www.glencore.com.au/operations-and-projects/coal/current-operations/bulga-coal/monitoring-documents).

Nest Boxes

60 nest boxes were installed in the Vere BOA from February 2017 to October 2017. This monitoring program meets the Habitat Augmentation requirements outlined in the Vere BOMP. The monitoring program commenced in December 2018 and it is conducted every three years. The most recent program was completed in December 2021.

Revegetation and Regeneration Assessment

An assessment of completed revegetation works and of natural regeneration across the offset was undertaken by Koru Environmental in November 2022, with the following findings:

- Overall, opportunities for large-scale revegetation are somewhat limited and it is unlikely that actively revegetating 33.8 ha (as per current approval requirements) will be required;
- Signs of active natural regeneration were observed in many locations, particularly along the fringes of remnant vegetation and within smaller clearings/openings surrounded by remnant vegetation (i.e. facilitated by edge effect ecological processes);
- The large area to the south-east of the offset where previous ground disturbance occurred was generally well-recovered and regenerated, and will only require minor, targeted and localised improvement works;
- In many areas the implementation of revegetation works will likely be hindered by a dense shrub layer (i.e. prior thinning/clearing may be required) and/or a thick layer of invasive priority weed grasses (particularly South-African Pigeon Grass and Kikuyu) or other weeds, which will first need to be managed; and
- In total, less than 21.0 ha of cleared or partially cleared land was estimated as requiring broadscale revegetation works.

Key findings from the Vere BOA assessment are summarised in **Table 39**.

Table 39 Bulga Coal Regeneration Assessment at Vere BOA

Type	Cumulative area (ha)	Recommended action
Area of previous ground disturbance – Successfully recovered	6.3	Unlikely to require enhancement works
Area of previous ground disturbance – Poor condition	3.5	Full rework and revegetation
Natural regeneration – Active (moderate to high)	7.4	Unlikely to require active revegetation
Natural regeneration – Active (low to moderate)	1.0	Infill plantings at reduced planting effort
Natural regeneration – Limited to absent	21.0	Broadscale active revegetation / plantings

Implemented/Proposed Improvements

Weed Management

The 2023 weed management strategy for the Vere BOA will focus on the management of priority species identified in the 2022 monitoring and inspection programs including creeping lantana (*Lantana montevidensis*), golden wreath wattle (*Acacia saligna*), cootamundra wattle (*Acacia baileyana*), Queensland silver wattle (*Acacia podalyriifolia*), southern silky oak (*Grevillea robusta*), coolatai grass (*Hyparrhenia hirta*) and exotic grasses.

Pest Management

During surveys in 2022, evidence of feral pigs was widespread lower lying areas of the Vere BOA and a solitary cat was photographed by a field camera. No other evidence of introduced feral predators or pests were detected by field camera over a monitoring period of several months.

In 2022 pest control activities will continue to be implemented with additional opportunistic management also undertaken in response to sightings or evidence of pest species presence. Planned pest management activities include wild dog and fox baiting in collaboration with Local Land Services to maximise the effectiveness of the program and pig trapping.

General Management

Slashing of boundary fencing, tracks and annual weed infestations will be undertaken where feasible to minimise both bushfire risk and further spread of weeds.

Fence repairs and tracks maintenance will be undertaken on an as needs basis, as identified through inspection programs.

6.7 Weeds and Pests

6.7.1 Environmental Management

An ongoing weed control program was carried out by licenced contractors. Annual buffer land inspections monitor success of any previous weed control and identify areas which will require additional treatment. Major efforts were implemented in 2022 to conduct weed management by prioritising the significance, timing and treatment method.

Land management contractors were engaged by Bulga Coal to undertake vertebrate pest control programs in autumn, spring and summer in conjunction with the coordinated program being organised by Local Land Services, where possible. As part of the program, 1080 baiting was conducted, targeting wild dog and fox populations within the landholdings. Pig trapping was conducted in targeting populations onsite travelling through buffer lands and BOAs (Broke Road, Condran and Reedy Valley).

6.7.2 Environmental Performance

Annual buffer land inspections generally indicate that weed management is successful, but ongoing monitoring and treatment is required to prevent further infestations.

The 1080 baiting program was undertaken in autumn and spring. The autumn program included a total of 588 baits laid with a total of 134 baits taken, which represented 23% of the available baits and a decrease on the 2021 results. The spring baiting program had 33 baits taken by target species which represented 29% of the available baits and the autumn baiting program had 62 baits taken by target species which represented 21% of the available baits. This was in general lower than the previous year's results.

6.7.3 Implemented/Proposed Improvements

Weed management will focus on the recommendations from the Annual Weed Action Plan. Monitoring inspections will continue, and further vertebrate pest control will be undertaken during 2023.

6.8 Archaeology and Heritage

6.8.1 Environmental Management

Bulga Coal continues to work with the Registered Aboriginal Parties (RAPs) regarding aspects of Aboriginal heritage and the implementation of the *Bulga Coal Aboriginal Cultural Heritage Management Plan* (ACHMP).

Bulga Coal manages European (historical) heritage through the implementation of the *Historic Heritage Management Plan* (HHMP).

6.8.2 Environmental Performance

6.8.2.1 2022 Quarterly Monitoring

A program for quarterly monitoring of Aboriginal heritage sites began in 2013 at Bulga Coal. Bulga Coal continued to monitor Aboriginal heritage sites in conjunction with (up to) four RAPs and an OzArk archaeologist in 2022. Quarterly monitoring reports are available on the Bulga Coal website (https://www.glencore.com.au/operations-and-projects/coal/current-operations/bulga-coal/monitoring-documents) and the results are summarised as:

- Quarter 1 monitoring was undertaken on 2 March 2022. The inspection included review of sites primarily at the Loders Creek Grinding Grooves Relocation Area (LCGGRA) and at site BCO10 (37-6-1401) within the WBCA;
- Quarter 2 monitoring was undertaken on 25 May 2022, this included a review primarily of sites to the west of Charlton Road;

- Quarter 3 monitoring was undertaken on 14 and 15 September 2022. This monitoring was focused on sites primarily to the south of Bulga Coal (south of Broke Road) and sites to the east of Broke Road. In addition, an inspection was undertaken at the LCGGRA to inspect the erosion impacts which occurred during a July flooding event; and

- Quarter 4 monitoring occurred on 9 November 2022. This monitoring was focused on sites to the northeast of Bulga Coal and west of Charlton Road.

6.8.2.2 New Aboriginal Heritage Sites

On 2 March 2022 during a due diligence heritage assessment for proposed tree planting in the WBCA an isolated mudstone flake (WBCAA IF-2) was recorded. WBCAA IF-2 (37-6-4195) was located at the edge of a disused track on a slight slope in regenerating Casuarina woodland. The area had been previously cleared and intensively grazed. Following the recording of WBCAA IF-2, the site was excluded from the tree planting disturbance area.

6.8.2.3 Salvages During 2022

During 2022, four sites were salvaged in accordance with the Aboriginal Cultural Heritage Impact Assessment for the Bulga Coal Optimisation Project Modification 3 and Modification 7. The salvage works as described in Section 8.1.2 of the ACHMP were conducted in accordance SSD-4960 at sites BP L5 (37-6-1659), BP L6 (37-6-1660), BOP OS-10 (37-6-2844) and Bulga IF-2 (37-6-3763) on 14 September 2022.

The salvage program resulted in the one artefact being collected from Bulga IF-2 (37-6-3763). No artefacts were located at BP L5 (37-6-1659), BP L6 (37-6-1660) or BOP OS-10 (37-6-2844). At the conclusion of the salvage program, all four sites are considered 'destroyed' and require no further management or investigation. Aboriginal Site Impact Recording Forms have now been submitted to the Aboriginal Heritage Information Management System register to record that all sites are now considered 'destroyed'.

6.8.2.4 Wollombi Brook Conservation Area

The WBCA is both a biodiversity offset area and an Aboriginal and Cultural Heritage Offset Area. Heritage is managed in accordance with the *Wollombi Brook Plan of Management* (Appendix J of the ACHMP). Land management is undertaken in accordance with the BOMP.

The Minimbah Teaching Place was built in December 2021. The facility is located in the WBCA and will be available for the community and tourists to learn about local Aboriginal history. It will also store salvaged artefacts from Bulga Coal, United Wambo and Mount Owen Glendell Operations. There is access to the waterhole in Wollombi Brook and interpretive signage telling the Wonnarua story.

On 24 June 2022 Minimbah Teaching Place was officially opened by the Wonnarua community at a celebratory morning tea (**Photo 1**). Around 85 guests enjoyed traditional dancing (Photo 2), music and bush tucker. Bulga Coal will continue to work with the Aboriginal community on projects including bush tucker gardens, walking trails, signage and educational resources. On 25 November 2022 the Annual Aboriginal Stakeholder meeting was also held at the Minimbah Teaching Place.

Photo 1 Opening of Minimbah Teaching Place

Photo 2 Traditional Dancing at the Opening of Minimbah Teaching Place

6.8.2.5 Loders Creek Grinding Grooves Conservation Area

On 3 November 2022 the LCGGCA Agreement was executed by Heritage NSW. The LCGGCA is an Aboriginal and Cultural Heritage conservation area. Heritage is managed in accordance with the LCGGCA Plan of Management (Appendix K of the ACHMP). Land management is undertaken in accordance with the *Biodiversity Management Plan*.

Photographic monitoring of the LCGGCA occurs annually, and the site is monitored once a year as part of the Quarterly Monitoring Program. In March 2022, the four fixed photo points were photographed to monitor the condition of the Loders Creek Grinding Grooves. There are 5 main groups of grooves within the site (Groups A to E). The site was originally photographed in September 2015 following the relocation, and annually between 2017 and 2022. In summary, the 2022 monitoring showed that natural weathering is occurring to the Group A and Group D grooves. Group A has a layer of sandstone starting to exfoliate and Group D grooves are weathering and becoming less obvious. Despite weathering the grooves remain in good condition and no further management is required. All results from the monitoring are presented in **Appendix G**.

6.8.2.6 Incidents

No heritage related incidents occurred during 2022.

6.8.3 Implemented/Proposed Improvements

The ACHMP and HHMP were both revised and submitted to DPE in November 2020 and were approved in May 2022.

Key changes in the ACHMP included:

- Updates to reflect current consent conditions;
- Updates to Appendix H (Loaders Creek Grinding Grooves Conservation Area Plan of Management) to include RAP comments; and
- The addition of sections for incident reporting, complaints management and reporting.

Key changes to the HHMP included:

- Updates to reflect current consent conditions;
- Updates to evidence of DPE consultation; and
- Revision of Sections 2.1, 5.2, 5.7.4, 6.2.1, 6.2.2.

6.9 Visual and Lighting

6.9.1 Environmental Management

Control strategies are implemented to reduce potential visual and light related impacts associated with mining operations. Management is undertaken in accordance with the *Bulga Lighting Plant Procedure* and the *Visual Impact Management Plan* which was revised in 2020 and was approved by DPIE on 30 June 2021.

A reviewed version of the *Visual Impact Management Plan* has been submitted to the DPE in early 2023, to include additional visual screening along Broke Road.

Visual and lighting impacts are assessed through monitoring and inspection regimes. Onsite monitoring includes assessments of lighting impacts, compliance with development consent conditions and the angle at which light is emitted from lamps and luminaries, glare, spill and sky glow.

6.9.2 Environmental Performance

Potential lighting impacts are assessed as part of the overburden dump design process. Dumps are orientated, where practicable, and windrows or bunds are designed and constructed to mitigate lighting impacts.

A sensitive lighting receiver map is updated and communicated to mining personnel prior to commencing exposed dumps that have the potential to cause lighting impacts offsite.

6.10 Spontaneous Combustion

6.10.1 Environmental Management

Spontaneous combustion is managed in accordance with the *Spontaneous Combustion Management Plan*. Inspections of potentially affected areas are conducted during each shift. Spontaneous combustion incidents at Bulga Coal are predominantly associated with coal stockpiles.

Portable gas monitoring units are used by units working in areas of spontaneous combustion or where toxic gases are suspected of being present. This is for the purpose of identifying the presence of spontaneous combustion and any potential increase in risk.

6.10.2 Environmental Performance

There were no incidences of spontaneous combustion in 2022.

6.11 Bushfire

6.11.1 Environmental Management

Bushfire management strategies and monitoring are undertaken at Bulga Coal in accordance with the *Bushfire Management Plan* which was updated in August 2022. The contact details of key personnel were updated and the revised documents were provided to the Rural Fire Service (RFS).

The following activities were undertaken during the reporting period:

- Consultation with RFS to provide the latest version of the Bushfire Management Plan;
- Annual fire season review completed including currency of contacts and refuge points, GIS database and works required prior to the bushfire season;
- Monitoring of fuel loads in areas that adjoin Charlton Road and the former Broke Road, private property boundaries, tenanted properties and mine owned assets;

- Monitoring of tracks and trails within the Bulga Coal colliery holding to ensure these remain accessible by checking for fallen logs, erosion or other signs of trail degradation;
- Monitoring of weather conditions; and
- Hazard reduction measures were implemented including slashing powerline easements, access tracks and boundaries of adjoining land holdings.

6.11.2 Environmental Performance

No bushfires were recorded on the site.

6.11.3 Implemented/Proposed Improvements

Bulga Coal continued to maintain existing fire breaks and monitor fuel loads.

6.12 Greenhouse Gas Emissions

6.12.1 Environmental Management

Bulga Coal implements controls to mitigate air quality impacts in accordance with the *Air Quality and Greenhouse Gas Management Plan*. The Air Quality and Greenhouse Gas Management Plan was revised in 2020 for SSD-4960 Modification 3 and DA 376-8-2003 Modification 7 and was approved by DPE in May 2022.

Bulga Coal use both pre-mining and post-mining gas drainage to provide a safer, more productive mining environment. Pre-mining drainage wells extract methane and carbon dioxide from the coal seams which is piped to the 9 Megawatt (MW) gas fired power station and Flaring Facility where it is converted to carbon dioxide. A small amount of coal seam water is also extracted from the pre-drainage wells as a by-product of gas production. All coal seam water is contained within the Bulga Coal water management system.

The underground goaf atmosphere is managed with the post-mining gas drainage infrastructure. This helps reduce the potential for spontaneous combusting within the sealed underground workings and potential leakage of methane from the sealed workings intercepted by open cut mining.

Post-mining drainage methane and carbon dioxide is extracted from the mined out goaf and is sent to the Post-drainage Flaring Facility for combustion of the methane. This conversion of coal seam methane gas to carbon dioxide gas and water substantially reduces greenhouse gas emissions from the Bulga Underground Operations.

Methane and carbon dioxide levels are measured in the gas drainage operations. The gas drainage operations have monitoring at the gas wells, flaring facilities and the 9 MW power station. The gas composition and flow rate are trended in the site's continuous monitoring system, and long-term data stored offsite in a database.

6.12.2 Environmental Performance

6.12.2.1 Reported Greenhouse Gas Emissions

Bulga Coal reports greenhouse gas emissions (GHG) in accordance with National Energy and Greenhouse Gases (NGER) legislation. Each financial year Bulga Coal is required to submit to the federal government the emissions from their NGERs registered facility. Also, because Bulga Coal emits over 100 kt of CO2e- each year, Bulga Coal is registered as a Safeguard facility and therefore also had a Safeguard baseline. Emissions above the baseline for that year need to be offset by retiring Australian Carbon credit Units (ACCUs).

The NGERs reporting year is based on a financial year, not a calendar year such as this Annual Review. To prevent incompatible public reporting, the values in this report also cover a financial year. **Table 40** contains the Scope 1 (direct emissions from the mining activities during the year), and Scope 2 emissions (electricity consumption by the mine during the year).

Table 40 Bulga Coal Greenhouse Gas Emissions (Scope 1 and 2 Direct Emissions) FY 2021/2022

Emissions	Bulga Coal (t CO2-e)			
	2019/2020	2020/2021	2021/2022	Predicted maximum annual totals
Total Scope 1 Emissions	***747,505***	***516,614***	***474,479***	***1,011,888***
Total Scope 2 Emissions	***51,673***	***42,420***	***46,126***	***55,042***
Total Emissions (Scope 1 and 2)	**799,178**	**559,034**	**520,605**	**1,066,930**

Note – The predicted maximum annual total includes 1,066,930 t CO_2-e (1,011,888 t CO2-e Scope 1 and 55,042 t CO_2-e Scope 2) from the Greenhouse Gas and Energy Assessment for the Bulga Optimisation Project EIS and excludes the Bulga Underground Operations. The annual emissions included in Table 40 also include the emissions from the remnant underground gas drainage.

Overall, there was a decrease in Bulga Coal emissions of approximately 7% when compared to the 2020/2021 reporting period. The decrease is attributable to reduced fugitive emissions from ROM coal. Over the 2021/2022 period Bulga mined coal in areas of the mine which have lower gas zones compared to the 2020/2021 period.

6.12.2.2 Comparison Against Predictions

A Greenhouse Gas and Energy Assessment was prepared for Bulga Coal by Umwelt (2012) as a component of the Bulga Optimisation Project EIS. The assessment does not include the emissions associated with the Bulga Underground. A comparison against the predictions of the Greenhouse Gas and Energy Assessments is included in **Table 40**.

Predictions represent the maximum annual greenhouse gas emissions for Bulga Coal during operations, hence both Scope 1 and Scope 2 emissions were lower than predicted. Overall, greenhouse emissions were approximately 51% lower than the maximum predicted, primarily because the deeper coal which is higher in emissions has not yet been mined.

6.12.3 Implemented/Proposed Improvements

Bulga Coal is a part of the wider coal assets held by Glencore across Australia. Glencore Coal Assets Australia (GCAA) are themselves a part of the global Glencore mining portfolio. In line with the ambitions of the 1.5°C scenarios set out by the IPCC, Glencore target a short-term reduction of 15% by 2026 and a medium-term 50% reduction of our total (Scope 1, 2 and 3) emissions by 2035 on 2019 levels. Post 2035, Glencore's ambition is to achieve, with a supportive policy environment, net zero total emissions by 2050.

Glencore incorporates energy costs and our carbon footprint into our annual planning process. Commodity departments, such as Glencore Coal Assets Australia, are required to provide energy and GHG emissions forecasts for each asset over the forward planning period and provide details of emissions reduction projects.

In the case of Bulga Coal this includes involvement with GCAA when considering available GHG abatement technology and mine planning to optimise efficiency (which usually translates into reduced fuel consumption).

In 2023 Bulga Open Cut will install coal seam gas drainage wells into the Piercefield Seam to enable the safe and productive open cut mining of the seam. The captured gas which is predicted to have a high methane concentration, will be piped to the gas fired power station and associated flares where it will be converted to carbon dioxide to reduce greenhouse gas emissions.

6.13 Hydrocarbon Management

6.13.1 Environmental Management

Controls implemented to manage the risk of hydrocarbon related impacts are conducted under:

- *Bulga Coal Hydrocarbon Management Plan*, incorporating spill response procedure and Bulga Open Cut Hydrocarbon TARP;
- Bioremediation Area Management Plan; and
- Bulga Coal Pollution Incident Response Management Plan.

Hydrocarbon storage facilities have been designed generally in accordance with AS 1940-2004 – '*The Storage and Handling of Flammable and Combustible Liquids*'. The storage system includes computerised controls for the purpose of monitoring and identification of faults.

Bulga Coal monitor for petroleum hydrocarbons at dirty water dams, EPL discharge points and groundwater bores surrounding hydrocarbon storage and natural watercourses, in accordance with the *Bulga Open Cut Remediation Action Plan* and the *Bulga Coal Hydrocarbon Management Plan*. The monitoring program involves:

- Regular inspections of hydrocarbon infrastructure to identify losses or leakages;
- Monthly oil and grease analysis at the surface water monitoring sites shown on **Figure 22**; and
- Hydrocarbon monitoring at the locations listed in **Table 41**. Surface water sites are monitored quarterly, following rain. Groundwater sites are monitored six-monthly.

Bulga Coal

FIGURE 22 - Bulga Coal Hydrocarbon Surface and Groundwater Monitoring 2022

GLENCORE

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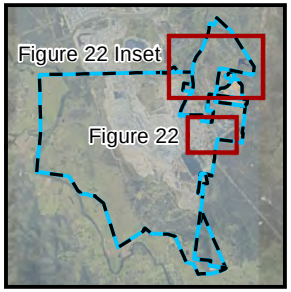
Legend

- Mining Lease
- Hydrocarbon Groundwater
- Hydrocarbon Surface Water
- Local Roads
- Watercourse
- Railway



GDA2020

Date Created: 23/03/2023
Map Size: A4 Landscape
Scale: 1:10,000
Map Created By: MPollock
Coordinate System:
GDA2020 MGA Zone 56
Projection: Transverse Mercator
Datum: GDA2020

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6.13.2 Environmental Performance

Surface water and groundwater monitoring was conducted at the locations listed in **Table 41** and shown on **Figure 21**. Results were assessed against the Hydrocarbon Trigger Action Response Plan (TARP) triggers in **Table 42**.

Table 41 Hydrocarbon Monitoring Sites

Type	Monitoring Location
Groundwater	ASMW02
	ASMW06
	ASMW07
	C2MW03
	C2MW04
	C3MW01
Surface Water	NMC4
	NMC5
	NMC6
	NMC Culvert
Licenced Discharge Point (LDP)	Northern Dam (ND1)
Onsite Dirty Water Dam	AS Dam 1
	AS Dam 2
	AS Dam 3
	C2 Dam
	C3 Dam

Table 42 Ecological Investigation Levels (ANZECC) Adopted for Natural Waters (Surface and Groundwater) at Bulga Open Cut

Sampling Location	Contaminant	Trigger (µg/L)
Surface Water **NMC4, NMC5, NMC6, Nine Mile Creek Culvert, ND1.** **Groundwater** **ASMW02, ASMW06, C2MW03, C2MW04, C3MW01.**	TRH C6-C10	20 (LOR)
	TRH >C10-C16	100 (LOR)
	TRH >C16-C34	100 (LOR)
	TRH >C34-C40	100 (LOR)
	TRH >C10-C40	300 (LOR)
	Naphthalene	16
	Phenanthrene	0.6
	Anthracene	0.01
	Fluoranthene	1
	Benzo(a) pyrene	0.1

Groundwater monitoring results in 2022 were below the Ecological Investigation Levels.

Surface water monitoring results from the Nine Mile Creek monitoring sites and the Northern Dam were also below the Ecological Investigation Levels.

Hydrocarbon spills were contained, cleaned-up and bioremediated or transported offsite as hazardous waste by a licensed waste contractor.

6.13.3 Implemented/Proposed Improvements

A new bulk fuel facility and a new light vehicle workshop will be constructed in the East Pit to replace the existing infrastructure in the Area Station.

A new ultra-class workshop will be constructed within the maintenance workshop area.

6.14 Public Safety

6.14.1 Environmental Management

Controls implemented to minimise the potential for public safety incidents include:

- Implementation of a security system. These systems and procedures have been established in accordance with the relevant requirements under the *Work Health and Safety Act 2011*, *Mining Act 1992* and conditions stipulated in the relevant mining tenements;
- Using sentries to prevent unauthorised entry into the blast exclusion zone; and
- Maintaining a fence around the perimeter of mining operations.

6.14.2 Environmental Performance

There were no public safety incidents recorded at Bulga Coal during the reporting period. Management measures and control strategies implemented at Bulga Coal have been effective in the prevention of incidents regarding public safety during the reporting period.

There were no changes to public safety management in 2022.

7.0 Water Management

7.1 Water Management

The 2022 reporting period recorded 1,200 mm of rain with substantial flooding in February, March and July followed by November and December being dryer than usual. The surface and groundwater monitoring data reflects the natural response to a second year of greater than average rainfall, surface flows and groundwater recharge.

7.1.1 Water Balance

Bulga Coal uses a water balance model to assist in the management of water onsite. The model is used to review performance and undertake short term projections (12 months) of water requirements. The model is also used to predict water needs for the life of the mine. Major water transfers are monitored via flow meters. Water storage volumes are monitored with level sensors or measured fortnightly.

The water balance for Bulga Coal is presented in **Table 43**. The discrepancy between inflows, outflows and change in storage is due to the limitations of the accuracy of the surface and groundwater storage measurements and water balance model predictions.

Table 43 Bulga Coal 2022 Water Balance

Bulga Coal 2022 Water Balance	Volume (ML)
Water Inventory and Capacity	
Total estimated water stored on site 1 January 2022 (8,804 ML predicted to be in the underground goaf)	15,877
Total estimated water stored on site 31 December 2022 (11,742 ML predicted to be in the underground goaf)	22,117
Change in water inventory	6,240
Inflows	
Water extracted from Hunter River (monitored)	1,641
Rainfall and runoff intercepted from mine areas (Approximately 1.6 GL into Blakefield South goaf)	13,538
Groundwater inflow (Groundwater model prediction)	795
Pumped from dewatering bores	528
Water entrained in CHPP feed material	681
Potable supply	10
Mt Thorley Mine water supply	190
Total Inflows	**17,383**
Outflows	
Evaporation	2,787
Discharge to Hunter River under Hunter River Salinity Trading Scheme	3,849
Discharge via spill	230

Bulga Coal 2022 Water Balance	Volume (ML)
Water entrained in product coal, coarse rejects and tailings	1,566
Open Cut Dust suppression	1,196
Bulga Underground Operations Water Consumption	0
Potable water consumption	10
Other losses	5
Total outflows	9,643

7.1.2 Licensed Water Take

Water taken by Bulga Coal during the previous water year (1 July 2021 to 30 June 2022) is summarised in **Table 44**.

Table 44 Water Take 2021–2022

Water Licence #	Water Sharing Plan, Source and Management Zone	Entitlement (ML)	Total entitlement under Source	Passive take/ inflows	Active Pumping	Total
Groundwater						
WAL41687	Mining: Sydney Basin-North Coast Groundwater Source	500	2365	795	226	1,021
WAL41546	Mining: Sydney Basin-North Coast Groundwater Source	365				
WAL41543	Mining: Sydney Basin-North Coast Groundwater Source	500				
WAL41544	Mining: Sydney Basin-North Coast Groundwater Source	500				
WAL41545	Mining: Sydney Basin-North Coast Groundwater Source	500				
WAL36221	Mining: Wollombi Brook Aquifer leakage to Permian coal measures	300	300	0	0	0
Surface Water						
Singleton Council Agreement	Hunter River	2,067		0	1,392	1,392

*This is the annual Singleton Council agreement allocation (867 ML) along with an additional 1200 ML temporary transfer from Resource Pacific Pty Ltd (Ravensworth Mine) under licence 20AL203244. Bulga did not transfer water to other mines in 2021/2022.

7.2 Surface Water

7.2.1 Environmental Management

Bulga Coal implements surface water management measures in accordance with the *Water Management Plan*. This Plan outlines procedures for the detection of significant offsite impacts. The Plan also outlines trigger levels to identify and manage potentially adverse impacts. Trigger levels are included in the site Environmental Monitoring Database (EMD), which generates an alarm if a trigger level is reached.

The site also operates a Surface Water TARP to assist with managing the site's surface water during storm events. The Plan further outlines the methods for monitoring the quantities of water extracted, imported or discharged under groundwater extraction licences, surface water extraction licences and the EPL.

Monthly surface water quality monitoring is undertaken at dams, streams and creeks in and around Bulga Coal mining operations. Monitoring locations were selected to obtain representative samples. Water quality parameters including temperature and depth are tested onsite, whilst pH, electrical conductivity (EC), and total suspended solids (TSS) are undertaken by a National Association of Testing Authorities (NATA) accredited laboratory.

Surface water quality monitoring is conducted in accordance with:

- AS 5667.4 – 1998 Water Quality Sampling – Guidance on Sampling from Lakes, Natural and Man-made;
- AS 5667.6 – 1998 Water Quality Sampling-Guidance on Sampling of Rivers and Streams; and
- The Bulga Coal Water Management Plan.

The *Water Management Plan* was approved by DPIE in 2021.

7.2.2 Environmental Performance

A summary of surface water monitoring results against relevant criteria from the Water Management Plan is provided in **Table 45**. The location of surface water monitoring sites is shown on **Figure 7**. Monitoring data is available on the Bulga Coal website (https://www.glencore.com.au/operations-and-projects/coal/current-operations/bulga-coal/monitoring-documents). Jacobs have produced the Bulga Coal Complex Annual Surface and Groundwater Monitoring Report (Jacob, 2023) which is attached as Appendix D.

Table 45 Summary of Surface Water Monitoring Results – 2022 Annual Averages

Sample Point	pH (range Min-Max)	pH Criteria		EC (µS/cm)	EC Criteria (µS/cm)	TSS (mg/L)	TSS Criteria (mg/L)
		Lower 20th percentile	Upper 80th percentile		80th percentile		80th percentile
LR1[1]	6.6–7.3	7.12	7.81	310	944	23	12
LR2	6.9–7.8	7.39	7.91	1,511	4,924	12	40
LR5	6.7-7.3	7.41	7.98	452	1,350	13	12
W2	6.8-7.4	7.13	7.67	472	836	13	12
W4	6.7-7.4	7.33	7.87	475	947	14	10

Sample Point	pH (range Min-Max)	pH Criteria		EC (µS/cm)	EC Criteria (µS/cm)	TSS (mg/L)	TSS Criteria (mg/L)
		Lower 20th percentile	Upper 80th percentile		80th percentile		80th percentile
SDL1	6.8-7.6	6.70	7.24	215	285	20	39
NDL1	7.1–8.3	7.14	7.26	4,683	399	18	70
W9[3]	7.8–9.0	7.36	7.92	5,605	1,970	18	157
W10	7.6–8.7	7.00	7.64	15,933	691	31	102
NMC1[2]	6.8–8.6	-	-	918	-	19	-

[1] Site is upstream of the operations and is used as a reference site.

[2] Insufficient data to establish criteria.

[3] W9 replaced W8 as it was mined through.

7.2.2.1 Surface Water pH

Historic pH trends mostly continued into 2022 with all sites showing similar variability in pH. Measured pH ranged from a maximum of 9.0 at W9 north-east of Bulga Coal, to a minimum of 6.62 at LR1 south of the BCC.

pH in Wollombi Brook remained generally neutral, while all other watercourses remained slightly alkaline in accordance with historic trends. pH in Loders Creek, measured from W9, which showed elevated alkalinity for the length of 2022, reached a maximum of 8.95 in March. W9 and W10 are located within refugial pools which typically have poor quality water, being alkaline and highly saline.

pH measured at the northern drainage line (NDL1) rose steadily over the length of 2022, reaching 8.27 in December 2022. This increase is well correlated with rising EC seen at the site over 2022. NDL1 is located on an ephemeral drainage line, it is sampled from a standing pool of water, which generally has low water levels and becomes dry after low rainfall.

All monitored watercourses remained within historic pH ranges. Erratic changes in waterway pH can be attributed to high rainfall from 2021-2022 contributing to heterogenous waterway conditions throughout the year as well as usual seasonal variability.

7.2.2.2 Surface Water EC

Historic surface water Electrical Conductivity (EC) trends mostly continued into 2022, as all sites show significant variability in EC over the monitoring period. Measured EC ranged from a maximum of 24,000 µs/cm at W10 west of Bulga Coal, to a minimum of 134 µs/cm at SDL1, south-west of Bulga Coal.

Six of nine monitored sites were measured to be below the adopted trigger level during sampling events in 2022.

Measured EC in Loder Creek at W9 and W10, upstream of confluence with Nine Mile Creek, exceeded the adopted trigger value for most of 2022. W9 and W10 are located within refugial pools which typically have poor quality water, being alkaline and highly saline. EC was measured at 19,600 µs/cm at W10, exceeding the adopted trigger of 691 µs/cm.

EC at the Northern Drainage line (NDL1) also increased over 2022, rising from 1,940 µs/cm in January to 11,200 µs/cm in December 2022. Extreme rainfall events are likely to account for significantly lower EC at NDL1 as seen in July (538 µs/cm) and October (389 µs/cm) of 2022. NDL1 is located on an ephemeral drainage line, it is sampled from a standing pool of water, which generally has low water levels and becomes dry after low rainfall.

EC of surface water measured at all other sample points was found to be below trigger values and/or well within historic ranges for the duration of 2022.Erratic changes in waterway EC seen across the investigated area can be attributed to high rainfall from 2021 extending into 2022, contributing to heterogenous waterway conditions throughout the year as well as usual seasonal variability.

7.2.2.3 Surface Water TSS

Historic Total Suspended Solids (TSS) trends mostly continued into 2022 with all sites showing similar variability in TSS.

All monitoring locations remained within trigger ranges and historic ranges during the year, with the exception of the Wollombi Brook locations. Wollombi Brook showed significant variation over the measured period, exceeding the adopted triggers for extended periods at multiple sites in 2022. Significant fluctuations generally correlated with elevated rainfall events in March, July, and October 2022. TSS values at all other sites were the most part within the trigger ranges assigned by the adopted Water Management Plan.

7.2.2.4 Stream Flow in Wollombi Brook

Stream flow impacts in Wollombi Brook from Bulga Coal are determined by comparing the Water NSW gauging station records, upstream and downstream of the site. The upstream site is the Wollombi Brook – Brickmans Bridge (Paynes Crossing) gauging station (210135), which is located approximately 20 km upstream of Bulga Coal. The downstream site is the Wollombi Brook – Bulga gauging station (210028), located approximately 5 km downstream of Bulga Coal. **Figure 23** and **Figure 24** show the gauging station records for 2020 to 2022 for the upstream and downstream sites, respectively.

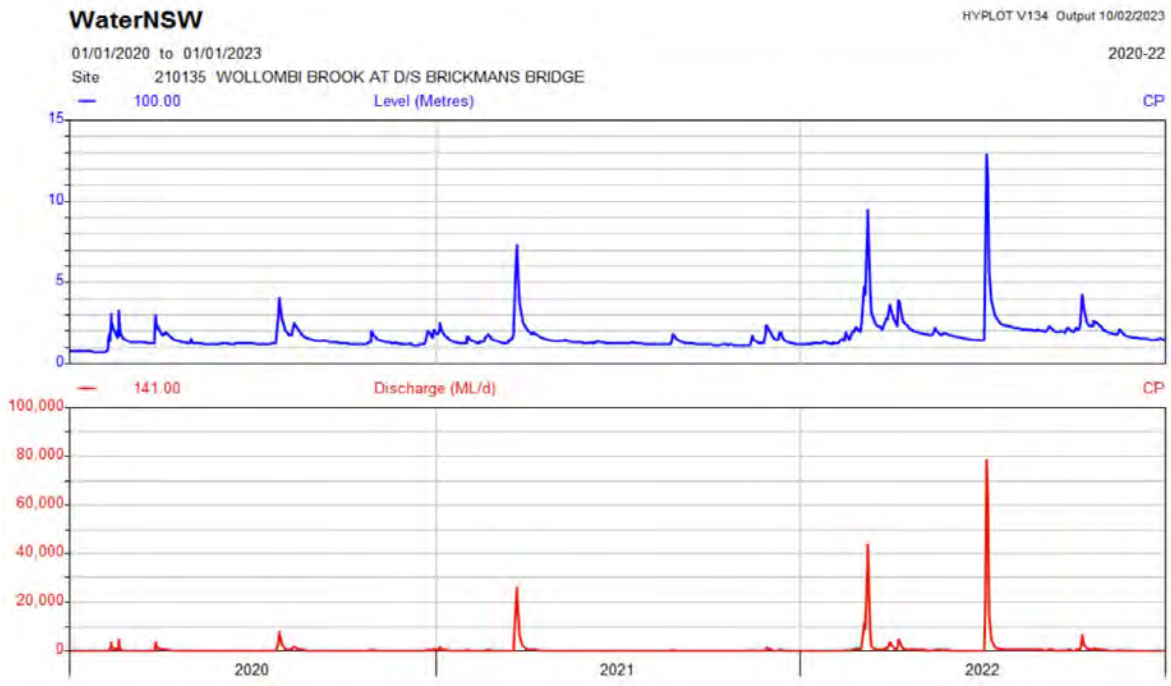

Figure 23 **Wollombi Brook Brickmans Bridge Gauging Station 210135**

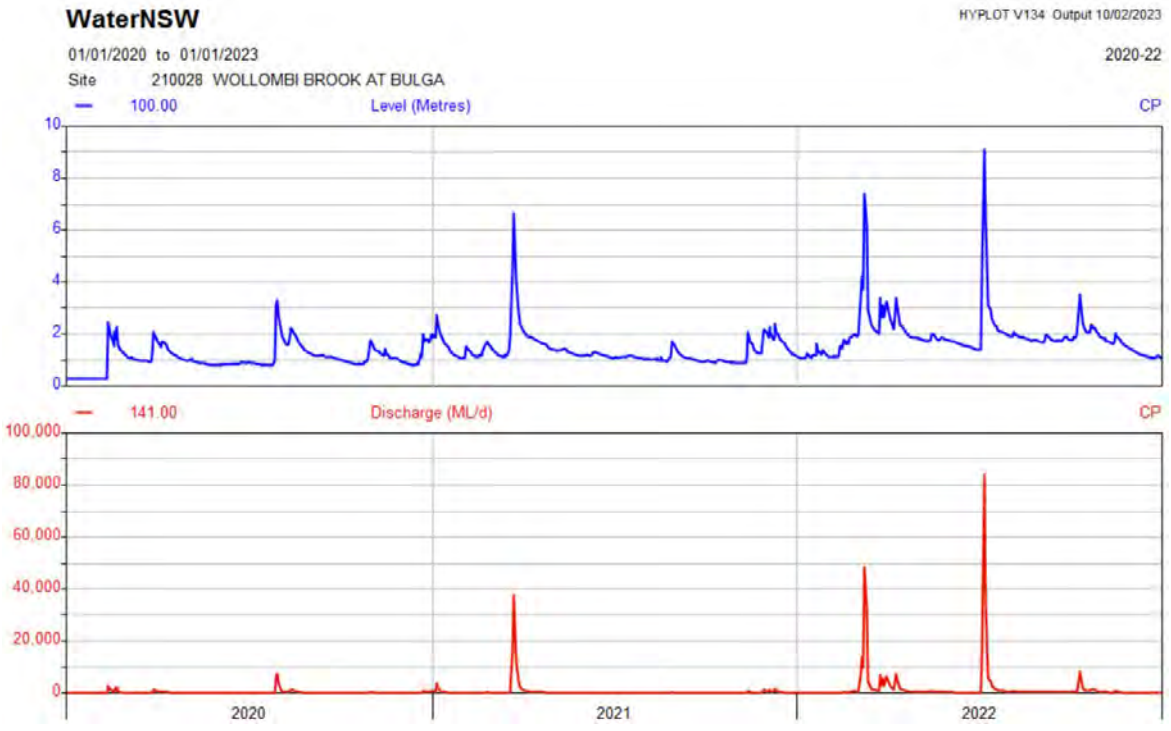

Figure 24 **Wollombi Brook – Bulga Gauging Station (210028) (Downstream)**

The data presented in **Figure 23** and **Figure 24** indicates that the water level in Wollombi Brook increased over the 2020–2022 period due to consistent rain. Some fluctuations occurred in response to large rainfall events particularly in March and July 2022.

7.2.2.5 Hunter River Salinity Trading Scheme

The site has one Hunter River Salinity Trading Scheme (HRSTS) discharge point, EPL ID 11 – Northern Dam.

EPL 563 requires the discharge volume, pH, TSS and turbidity to be monitored during discharge events.

A total of 3,848 ML was discharged from the Northern Dam (EPL ID 11) during 2022 during 15 HRSTS discharge blocks. The daily volumes discharged was compliant with the maximum daily discharge limits EPL limits of 500 ML. Total Suspended Solids and pH levels measured during discharge were compliant with the limits of 120 mg/L and 6.5–9.5, respectively. Details are provided in **Table 46** and **Table 47**.

During the 8 March flooding event, Bulga Coal discharged 58 ML from the HRSTS discharge point between 11:00 – 14:00 for Block 67. Bulga Coal were of the understanding that their HRSTS credits had been transferred back, after which Bulga commenced discharging. On investigation it was found that the credits had been transferred back for block 69 and not 67. HRSTS discharge block 68 to 71 were flood TAD events. Bulga Coal subsequently discharged a further 1,667 ML in blocks 68 to 90 in accordance with the HRSTS protocols.

Table 46 Discharge Records

River Register Information		Discharge Record						
Block ID	Total allowable discharge	Start		Finish		Volume discharged	Mean EC	Salt load
(1 block / line)	Tonnes	Date	Time	Date	Time	ML	ms/cm	Tonnes
2022-67(2)	6013	8/03/2022	11:00	8/03/2022	14:00	58.82	1290	45.7
2022-68(4)	Flood TAD	8/03/2022	14:00	9/03/2022	14:00	446.19	1367	324.3
2022-69(2)	Flood TAD	9/03/2022	14:00	10/03/2022	14:00	326.02	1586	328.7
2022-71(1)	Flood TAD	11/03/2022	14:00	12/03/2022	14:00	447.87	1641	458.7
2022-88(3)	2711	28/03/2022	14:00	29/03/2022	14:00	187.57	1894	222.3
2022-89(1)	1981	29/03/2022	14:00	30/03/2022	14:00	141.18	1888	167.1
2022-90(2)	4184	30/03/2022	14:00	31/03/2022	14:00	119.01	1923	135
2022-185 (1)	2726	3/07/2022	10:30	4/07/2022	14:00	21.82	2195	28.8
2022-186 (1)	2755	4/07/2022	14:00	5/07/2022	14:00	138.21	2157	178.7
2022-187 (1)	1812	5/07/2022	14:00	5/07/2022	15:40	6.78	1955	7.9
2022-187 (2)	11782	5/07/2022	15:40	6/07/2022	14:00	442.10	1974	523.6
2022-188 (4)	663	6/07/2022	14:00	7/07/2022	14:00	478.50	1913	558.1
2022-189 (3)	672	7/07/2022	14:00	8/07/2022	14:00	478.49	1841	529.1
2022-285 (2)	Flood flow	11/10/2022	14:00	12/10/2022	14:00	332.78	2344	479
2022-286 (1)	6880	12/10/2022	14:00	13/10/2022	14:00	176.27	2311	256.2
2022-287 (1)	3492	13/10/2022	14:00	14/10/2022	14:00	46.58	2286	66.3

Table 47 Discharge Water Quality Results

Block ID	pH grab sample during discharge	pH Limit	TSS grab sample during discharge (mg/L)	TSS Limit (mg/L)
2022-67(2)	8.5	6.5–9.5	10	120
2022-68(4)	8.5		44	
2022-69(2)	8.6		73	
2022-71(1)	8.8		83	
2022-88(3)	8.7		58	
2022-89(1)	8.6		100	
2022-90(2)	8.6		93	
2022-185 (1)	8.2		18	
2022-186 (1)	8.6		34	
2022-187 (1)	8.5		120	
2022-187 (2)	8.5		120	
2022-188 (4)	8.6		120	
2022-189 (3)	8.6		110	
2022-285 (2)	8.7		17	
2022-286 (1)	8.6		15	
2022-287 (1)	8.6		16	

7.2.2.6 Channel Stability Monitoring Results

The Commonwealth Scientific and Industrial Research Organisation (CSIRO) Ephemeral Stream Assessment Methodology was used to assess the channel stability of Nine Mile Creek, Loders Creek and Wollombi Brook. The assessment uses indicators (vegetation presence, shape and profile, type of materials, nature of walls etc.) to produce a rating which ranges from Very Stable to Very Active.

There were no changes to the CSIRO ESA ratings at 14 of the 16 channel stability monitoring sites in 2022, reflecting the consistency in conditions experienced over the past year. Some of the Loder Creek sites have recorded improved CSIRO ESA category scores over the post drought period (since 2019), owing to proliferation of riparian vegetation including groundcovers and riparian swamp oak canopy foliage in response to consistent wet weather, or changes to the composition of channel sediments associated with fluvial processes. For the most part, changes to individual CSIRO category scores have been insufficient to cause changes in the overall ratings band, however sites LC2 and LC5 have recorded improvements from Active to Potentially Stabilising (in 2020), and site LC3 has recorded an improved rating from Very Active to Active (in 2022). Furthermore, downstream Loder Creek site LC12 was the only site to record a lower CSIRO rating in 2022 (from Potentially Stabilising to Active), due to the relative decrease of vegetation on the channel floor between surveys due to scouring flow events (common reeds and the invasive spiny rush). Site BM34 also recorded a reduced category score for the same phenomena (flood scouring of instream vegetation), however the reduced overall score remained within the band of Stable.

7.2.2.7 Stream Health

The Rapid Appraisal of Riparian Condition (RARC) is an assessment method incorporating indicators of geophysical, and biological properties and processes which are likely to provide reliable estimate of ecological condition in riverine ecosystems. Each indicator is given a score which combine to provide an overall creek health score, ranging from Very Poor (<25) to Excellent (40–50).

The 2022 Stream Health Monitoring RARC results have shown consistency over the consecutive post-drought surveys since 2020. Compared to the previous survey, there were no changes to the overall RARC classification ratings in 2022, which ranged between Average (Loder Creek site BM35 and Wollombi Brook site BM36) and Good (Nine Mile Creek site BM22 and Loder Creek site BM34). The main factors contributing to the lower score at BM35 relates to the channel morphology and riparian corridor. In particular, the site channel banks are steep with compact, eroded soils, and the riparian swamp-oak corridor limits the ability for establishment and succession of understorey species through canopy shading and smothering by a dense layer of swamp-oak needles. Site BM36 contains a generally thin strip of riparian canopy forming species along the immediate riverbank (mature swamp-oaks), and whilst much of the adjacent land is being re-vegetated, the legacy of former agricultural activity has resulted in the presence of weeds species and lack of established woodlands, which contributes to the RARC rating of Average. In comparison, both BM22 and BM34 contain a more continuous riparian corridor with higher degree of vegetation coverage, comprising higher proportions of native species.

7.2.2.8 Aquatic Ecology

Bi-annual aquatic ecology monitoring was undertaken in autumn (June) and spring (November) 2022. The aquatic ecology monitoring included sampling of the aquatic macroinvertebrate fauna using the AusRivAS sampling, sorting and identification protocols, field water quality metering and baited fish trapping. A total of 10 sites were sampled in autumn 2022, and nine sites in spring 2022 (LCM1 was inaccessible) from creek drainages downstream of mining operations and the Licenced Discharge Point (Northern Dam). Drainages include Nine Mile and Loder Creek to the east and the Southern and Northern Drainage Lines plus Wollombi Brook to the west. 2022 saw a continuation of above average precipitation, with March recording the highest monthly total (350.5 mm) since records commenced in 1960 and heavy rainfall experienced in July, resulting in two major flow events causing widespread flooding throughout the tributary drainages of Nine Mile and Loder Creek, and Wollombi Brook water levels reached over 7 m and 9 m respectively. The periods leading into both seasonal surveys were characterised by wet conditions, and all aquatic ecology sample sites contained stream flows for both survey events.

Aquatic Habitat Condition

The diversity of aquatic macrophytes within monitoring sites has increased over successive surveys, with 15, 16 and 17 taxa recorded in spring 2021, autumn 2022 and spring 2022, respectively. Most of the sites contained indications of flow event water levels on both survey occasions, as indicated by scouring of stream detritus or macrophytes and debris accumulations in trees and along banks. There were localised impacts to channel edge banks from feral pigs at NMDn, Pt11 and LCM1, however despite these observations, there were no major changes to the site Riparian, Channel and Environment inventory (RCE) scores between the previous spring 2021 survey to spring 2022. The main source of inter-survey variation in RCE scores were owing to fluctuations of stream detritus or the relative levels of filamentous green algae and macrophyte coverage, however for the most part, the differences were minor (<5%).

Aquatic Ecology Site Water Quality

Surface waters were generally well mixed and there were no indications of layering between surface and bottom water quality readings at most aquatic ecology sample sites. Dissolved oxygen levels were supersaturated in Loders Creek upstream of Nine Mile Creek confluence in spring 2022 which was attributed to production by filamentous green alga present in site pools, and most of the other readings were moderate to good (60 to 110% saturation). The overall highest water conductivity levels were recorded in Loders Creek upstream of Nine Mile Creek junction, and while upstream Nine Mile Creek supported some isolated high values, salinity readings generally decreased with distance downstream in each system for both survey occasions. Conductivity values in Wollombi Brook and the Southern Drainage Line are much lower and more stable.

Aquatic Macroinvertebrate Results

There were 50 and 59 macroinvertebrate taxa recorded from the monitoring sites in autumn and spring 2022, respectively. The Wollombi Brook sites continue to record higher and more temporally stable macroinvertebrate indices, as shown by the macroinvertebrate diversity (richness), SIGNAL-2 pollution tolerance index and the diversity of sensitive EPT macroinvertebrate taxa results in autumn and spring 2022. Notwithstanding, the Nine Mile Creek site NMDn and Loders Creek sites, including downstream of Northern Dam site Pt11, showed successive improvements in indices values from autumn to spring 2022, which is attributed to improvements in habitats and persistent wet weather events maintaining relatively favourable water quality conditions.

Fish Sample Results

The invasive pest fish species plague minnow is the most successful species occurring within the area, being recorded at every aquatic ecology sample site in 2022. The small native firetail gudgeon (*Hypseleotris galii*) was also relatively widespread, being recorded from all but one site for both surveys. Other native species encountered during 2022 were Australian smelt (*Retropinna semoni*), schooling mullet, flathead, empire and striped gudgeons. Carp (*Cyprinus carpio*) were recorded from Wollombi Brook downstream site WBDn only. Overall, the consistent wet weather has likely maintained fish habitats and passage throughout the Nine Mile and Loders Creek study area.

7.2.3 Comparison against Predictions

A Surface Water Assessment was undertaken by Umwelt (2013) as part of the Bulga Optimisation Project EIS. The assessment concluded that with the implementation of the water management system and the proposed controls there was only a low risk of impacting on the water quality of the downstream watercourses, and that results would be comparable to background levels. A comparison of the background water quality against the 2022 data has been made in **Table 48** The *Annual Surface and Groundwater Assessment* (Jacobs, 2023) (refer to **Appendix D**) reviews groundwater performance against criteria.

Table 48 Comparison of Surface Water Monitoring Results (2022) against Background (2013 Bulga Optimisation Project EIS)

Sample Point	pH		EC (µS/cm)		TSS (mg/L)	
	2022 Range	EIS Range	2022 Average	EIS Range	2022 Average	EIS Range
LR1	6.6–7.3	6.6–8.8	310	4–9,470	23	1–72
LR2	6.9–7.87	6.3–8.8	1,511	130–6,230	27	3–440
LR5	6.7–7.3	6.7–8.4	452	196–3,470	22	2–144
W2	6.8–7.4	6.6–8.2	472	195–1,470	13	1–114
W4	6.7–7.4	6.5–8.2	475	200–1,760	14	2–42

The results presented in **Table 48**, show that the 2022 data is within the EIS ranges at all sites.

7.2.4 Long Term Trend Analysis

Figure 25, **Figure 26** and **Figure 27** show surface water monitoring results recorded by Bulga Coal during the period 2005 to 2022 for EC, pH and TSS, respectively.

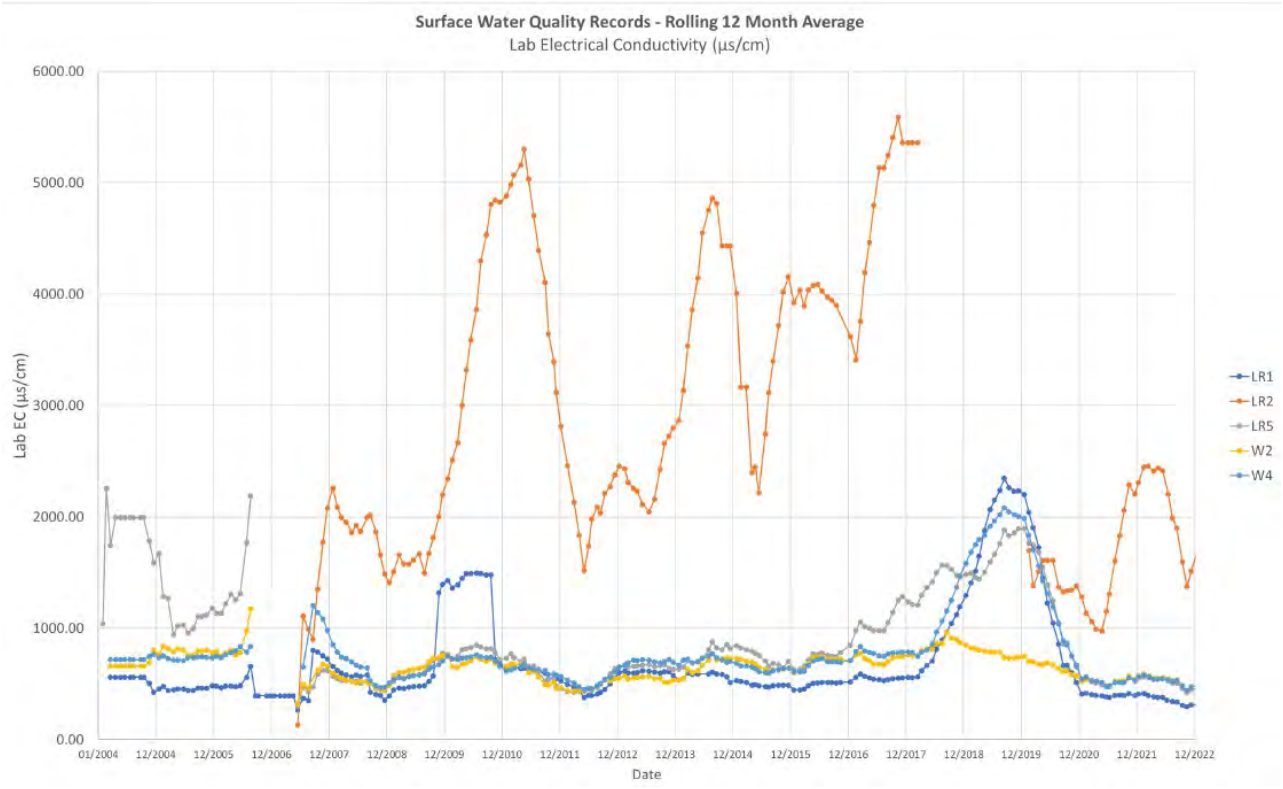

Figure 25 Long Term Surface Water EC Results

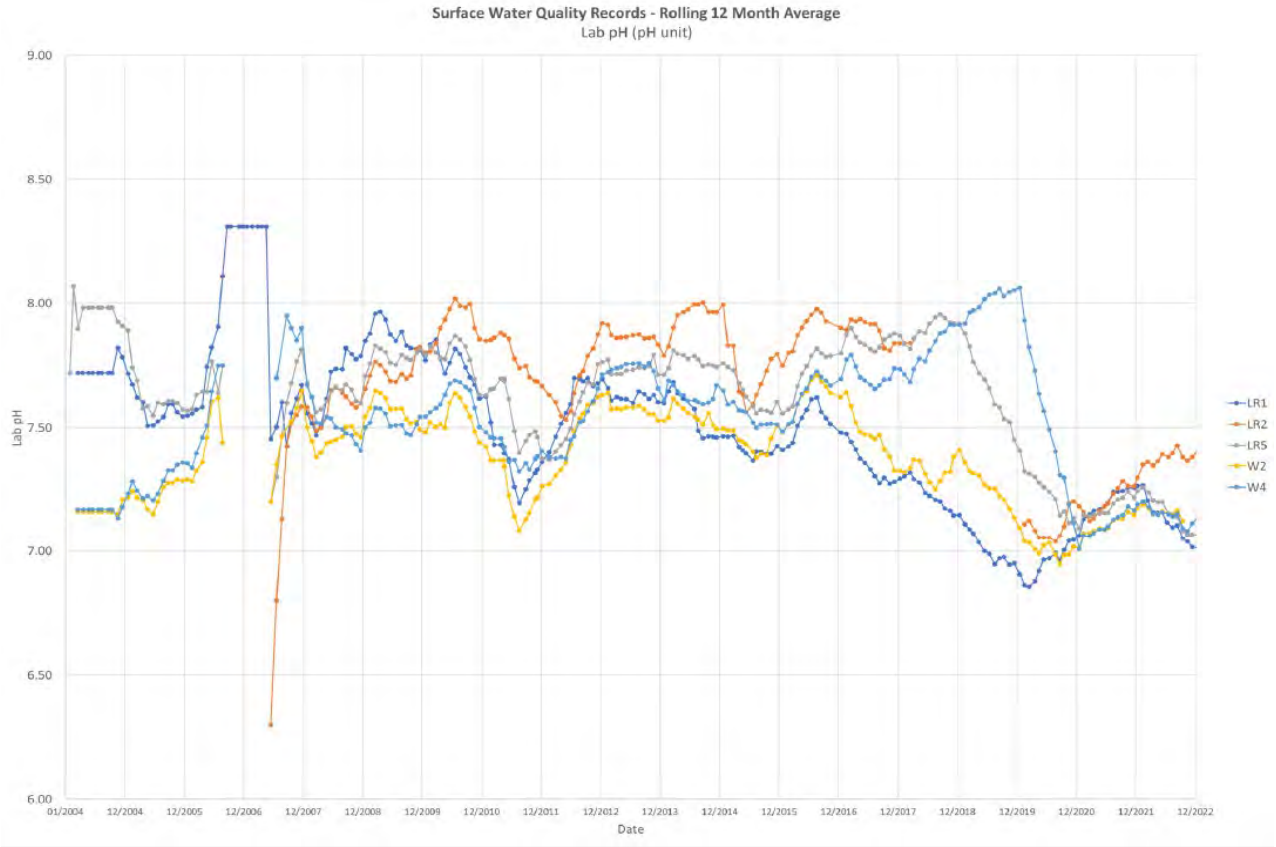

Figure 26 Long Term Surface Water pH Results

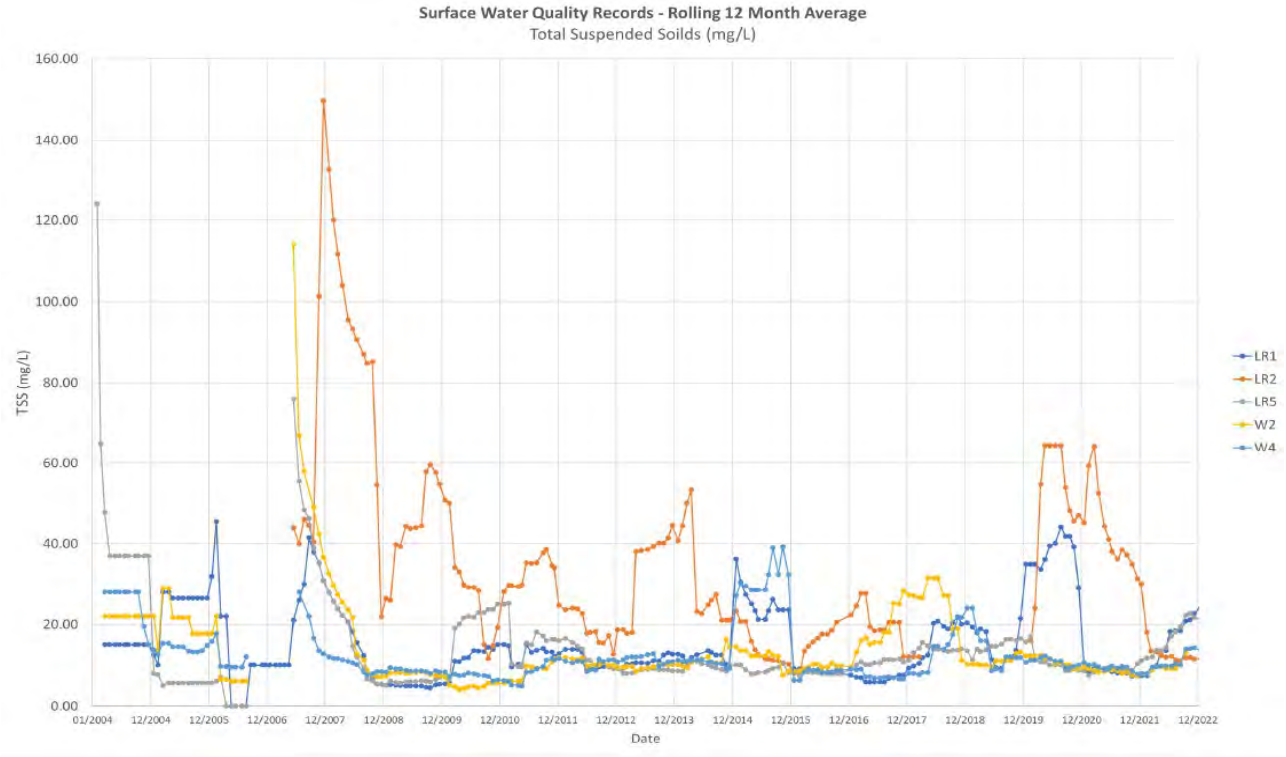

Figure 27 Long Term Surface Water TSS Results

Seasonal variations in pH, EC and TSS are evident at the sites along Wollombi Brook (LR1, LR5, W2 and W4) with values generally remaining within the predicted ranges shown in **Table 48**.

7.3 Erosion and Sedimentation

7.3.1 Environmental Management

A variety of controls are implemented at Bulga Coal to mitigate operational risks associated with erosion and sedimentation. During and following ground disturbance, structures such as sediment ponds, sediment fences, spoon drains, sediment catches and site catch sumps are used where appropriate to manage runoff and minimise erosion and sedimentation. Inspections are undertaken following more than 20 mm of rain in 24-hours to evaluate the effectiveness of erosion and sediment control structures and any maintenance or dewatering requirements. Additional stabilisation works for these areas may include reshaping, amelioration of dispersive soil, revegetation, fencing and weed control.

High risk sediment dams have been incorporated into an automatic management system which continuously monitors dam water levels and commences dewatering when the water level reaches set trigger levels. Other sediment dams are monitored weekly and following rainfall events to determine pumping requirements.

Monitoring and inspections at Bulga Coal are completed in accordance with the *Bulga Coal Erosion and Sediment Control Plan* approved in 2021. This monitoring system is designed to comply with EPL 563 and the erosion and sediment control conditions stipulated within the Bulga Underground Operations and Bulga Open Cut Development Consents.

7.3.2 Environmental Performance

There were no erosion related incidents recorded at Bulga Coal during the reporting period.

7.4 Groundwater

7.4.1 Environmental Management

Groundwater is managed in accordance with the approved *Water Management Plan*.

Mapping of the deep and shallow depressurisation of the hard rock (coal measures) strata is undertaken. This identifies the potential for any adverse impacts on the shallow alluvial aquifer systems associated with Wollombi Brook and Monkey Place Creek. Depressurisation is predicted within the coal measures on a regional scale; however, it is not expected to produce any measurable impact in the overlying alluvial aquifer.

The monitoring program provides early warning for potential changes in groundwater levels and quality.

Bulga has a comprehensive groundwater monitoring network within and outside of the mine footprint area with groundwater monitoring points shown in **Figure 7**. The monitoring network comprises both standpipe piezometers and multilevel vibrating wire piezometers installed in all hydrostratigraphic units.

As part of the EPBC Act approval EPBC 2018/8300 (as varied on the 9 September 2021), an ecohydrological conceptual model was submitted to the Department of Climate Change, Emergy, the Environment and Water (DCCEEW) 20 December 2021, currently pending approval.

7.4.2 Environmental Performance

A summary of groundwater monitoring results and relevant criteria from the Water Management Plan is provided in **Table 49**, with detailed groundwater monitoring results available on the Bulga Coal website (https://www.glencore.com.au/operations-and-projects/coal/current-operations/bulga-coal/reporting-documents).

Table 49 Summary of Groundwater Monitoring Results – 2022 Annual Averages

Piezometer No.	Water elevation (mAHD)	Water Level (mAHD)	Lab pH	Lab pH		Lab EC (µS/cm)	Lab EC (µS/cm)
		Lowest Depth Trigger Value		20th Percentile Trigger Value	80th Percentile Trigger Value		80th Percentile Trigger Value
Broke Area Alluvials							
GW1	91.18	84.37	7.3	6.7	7.3	1,637	3,634
GW2	85.65	NA[1]	7.3	-	-	3,216	-
GW3	77.12	74.48	7.5	6.7	7.2	872	6,010
GW4	79.95	NA [1]	7.3	-		1,531	-
GW5	81.46	NA [1]	6.8	-	-	780	-
GW6	75.86	72.21	7.2	6.7	7.4	3,752	7,900
GW7	74.74	63.21	6.8	6.6	7.0	4,338	3,946
GW8	73.49	66.86	7.0	6.7	7.2	2,865	5,936
GW9	73.16	70.83	6.8	7.1	7.6	3,711	4,458
GW10	72.95	69.76	7.3	7.1	7.6	6,600	10,252
V3	72.12	65.49	7.2	6.7	7.4	1,452	1,744
Broke Area Wollombi Seam							
P2	69.59	67.10	7.0	7.4	8.0	6,011	12,834
P5A	70.72	67.84	7.7	7.5	8.2	3,880	6,242
P6A	69.47	63.40	7.4	7.0	8.1	1,482	2,740
Northern Area Shallow Alluvials							
F1	65.37	61.26	7.5	7.2	7.6	1,115	1,025
F2	66.84	63.30	6.9	7.1	7.4	901	1,720
WBR50A	60.81	56.98	6.9	7.1	7.7	722	14,000
V1	66.42	63.14	7.4	7.3	7.7	832	1,570

Piezometer No.	Water elevation (mAHD)	Water Level (mAHD)	Lab pH	Lab pH		Lab EC (µS/cm)	Lab EC (µS/cm)
		Lowest Depth Trigger Value		20th Percentile Trigger Value	80th Percentile Trigger Value		80th Percentile Trigger Value
V2	62.69	58.56	6.3	6.4	7.1	167	922
SBC/Broke Area Lower Whybrow Seam							
P6B	-14.39	-24.84	8.2	6.7	7.3	1,429	1,353
P8	73.96	63.30	6.5	7.3	9.3	3,035	5,076
Northern Area Lower Whybrow Seam							
WBR50	30.39	24.30	6.5	6.4	8.0	170	8,382
Northern Alcheringa Seam							
WBD62A	69.36	24.30	6.8	-	-	213	-
Beltana Area Miscellaneous Bores and Wells							
Dwyers	65.95	60.90	7.4	7.3	7.6	640	1,476
Fernance	67.34	59.74	7.7	7.3	8.0	734	1,473
McG1	97.09	89.86	7.4	7.5	8.0	439	918
White1	71.82	63.36	7.4	7.0	7.4	648	2,444
WBR15	68.5	59.32	7.4	6.8	7.3	848	924
Beltana Area NPZ							
NPZ3-A	-[2]	56.01	-[2]	6.5	8.1	-[2]	1,362
NPZ3-B	70.47	59.63	7.4	7.3	7.5	563	921
NPZ4-A	70.99	58.54	7.1	6.9	7.3	648	729
NPZ4-B	58.01	45.32	7.5	7.3	7.8	1,286	1,342
NPZ5-A	67.13	60.90	6.9	6.9	7.3	814	886
NPZ5-B	52.47	41.16	7.4	7.1	7.6	2637	2,760
NPZ7-1	67.62	53.47	7.4	6.7	7.7	971	1,240

Piezometer No.	Water elevation (mAHD)	Water Level (mAHD)	Lab pH	Lab pH		Lab EC (µS/cm)	Lab EC (µS/cm)
		Lowest Depth Trigger Value		20th Percentile Trigger Value	80th Percentile Trigger Value		80th Percentile Trigger Value
NPZ7-2A	68.09	62.04	7.2	7.1	7.6	731	2,250
NPZ7-2B	68.08	45.36	7.5	6.8	7.8	897	1,307
NPZ7-3A	68.73	62.0	7.7	7	7.5	1,683	2,540
NPZ7-3B	71.37	53.7	7.7	7.4	7.8	1,225	1,316
Wollombi Alluvials and Shallow Coal Measures[1]							
WBD160	66.21	63.83	7.0	6.9	7.3	442	1,310
WBR180	35.97	34.30	7.3	7.1	7.5	20,200	20,850
WBR181	61.98	59.41	7.2	7.2	7.5	2,265	2,670
WBR182	64.19	61.70	7.3	7.3	8.3	1,316	1,512
WBR183	63.29	58.96	7.3	7.0	7.4	3,643	3,484
SBD196	70.13	NA	6.6	-	-	2,056	-
WBR240	61.45	58.36	7.4	7.0	7.5	15,050	26,800
WBR241	62.29	59.63	6.6	6.4	6.9	320	435
Loders Creek Alluvials							
LC1	-[2]	NA[1]	-[2]	NA[1]	NA[1]	-[2]	NA[1]
LC2	43.46	NA[1]	7.5	NA[1]	NA[1]	2,410	NA[1]
Northern Tailings emplacement facility piezometers[3]							
MB1a	64.11	NA[1]	-	NA[1]	NA[1]	-	NA[1]
MB1b	-[2]	NA[1]	-	NA[1]	NA[1]	-	NA[1]
MB2	67.34	NA[1]	-	NA[1]	NA[1]	-	NA[1]
MB3a	53.74	NA[1]	-	NA[1]	NA[1]	-	NA[1]
MB3b	-9.94	NA[1]	-	NA[1]	NA[1]	-	NA[1]

Piezometer No.	Water elevation (mAHD)	Water Level (mAHD)	Lab pH	Lab pH		Lab EC (µS/cm)	Lab EC (µS/cm)
		Lowest Depth Trigger Value		20th Percentile Trigger Value	80th Percentile Trigger Value		80th Percentile Trigger Value
Warkworth Sands monitoring bores							
WWS1	94.15	NA[1]	6.2	NA[1]	NA[1]	91	NA[1]
WWS2a	94.74	NA[1]	5.9	NA[1]	NA[1]	95	NA[1]
WWS2b	94.69	NA[1]	5.9	NA[1]	NA[1]	173	NA[1]
WWS3a	83.92	NA[1]	5.5	NA[1]	NA[1]	70	NA[1]
WWS3b	83.72	NA[1]	6.0	NA[1]	NA[1]	134	NA[1]

[1] No trigger values have been established.

[2] No results available for 2022. LC1 dry when sampling. NPZ3-A no longer monitored since 2015. Datalogger from MB1B, recorded invalid data in several instances during 2022, caused by low battery and a faulty datalogger. The datalogger was replaced in early 2023.

[3] The Northern Tailings emplacement facility piezometers sites are grouted live wire piezometers and do not have access to water quality.

Jacobs have produced the 2022 Bulga Coal Complex Annual Surface and Groundwater Monitoring Report (Jacob, 2023) which is attached as **Appendix D**. The following is a summary of the groundwater monitoring review.

The 2022 reporting period recorded 1,200 mm of rain with substantial flooding in February, March and July followed by November and December being dryer than usual. The surface and groundwater monitoring data reflects the natural response to a second year of greater than average rainfall, surface flows and groundwater recharge.

The groundwater monitoring network covers the area along the Wollombi Brook and Monkey Place Creek to the west and south and extends 5 km to the north and northwest of the Blakefield South footprint. The current groundwater monitoring network is comprehensive and includes 50 monitoring locations in the alluvium, overburden strata (sandstone and coal seams), Whybrow Seam, Blakefield Seam and underlying and overlying strata.

Overburden pressures in the top 50 m to 100 m from surface have recorded generally increasing groundwater levels in 2021 following the cessation of extraction at Blakefield South in 2018. Recovery observed in various bores is likely related to the increasing rainfall between 2020 through 2022.

Groundwater levels in SBD196 (Blakefield Seam) have recovered over the monitoring period, returning to near-2015 pressures. Re-pressurisation in the Alcheringa Seam is observed through hydrographs for numerous bores monitoring the seam. Groundwater levels in most monitoring bores targeting the Alcheringa Seam increased significantly over the period. The majority of recovery in the seam has occurred since the start of 2020 and is related to the cessation of extraction in 2018 and prevailing climatic conditions since 2020.

Shallow groundwater levels in the alluvium (Wollombi Brook and Monkey Place Creek) continued to increase or remained stable over the period, continuing the recovering to pre-2016 to 2019 drought conditions observed in 2021/2022. Rainfall continues to be the major influence on alluvium groundwater levels with no apparent influence from mining operations.

Groundwater quality (EC and pH) trigger values were exceeded for several monitoring bores over the monitoring period. While the trigger values are not assessment criteria, exceedances are used to initiate investigations into groundwater quality. Groundwater pH exceedances were within ranges of natural variation, and do not show impacts attributable to Bulga Coal over the period.

The major ion chemistry for groundwater samples collected in June and December 2022 are similar to December 2020 and 2021 data. The alluvium and sandstone water samples typically plot as different water types, with some minor over-lap, indicating different recharge mechanisms and residence times. The water type interpretation indicates that the alluvium and coal seam water samples may predominantly receive recharge directly or indirectly from rainfall and/or have shorter transmission times from the recharge point.

7.4.3 Comparison Against Predictions

Two successive years of above average rainfall and flooding have resulted in substantial volumes of rainfall runoff reporting to the open cut (approximately 13.5 GL) and increased groundwater recharge. Additionally, approximately 1.6 GL of rainfall runoff flowed and was pumped into the Blakefield South goaf. Both the alluvial and Permian aquifers continued recovering through 2022, masking any potential loss of groundwater to either the Open Cut or Bulga Underground goaves. The potential mine impacts on the surround groundwater regime are below any predictions.

7.4.4 Long Term Trend Analysis

Bulga Coal has an extensive groundwater monitoring network which covers Wollombi Brook and Monkey Place Creek alluvium, overburden, sandstone, and deep coal seam hydrostratigraphic units. A long-term monitoring record (over 20 years) now exists and it enables interpretation of groundwater trends.

The groundwater levels in the Wollombi Brook and Monkey Place Creek alluvium continue to fluctuate in response to rainfall events clearly evident in 2022. Overall, there does not appear to be any measurable impact from mining operations on the alluvial aquifers (Jacobs, 2023). Detailed groundwater monitoring trend graphs are presented in (Jacobs, 2023) which is attached as **Appendix D**.

8.0 Rehabilitation

Progressive rehabilitation of disturbed areas is an important aspect of the mining operations at Bulga Coal. The objective of rehabilitation is to restore the land to a condition that is equal or greater than that prior to disturbance. Ongoing rehabilitation of areas disturbed by operations has continued throughout the reporting period. Annual rehabilitation inspections and scientific plot-based monitoring is undertaken by experienced rehabilitation consultants to monitor the success of rehabilitation works.

8.1 Post Mining Land Use

In accordance with SSD-4960 and the *Biodiversity Management Plan*, rehabilitation has continued to focus on the goal of establishing EECs.

The post-mining land use goal is the combination of objectives contained in the Bulga Optimisation Project approval (for the Bulga Open Cut), the Bulga Underground Operations 2003 EIS and *Bulga Optimisation Project Modification 3 and Bulga Underground Modification 7– Statement of Environmental Effects* (Umwelt, 2019). It is anticipated that following the expected closure of Bulga Coal and the subsequent rehabilitation activities, that the areas disturbed by mining activities will be predominantly native vegetation (woodlands on spoil dumps and riparian communities along established drainage lines) with a minimum of 260 ha being returned to land suitable for agricultural uses. In summary, the land associated with Bulga Underground Operations to the east of Charlton Road is either contained within the footprint of the Bulga Open Cut final land use or is regenerating woodland above underground workings; whilst the land to the west of Charlton Road is principally agricultural land used for grazing, viticulture or olive groves. Apart from an ecological and archaeological conservation area in the north-west of the colliery holding, the goal is to retain the agricultural productivity of the land to the west of Charlton Road and above the underground mine (SLR, 2020).

It is expected that the areas disturbed by mining will be predominantly returned to land and soil capability Classes 6 and 7. Existing areas currently mapped as being land and soil capability Class 3 and Class 4 will remain generally consistent post-closure, with a small reduction in Class 5 areas expected. Based upon current approvals mining operations at Bulga Coal will cease mining in 2039.

8.2 Rehabilitation Performance During the Reporting Period

8.2.1 Rehabilitation Summary

Rehabilitation activities have been completed in accordance with the approved Bulga Open Cut and Bulga Underground Operations MOPs, Forward Work Program and Bulga Coal Rehabilitation Management Plan. Rehabilitation activities undertaken in 2022 included:

- Shaping of overburden dumps;
- Removal of decommissioned infrastructure (where required);
- Installation of geomorphic drainage structures;
- Deep ripping;

- Rock raking;
- Installation of habitat features (e.g. stag trees, woody debris, rock piles);
- Spreading of topsoil;
- Application of ameliorants;
- Re-ripping of prepared surface; and
- Seeding with target ecological communities.

Further details on these steps are provided in the Bulga Coal Rehabilitation Management Plan which is available on the Bulga Coal website (https://www.glencore.com.au/operations-and-projects/coal/current-operations/bulga-coal/management-plans). A summary of rehabilitation at Bulga Coal as at the end of 2022 is presented in **Table 50**.

Table 50 Rehabilitation Status at Bulga Coal

Mine Area Type	Previous Reporting Period (Actual) 2021	This Reporting Period (Actual) 2022	Next Reporting Period (Forecast) 2023
Total mine footprint	3,489	3,481.9	3,500.7
Total active disturbance	2,400	2,358.1	2,404.9
Land being prepared for rehabilitation	0	0	0
Land under active rehabilitation	1,089	1,123.8	1,095.8
Completed rehabilitation*	0	0	0

* Denotes land that has been signed off by DPE-RR as completed rehabilitation.

8.2.2 2022 Rehabilitation – Bulga Open Cut

During 2022, Bulga Coal completed 36.8 ha of rehabilitation, including 15.46 ha at the Eastern Emplacement Area and 19.6 ha on the Noise and Visual Bund, with maintenance of previously established rehabilitation also occurring throughout the year. The rehabilitation establishment methodology is outlined in the *Bulga Coal Rehabilitation Management Plan* available on the Bulga Coal public website (https://www.glencore.com.au/operations-and-projects/coal/current-operations/bulga-coal/management-plans).

8.2.2.1 Landform Details

During 2022, Bulga Open Cut continued to implement a geomorphic natural landform design, as shown in **Photo 3**. Shaping of overburden dumps occurred on both the Eastern Emplacement Area and the Noise and Visual Bund. Bulga Open Cut continued to progressively rehabilitate all available overburden emplacement areas which have reached final landform extents.

Photo 3 Rehabilitation completed in 2022 surrounded by previously rehabilitated areas on the Noise and Visual Bund

Natural drainage patterns are included in the design phase and refined during construction. An example of a constructed geomorphic drain is shown in **Photo 4**.

Photo 4 Constructed geomorphic landform drainage on the Noise and Visual Bund in 2022

8.2.2.2 Topsoil

Stockpiled topsoil was spread at a nominal thickness of 100 mm on the Noise and Visual Bund and Eastern Emplacement Area. Some topsoil was sourced directly from topsoil stripping activities. Gypsum was applied immediately after at a rate of 8 t/ha and then deep ripped to a depth of 450 mm to incorporate the topsoil into overburden material to create a suitable seed bed.

8.2.2.3 Physical and Chemical Characteristics

Bulga Open Cut has identified some coal seams and interburdens which are potentially acid forming and contain elevated sulfur levels and or contain carbonaceous materials. These seams and interburdens have been analysed and are separated and handled/dumped to reduce the long-term potential to form acids and or generate heating. Further detail on this material and its management is provided in the Bulga Coal Rehabilitation Management Plan.

8.2.2.4 Vegetation Species

Revegetation activities in 2022 focused on the establishment of the Central Hunter Grey Box – Ironbark Woodland EEC on both the Eastern Emplacement Area and the Noise and Visual Bund. The seed mix for these areas focused on establishing the key overstorey, shrub and groundcover species for the community (as outlined in the *Bulga Open Cut MOP*, *Bulga Coal Rehabilitation Management Plan* and *Biodiversity Management Plan*). Outcomes from the Hunter Ironbark Research Program were used to guide the species selected to establish the target ecological communities.

8.2.2.5 Habitat Resources and Potential

The *Biodiversity Management Plan* outlines the requirement for incorporating habitat features into rehabilitated landscapes. In 2022 several methods were used to increase the habitat potential of rehabilitated areas, including the incorporation of:

- Woody debris;
- Drains and water structures (e.g. frog ponds);
- Rock piles; and
- Stag trees.

As rehabilitation matures, other habitat enhancement methods such as installing nest boxes will be utilised.

8.2.2.6 Temporary Rehabilitation and Visual Mitigation

No temporary rehabilitation was carried out during 2022.

8.2.2.7 Rehabilitation Maintenance

Rehabilitated areas at Bulga Open Cut are subject to an ongoing monitoring and maintenance program to ensure that rehabilitation objectives and completion criteria are achieved or are on trajectory to be achieved. Inspections are conducted annually by an external consulting rehabilitation specialist. A summary of care and maintenance activities undertaken during 2022 is provided in the following sections and in **Table 51**.

Table 51 Maintenance Activities on Rehabilitated Land for Bulga Open Cut

Nature of Treatment	Area Treated (ha)		Comment/control Strategies/Treatment Details
	2022 (actual)	2023 (planned)	
Additional erosion control works (drains, recontouring, rock protection, erosion repairs)	<1	<1	A landform stability inspection was conducted by a consultant in 2021 and 2022 to identify all erosion features across the Eastern Emplacement Area and Noise and Visual Bund rehabilitation areas. During 2022 repairs were undertaken on localised erosion features identified across the Noise and Visual Bund and the Southern section of the Eastern Emplacement Area. In 2023 a follow up landform stability inspection will be undertaken with continued erosion remediation works undertaken on drop structures, contour banks and slopes across rehabilitation areas, as required.
Re-seeding/replanting (species density, season etc.)	0	3.8	Remediation of bare contour banks and a bare area deficient of topsoil on the Noise and Visual Bund will occur in 2023.
Adversely affected by weeds (type and treatment)	~530	~120	Weed control works in 2022 were carried out across the entire Noise and Visual Bund, Eastern Emplacement Area and Bulga Underground Operations rehabilitation areas. This will continue in 2023 with new rehabilitation areas being added to the program as they are completed. The main weeds being controlled are Galenia, Blue Heliotrope, Acacia Saligna, Lantana and various exotic grass species.
Feral animal control (additional fencing, trapping, baiting etc.)	As required	As required	Feral animal control will concentrate on wild dog, kangaroo and pig control within rehabilitation areas.

8.2.3 Rehabilitation – Bulga Underground Operations

No rehabilitation of Bulga Underground Operations infrastructure was undertaken during 2022, however work continued on decommissioning legacy infrastructure to allow for the progression of open cut mining as described in **Section 4.4.4**.

8.2.3.1 Rehabilitation Maintenance

Rehabilitated areas at Bulga Underground Operations are subject to an ongoing monitoring and maintenance program to ensure that the rehabilitation objectives and completion criteria are achieved or on trajectory to be achieved. A summary of rehabilitation maintenance activities undertaken during 2022 are outlined in **Table 52**.

Table 52 Maintenance Activities on Rehabilitated Land for Bulga Underground Operations

Nature of Treatment	Area Treated (ha)		Comment/control Strategies/Treatment Details
	2022 (actual)	2023 (planned)	
Additional erosion control works (drains re-contouring, rock protection)	0	As required	Maintaining temporary controls around active rehabilitation areas as identified in routine and scheduled inspections.
Subsidence Repairs	As required	As required	Subsidence inspections are undertaken on an annual basis or after high rainfall events. Repairs are undertaken on an as needs basis as described in **Section 6.5**.
Soil treatment (fertiliser, lime, gypsum etc.)	0	0	Ameliorants applied to rehabilitation areas as required.
Re-seeding/replanting (species density, season etc.)	0	0	Supplementary seeding of rehabilitation maintenance and repairs identified in annual rehabilitation inspection.
Adversely affected by weeds (type and treatment)	As required	As required	Weed management activities were ongoing in 2022 and focused mainly on the Vere and Underground rehabilitation areas. Target areas identified during monthly inspections, annual rehabilitation inspections and buffer land inspections.
Feral animal control (additional fencing, trapping, baiting etc.)	As required	As required	Feral animal control concentrating on wild dog, kangaroo and pig control.

8.3 Decommissioning of Infrastructure

There was no decommissioning of infrastructure in 2022 that required rehabilitation. Refer to **Section 4.4.4** for a summary of other demolition and decommissioning of infrastructure that occurred in 2022.

8.4 Department of Regional NSW – RR Sign-Off on Rehabilitation

In 2022, no areas of rehabilitation received formal sign-off from RR that land use objectives and completion criteria had been met.

8.5 Variations from Proposed MOP Activities

Table 53 summarises the rehabilitation progress at Bulga Coal (including Bulga Open Cut and Bulga Underground Operations) during 2022 against the MOP and Forward Work Plan (FWP) forecasts. It is noted that the Regulation commenced on 2 July 2021, with a transition period of to 2 July 2022. Following the transition period, Mining Operations Plans ceased to exist in NSW.

A copy of the Annual Rehabilitation Report and Forward Program is provided as **Appendix F**.

Table 53 Bulga Coal Rehabilitation Performance against Forecast

Mine Area Type	2022 Actual Data	2022 MOP Forecast	2022 Forward Program Forecast
Rehabilitation (ha)	36.80	34.58	36.80
Disturbance (ha)	1.83	3.80	9.38

Rehabilitation in 2022 was as per the MOP and Forward Program forecast, whilst disturbance was less than planned due to delays in commencing construction of Dam S53.

8.6 Rehabilitation Monitoring, Trials and Research

Bulga Coal has an extensive rehabilitation monitoring program to track the establishment and progress of rehabilitated areas towards the completion criteria. The objectives of the rehabilitation monitoring program are to:

- Assess the long-term stability and functioning of re-established ecosystems on mine affected land;
- Assess rehabilitation performance against the completion criteria; and
- Facilitate continuous improvement in rehabilitation practices.

The monitoring program will continue within rehabilitated and non-mined areas (reference sites) until it can be demonstrated that rehabilitation has satisfied the closure criteria. The rehabilitation monitoring criteria for each domain have been developed to demonstrate that selected indicators (or criteria) have reached their established completion criteria or that a satisfactory successional trajectory has been established that will result in a self-sustainable ecosystem.

Based on the outcomes of the rehabilitation monitoring program, a care and maintenance program is implemented. The scope of the care and maintenance program may include weed and feral animal control, fertilising, re-seeding or planting (where required), and erosion and sediment control works.

8.6.1 Annual Rehabilitation Monitoring Program

The annual rehabilitation monitoring program includes Initial Establishment Monitoring (IEM) and Long-Term Monitoring (LTM). In summary, the IEM is a rapid style assessment of young (≤3 years old) rehabilitated areas, principally to determine germination success, landform stability and other management issues such as establishment of weeds. The LTM procedure is applied to rehabilitation that is a minimum of four years since establishment. The objective of the LTM program (areas >3 years old) is to evaluate progress of rehabilitation towards fulfilling completion criteria, additional statutory requirements that may apply to the operation and ultimately the targeted post-mining land use. The methods described for LTM apply to both rehabilitation and reference monitoring sites. For further details on methodology and timing refer to the *GCAA Completion Criteria and Rehabilitation Monitoring Procedure*.

8.6.1.1 General Observations

A total of 19 rehabilitation blocks and 52 transects/plots were assessed across the Viking Dump, Noise and Visual Bund and Eastern Emplacement Area, including eleven blocks monitored for IEM, seven blocks monitored for LTM and one block of temporary rehabilitation. All rehabilitation blocks assessed (except temporary rehabilitation) were being returned to a native woodland land use and covered a cumulative area of approximately 461.2 ha.

Ecological flora monitoring included the assessment of seven permanent monitoring plots established in areas of remnant native vegetation within the buffer zones surrounding Bulga Coal. This monitoring is implemented to identify potential deterioration (or lack thereof) in vegetation health or habitat quality as a result of mining operations.

Field surveys were undertaken in May 2022 (rehabilitation monitoring and reference sites) and November 2022 (monitoring of remnant sites) and followed two years of good local weather conditions and above-average rainfall (which in turn followed the severe state drought impacting the east-coast between 2016–2019).

Based on collected monitoring results and observations, management recommendations have been suggested to improve the condition of rehabilitation areas and ensure they are on a trajectory towards the defined rehabilitation and land use objectives.

Temporary Rehabilitation Summary Findings

Areas of temporary rehabilitation are inspected solely to demonstrate adequate stability and vegetative cover. The one block of temporary rehabilitation assessed in 2022 showed no major erosion issues and variable but overall satisfactory vegetative cover.

Rehabilitation IEM Blocks Summary Findings

As a function of the rainfall received in the past two years including several heavy rainfall events, some erosion issues have materialised across the IEM blocks where vegetation is in early stages of establishment (particularly in Year 1 blocks). Erosion repairs were ongoing at the time of monitoring, however several erosion issues remained. Seven of the eleven IEM blocks were identified as requiring erosion repair works, ranging from localised tunnel inlets in contour banks to gullying of moderate to high severity (i.e. 30 cm–<1 m in depth).

Ground cover protection (live + litter) was excellent in all IEM blocks and on average comprised between ~80.0–96.0%.

Native species germination and establishment were variable across the IEM blocks, with average native species richness ranging from a moderate ~24.0 species per site to a very high ~42.5 species per site. The Eastern Emplacement Area rehabilitation was typically more diverse than the Viking Dump / Noise and Visual Bund rehabilitation, which was attributed mainly to the lesser prevalence of invasive grasses and higher use of direct emplaced topsoil. Positively, native species assemblages were overall satisfactory in all blocks, with on average between 67.6–80.0% of total native richness comprised of species representative of the target vegetation communities.

Priority weed cover levels exceeded allowable levels in all IEM blocks across the Noise and Visual Bund/Viking Dump rehabilitation and were locally very severe. In all cases this was largely due to the high prevalence of invasive grasses across much of the emplacement, particularly South-African Pigeon Grass, Kikuyu, Coolah Grass and/or Rhodes Grass – with establishment largely promoted by the wet conditions of the past two years. The ground layer across this dump will ultimately need to be improved towards a native-dominated composition, however this undertaking is unlikely to be practical at least until significant tree growth has been achieved.

In contrast, priority weed cover levels across all Eastern Emplacement Area blocks were consistently low at the time of monitoring. However, moderate to high densities of young Lantana seedlings were establishing across most locations, which will rapidly become problematic. Lantana has been – and will continue to be – a key focus of the Eastern Emplacement Area annual weed management. Significant and ongoing management inputs will be required to control the species across the Eastern Emplacement Area.

Average tree stem densities were highly variable between the IEM monitoring blocks and ranged from 530 stems/ha to 2,633 stems/ha, and consistently exceeded the nominal target benchmarks 350 stems/ha.

Rehabilitation LTM Blocks Summary Findings

Promoted by excellent vegetation establishment, all LTM blocks showed excellent soil and slope stability with very limited active erosion processes recorded across the slopes.

Average native species richness was variable between the blocks and ranged from a low ~17.0 species per site to a very high ~42.0 species per site. Established native species assemblages were generally satisfactory and adequately representative of the target native communities in all vegetation layers.

Five of the seven LTM blocks returned a BAM compositional attribute score within the defined completion criteria. With localised exceptions, vegetation structure and function attribute scores were however below targets which mainly reflected the still relatively young ecological age of the rehabilitation. Positively, between 32.1–70.4% (average ~42.8%) of native tree and shrub species were recorded as bearing reproductive structures at the time of monitoring, indicating an overall good potential for the established communities to be self-sustainable.

Weed cover levels were satisfactory across all Eastern Emplacement Area rehabilitation LTM blocks (<5.0%), although ongoing routine weed control will be required to prevent existing weeds scattered across the emplacement (particularly Lantana) from spreading. In contrast, all blocks on the Viking Dump / Noise and Visual Bund displayed problematic weed levels, and the ground layer was often severely infested with high-threat grasses (likely compounded by the wet conditions of the past two years). Although inevitable to meet rehabilitation objectives, the management of these grasses will be difficult and likely require significant management inputs and long-timeframes.

Average tree stem densities were variable and ranged from ~450 stems/ha to >3,100 stems/ha. Of the seven blocks, two returned an average stem density within or close to the desirable range, while the other five had very high to excessive tree densities. Localised reductions in tree stem densities will likely be required in the future to encourage the development of adequate vegetation structure, however has not been recommended for immediate implementation on the precept that high tree densities should, in the short term, facilitate the management of high-threat grass populations.

Based on the 2022 field assessments of the IEM and LTM blocks (walkover observations and plot-based monitoring results), an assessment of the current rehabilitation condition against the completion criteria was provided within the 2022 Rehabilitation Monitoring Report, the full report is available on the Bulga Coal website (https://www.glencore.com.au/operations-and-projects/coal/current-operations/bulga-coal/reporting-documents).

8.6.1.2 Reference Site Monitoring

Monitoring was conducted at three reference sites in 2022 located within each of the following vegetation communities:

- Central Hunter Grey Box – Ironbark Woodland Endangered Ecological Community (EEC);
- Central Hunter Ironbark – Spotted Gum – Grey Box Forest EEC; and
- Swamp Oak Forest (two sites).

Native remnant vegetation in the buffer zones remained variable in condition. Riparian vegetation along creek lines generally showed higher degrees of degradation than areas of native woodland, especially in terms of native biodiversity levels. Weed infestations (particularly Lantana) continued to be the main issue affecting vegetation integrity and several sites may or will require active management inputs. However, results from 2022 showed no further deterioration in overall vegetation quality and integrity compared to previous years.

8.6.2 Rehabilitation Trials and Research

8.6.2.1 Tree Thinning Trial

A tree thinning trial commenced in 2021 across areas of rehabilitation on the Noise and Visual Bund in response to monitoring results demonstrating higher than desired densities of Eucalypt species leading to suppression of understory Central Hunter Grey Box-Ironbark Woodland EEC species. A team of experienced land management and environmental restoration contractors conducted the tree thinning using the cut and paint method. Areas subject to thinning works will be monitored in subsequent years to assess EEC development.

The 2022 rehabilitation monitoring program assessed areas that had been previously thinned for success and identified areas for future tree thinning. Based on the 2022 monitoring findings, further thinning of the tree layers is not recommended for immediate implementation but will likely be required in the future in areas of excessive stem densities (>1,000 stems/ha) to encourage the development of adequate community structure. Where implemented, selective tree thinning should be based on consideration of:

- Species composition – remove species that are not characteristic of the targeted community first, then species that are acceptable but not key diagnostic species of the community, such as Red Gums where they are over-represented. Wherever possible, species to be retained should be biased towards Grey Box and Ironbarks (GBIW), and Ironbarks, Spotted Gum and Grey Box (ISGGBF), whilst retaining scattered individuals of other canopy and sub-canopy species (e.g. Cooba, Smooth-barked Apple, Bulloak, Red Gum, etc);

- Growth habit and health condition – individuals selected for removal should in priority be those displaying poorer growth habit and/or poorer health condition, with the most robust and healthiest individuals retained; and
- Stem densities – aim to retain approximately 400–500 stems/ha (GBIW) to 600–800 stems/ha (ISGGBF), which represents one tree per ~20–25 m^2 (or ~4–5 m spacings between tree stems) for GBIW, and one tree per ~12–16 m^2 (or ~3–4 m spacings between tree stems) for ISGGBF. Heavy thinning must be avoided so to not excessively open the canopy and encourage colonisation by weeds and exotic grasses, and thinned areas will require increased and proactive weed control effort.

During thinning works, tree trunks and large limbs <10 cm in diameter should be used as ground logs and smaller branches mulched in situ or used as coarse woody debris.

In 2023 Bulga Coal will assess performance through the annual rehabilitation monitoring program and continue to implement tree thinning in select areas as per ecologist recommendations.

8.7 Key Issues that may Affect Rehabilitation

A review of the rehabilitation risk assessment was undertaken in 2022 in accordance with *RR Guideline: Rehabilitation Risk Assessment*. Risks and controls identified through this process have been incorporated in the *Bulga Coal Rehabilitation Management Plan*. The key risks to rehabilitation at Bulga Coal are:

- Potential contamination of disturbance areas;
- Spontaneous combustion of exposed coal seams in highwalls;
- Spontaneous combustion impedes rehabilitation;
- Tailings does not consolidate sufficiently to allow capping to progress as planned;
- Adverse surface and groundwater quality and quantity;
- Lack of habitat structures for colonisation or use;
- Softwall instability;
- Erosion within rehabilitation areas; and
- Extended water pond or redirection of creek and river flows.

Key risks to rehabilitation are included in a rehabilitation TARP within the *Bulga Coal RMP* to identify required management actions in the event of impacts to rehabilitation, or where rehabilitation outcomes are not achieved in an acceptable timeframe.

Ongoing works will be undertaken throughout the life of the operation to ensure rehabilitation areas meet completion criteria and rehabilitation objectives. These works will mostly include weed control, erosion repairs and planting/seeding to meet the requirements of target vegetation communities. Identification of these works will be through the rehabilitation monitoring program and annual walkover inspections.

8.7.1 Bulga Open Cut

8.7.1.1 Weed and Pest Species

Weed management in rehabilitation areas is an ongoing challenge for all mining operations. Considerable planning is undertaken at Bulga Open Cut to prevent weeds entering rehabilitation areas in the first instance, primarily through topsoil management. Despite this, several weed species are present throughout most historical rehabilitation areas and significant resources are dedicated to their removal. The methods employed at Bulga Open Cut include:

- Appropriate topsoil management, including scraping of topsoil stockpiles prior to spreading and weed control in areas prior to stripping;
- Seeding with quick establishing cover crops and acacia species to out-compete weed species;
- Ongoing weed spraying and removal; and
- Seeding with a eucalypt and acacia heavy native woodland seed mix to shade-out introduced weed species such as Rhodes grass (*Chloris gayana*) and Galenia (*Galenia pubescens*).

The key weed species targeted in 2022 were Lantana (*Lantana montevidensis*), Galenia (*Galenia pubescens*), Inkweed (*Phytolacca octandra*), African Boxthorn (*Lycium ferocissimum*), Narrow-leaved Cotton Bush (*Gomphocarpus fruticosus*), African Olive (*Olea europaea Africana*), Bitou Bush (*Chrysanthemoides monilifera*), Acacia Saligna (*Acacia Saligna*), Castor Oil (*Ricinus Communis*), Verbena (*Verbena bonariensis*), Blue Heliotrope (*Heliotropium arboescens/amplexicaule*) Queensland Silver Wattle (*Acacia podalyrilfolia*), Juncus (*Juncus acutus*), Setaria Grass (*Setaria species*), Coolatai Grass (*Hyparrhenia hirta*), Mayne's Pest (*Glandularia aristigera*), African Love Grass (*Eragrostis curvula*), Fleabane (*Conyza bonariensis*), Pigeon Grass (*Setaria sphacelate*), Saffron Thistle (*Varthamus lanatus*) and Scotch Thistle (*Onopordum acanthium*).

The 2023 Rehabilitation weed management program will continue to implement controls for the above mentioned weed species plus any additional weeds identified during 2023 inspections and monitoring, control of weeds will be undertaken in order of priority according to biosecurity duties and actions required to achieve target vegetation communities.

As part of the dog baiting program, 1080 baits were placed in rehabilitation areas where the presence of wild dogs had previously been identified.

8.7.1.2 Erosion and Water Quality

Drainage structures such as contour banks and drop structures at Bulga Open Cut are largely functioning as designed and require little to no maintenance.

During 2022 Bulga continued to implement the annual landform stability and drainage inspection across all rehabilitation areas and associated drainage structures. The inspection was undertaken by a consulting engineer to identify erosion features such as rills, tunnelling, silt accumulation and overtopping drains. Spatial data was collected for all erosion and drainage maintenance features identified across all rehabilitation areas. The inspection noted a marked improvement in landform stability from previous inspections with a reduced number of erosion and maintenance issues identified.

Spatial data from the 2021 and 2022 inspections was used to develop a maintenance program which was carried out throughout 2022. Maintenance works undertaken included repairing rock drainage lines, desilting contour banks, repairing rill and gully erosion and tunnelling. Coir logs were also successfully used to prevent and stabilise minor rill erosion across natural landform areas.

In 2023 another landform stability and drainage inspection will be conducted to identify any new erosion features or maintenance issues and assess the success of the 2022 maintenance program. Budget has been allocated to rehabilitation maintenance to allow for works to be conducted throughout the year and in response to new erosion identified following high rainfall events.

Monthly water quality sampling is undertaken on all sediment dams downstream of rehabilitated areas. Bi-annual full chemical analysis is also undertaken on the sediment dams. This monitoring will be used to assess when surface water runoff can be diverted back into clean water catchments.

8.7.1.3 Safety Risks

There are currently no rehabilitation areas that present safety risks to the public or employees. At the time of mine closure (in year 2039 based upon current approvals), the proposed final void and highwall will be rehabilitated in accordance with the Bulga Coal RMP and appropriate safety controls will be implemented.

8.7.2 Bulga Underground Operations

8.7.2.1 Weed and Pest Species

Due to the small and isolated nature of rehabilitation and the maintenance of buffer land at Bulga Underground Operations, weed and pest management activities are not isolated to rehabilitation areas. Weed and pest management, inclusive of rehabilitation was undertaken throughout 2022 as outlined in **Section 6.7**.

8.7.2.2 Erosion and Water Quality

Maintenance of erosion controls identified during scheduled and routine inspections was undertaken during 2022.

8.7.2.3 Safety Risks

There are currently no rehabilitation areas that present safety risks to the public or employees.

8.8 Actions for the Next Reporting Period

8.8.1 Rehabilitation Outcomes

The rehabilitation outcomes have been agreed with stakeholders and documented in the approved MOPs, which are available on the Bulga Coal website (https://www.glencore.com.au/operations-and-projects/coal/current-operations/bulga-coal/reporting-documents). It is noted that the Regulation commenced on 2 July 2021, with a transition period of to 2 July 2022. Following the transition period, Mining Operations Plans cease to exist in NSW. The Bulga Coal Rehabilitation Management Plan and associated works include rehabilitation outcomes (objectives, indicators and criteria) with the rehabilitation objectives pending approval from the NSW RR.

8.8.2 Proposed Rehabilitation Trials, Project and Initiatives

No additional rehabilitation trials are currently proposed at Bulga Coal in 2023.

8.8.3 Rehabilitation Activities Proposed for 2023

Bulga Coal plans to undertake the following rehabilitation and disturbance works during 2023:

- 18.82 ha of disturbance;
- 38.5 ha of rehabilitation (levelled/re-contoured, topsoiled and seeded);
- 66.5 ha of rehabilitation disturbance;
- Maintenance works as required on existing rehabilitation areas; and
- Subsidence repairs as required.

The proposed 2023 operations for Bulga Open Cut have been presented in **Figure 4**.

9.0 Community

9.1 Community Engagement

Bulga Coal engaged with the community through meetings, community barbeques and newsletters throughout 2022.

9.1.1 July Flood Event and Recovery

Bulga Coal and Glencore assisted the Broke and Bulga communities impacted by flooding in July 2022. Bulga Coal was a key part of the local operations team and worked with the community and agencies to provide financial and in-kind support throughout the recovery. We were thankful that we could help our community when it was most needed and experience the wonderful community spirit in Broke and Bulga (**Photo 5**).

Photo 5 July 2022 Flood Event and Recovery

9.1.2 Community Barbeques

We held four community barbeques in May and October 2022. In May we had 73 attendees at Broke and 63 in Bulga. In October we had 82 attendees in Bulga and 116 in Broke. The format of the barbeques in October was a cocktail style celebration and get together which was well received.

9.1.3 Newsletters

A community newsletter was distributed to letterboxes in Broke, Milbrodale and Bulga in August 2022. Other notices were distributed to letterboxes to provide information about community information sessions including community barbeques and Broke to Bulga Discovery Trail feasibility study consultation.

9.1.4 Community Consultative Committee

Bulga Coal enjoys an open and honest dialogue with community representatives and Singleton Council through our Community Consultative Committee. Bulga Coal hosted meetings in May and November 2022.

Minutes from the CCC meetings are available on the Bulga Coal website (https://www.glencore.com.au/operations-and-projects/coal/current-operations/bulga-coal/community-documents).

9.1.5 Voluntary Planning Agreement

Bulga Coal made payments for Part B (Broke Road Maintenance) and Part C (Community contributions to local events and education) during 2022.

9.1.6 Broke to Bulga Discovery Trail Feasibility Study

Bulga Coal together with the Broke Residents Association, engaged a consultant to undertake a feasibility study for a proposed shared walk and cycle trail between Broke and Bulga. The proposed route aims to showcase our community assets and provide access to local bushland including the Minimbah Teaching Place. There is overwhelming community support for the project. Bulga Coal will continue to work with the community and Singleton Council during 2023 to progress the project (**Photo 6**).

Photo 6 Feasibility Study for the Proposed Shared Walk and Cycle Trail between Broke and Bulga (Bulga Coal together with the Broke Residents Association) 2022

9.1.7 Mine Tours and Family Open Day

Bulga Coal participated in the Upper Hunter Mining Dialogue school tour program with around 60 primary and high school students visiting the mine in June and September 2022 (**Photo 7**). We also hosted additional school tours with a focus on rehabilitation and career opportunities. Bulga Coal hosted mine tours as part of the Bulga Open Cut Family Day for employees in August and as part of the Broke Village Fair in September.

Photo 7 Upper Hunter Mining Dialogue School Tour Program 2022

9.2 Community Sponsorship and Donations

Bulga Coal contributed approximately $72,000 in sponsorships and donations in 2022 to the projects and organisations listed below.

9.2.1 Broke School

The school purchased Science, Technology, Engineering and Mathematics (STEM) furniture and equipment with the annual contribution in Bulga Coal's Voluntary Planning Agreement.

9.2.2 Broke Bulga Landcare

Bulga Coal is a partner of the Wollombi Brook Riparian Rehabilitation Project with Hunter Local Land Services, Broke Bulga Landcare and Singleton Council (**Photo 8**). The project aims to reduce weed infestations and rehabilitate areas owned by private landholders along the Wollombi Brook. This year was the final year of the project. Bulga Coal attended committee meetings and provided in-kind support for bank stabilisation planting.

Photo 8 Wollombi Brook Riparian Rehabilitation Project 2022

9.2.3 Community Yoga Classes

Bulga Coal continued supporting weekly yoga classes in Bulga during 2022. The classes were well attended and appreciated by the community.

9.2.4 Broke Village Fair

Bulga Coal is the major sponsor of the annual Broke Village Fair. This year the Fair was the first event in Broke after the July flooding event and presented a great opportunity for the community to come together and encourage visitors back to the region. It was a successful event (the first since 2019 due to COVID-19 restrictions) with an estimated 5,000 visitors. Bulga Coal works in partnership with the Fair committee, participating in the committee and marketing the event. Native trees were handed out in the Bulga Coal marquee and around 300 people enjoyed bus tours to the Bulga Open Cut mine (**Photo 9**).

Photo 9 Broke Village Fair 2022 – Bulga Coal Marquee handing out Native Trees

9.2.5 Broke Fordwich Wine and Tourism Association

We continued our long-standing support of the Broke Fordwich Wine and Tourism Association by sponsoring a flood recovery marketing campaign to encourage visitors to the region after the flood event. We also continued our support for the event, A Little Bit of Italy.

9.2.6 Sponsorships

Organisations and events that were sponsored by Bulga Coal during 2022 included:

- Broke Fordwich Wine and Tourism Association: A Little Bit of Italy in Broke and flood recovery marketing campaign;
- Broke Residents Association events: Winterfest and Christmas with the Neighbours;
- Smoke in Broke barbeque festival;
- Broke Village Fair and Vintage Car Display;
- Singleton Tidy Towns Adopt a Spot Broke Road Clean-up;
- Broke Bulga Landcare;
- Singleton Library – Summer Reading Program; and
- Broke Public School – STEM furniture.

9.2.7 Donations

Donations were made to these recipients in 2022:

- Singleton Track and Field;
- Lifeline Hunter;
- Children's Medical Research Institute;
- Headspace;
- Hunter Food Relief; and
- Special Children's Christmas Party.

9.3 Community Complaints

During the reporting period, 17 community complaints were recorded from 7 stakeholders, with one stakeholder recording 9 complaints. 15 of the 17 complaints related to noise, received from 6 stakeholders. The other complaints related to blast vibration (1) and lighting (1).

Table 54 shows a comparison of the environmental complaints received by Bulga Coal during the reporting period against the previous five years.

Table 54 Summary of Complaints by Issue 2017–2022

Complaint Type	2017	2018	2019	2020	2021	2022
Blast vibration/ overpressure	0	0	1	2	1	1
Lighting	3	3	5	2	0	1
Dust	3	3	4	1	2	0
Noise	9	14	11	12	10	15
Traffic	1	0	0	0	0	0
Visual Amenity	0	2	2	0	0	0
Odour	0	0	0	0	0	0
Fume	0	0	0	0	0	0
Other	1	0	1	0	1	0
Total	17	22	24	17	14	17

Each of these complaints followed the *Bulga Coal Community Complaint Procedure* and the response is available in the complaints register on the Bulga Coal website (https://www.glencore.com.au/operations-and-projects/coal/current-operations/bulga-coal/community-documents).

Noise

Each noise complaint was investigated. Where the noise levels were found to be above the relevant criteria at the nearest real-time monitor or by the handheld monitor, operational changes were made to reduce the noise. Where the noise was below the criteria, the complainant was notified of this and the levels were monitored.

9.4 Community Feedback

Bulga Coal receives formal and informal feedback about the consultation program and environmental performance.

Bulga Coal received positive feedback from the community regarding Minimbah Teaching Place which was officially opened in June 2022. The venue is being utilised by a wide range of groups for cultural education. We also received positive feedback from the community and local organisations regarding the flood recovery assistance provided by Bulga Coal and Glencore during the July event. Bulga Coal was appreciative that we could help our community in their time of need.

There was overwhelming positive support in the community for a proposed walk and cycle path between Broke and Bulga. We will continue to work with the community and Broke Residents Association to progress the project.

10.0 Independent Audit

10.1 2021 Independent Environmental Audit

In accordance with the requirements of Schedule 5, Conditions 9 and 10 of SSD-4960, Condition 8.4 of DA 41-03-99 and Schedule 6, Conditions 6 and 7 of DA 376-8-2003, an Independent Environmental Audit (IEA) was undertaken for Bulga Coal in 2021. The audit was conducted in November 2021 and was approved by DPE on 6 April 2022.

The audit found that approximately 41% of all conditions and commitments were found to be compliant, 55% not triggered and 4% were non-compliant. A summary of non-compliances and the status of the proposed actions is presented in **Table 55**. Actions that are ongoing, required no action or were completed prior to this Annual Review period have been excluded.

Table 55 Non-Compliance Findings and Action Status from 2021 IEA

Non-Compliance Reference	Finding	Action Proposed by Bulga Coal	By When	Action Status
SSD-4960 Schedule 3 Condition 17	Several exceedances of 24-hour PM_{10} assessment criteria were recorded by the BCC air quality monitoring network during the audit period. While standard Glencore tenancy agreements are issued that include advice on health risks associated with exceedances, currently tenants of these properties are not notified of exceedances when they occur. Recommendation: Where exceedances of particulate emission limits occur, ensure that notification is provided for tenants on mine owned land.	Bulga will notify tenants of mine owned properties if the air quality criteria is exceeded in the region of the properties as a result of Bulga Coal emissions.	Triggered by exceedance	Not triggered within the reporting period.
SSD-4960 Schedule 3, Condition 27	Multiple discharge events of sediment laden water and chemical and hydrocarbon storage at workshop. Recommendation: Ensure chemical and hydrocarbon storage is periodically reviewed for compliance against the relevant Australian standards.	Undertake a compliance review against the relevant Australian Standards for chemical and hydrocarbon storage across site.	30/06/2023	Will be completed in 2023.

Non-Compliance Reference	Finding	Action Proposed by Bulga Coal	By When	Action Status
SSD-4960 Schedule 3, Condition 27	Multiple discharge events of sediment laden water and chemical and hydrocarbon storage at workshop. Recommendation: Consider diverting the water off the workshop roof structures to capture it for utilisation on site.	Investigate the potential and feasibility of diverting the water off the workshop roof to capture it onsite for use.	30/06/2022	Completed.
SSD-4960 Schedule 3, Condition 51A	Bushfire Management Plan. Recommendation: Section 9.1 of GCAA-625378177-10531 GCAA Work Authorisation and Permit System – Protocol should be referenced in Section 6 of the Bushfire Management Plan to meet item d.	Review the Bushfire Management Plan to ensure that Section 9.1 of GCAA-625378177-10531 GCAA Work Authorisation and Permit System – Protocol is referenced in Section 6 to meet item (d) of SSD-4960 S3 C51A.	30/06/2022	Completed.
SSD-4960 Schedule 3, Condition 52	Waste management. Recommendation: It is recommended that the bioremediation area be sign posted to better track contaminated material deposited.	Install sign posts at the bioremediation area to better track contaminated material deposited.	30/06/2022	Completed.
SSD 4960 Schedule 3, Condition 53	Rehabilitation Objectives. Recommendation: Undertake a whole of site soil balance to quantify shortfall and plan for contingency. There is 260 ha of 'Agricultural land' to be established at the end of mine life. This is currently a risk to lease relinquishment down the track if there is inadequate soil to verify the land is resilient to stock grazing, drought, erosion etc., in comparison to analogue sites. Some soil material was lost to Rhodes Grass contamination in the rehabilitation that is to be re-disturbed.	Undertake a whole of site topsoil balance to quantify shortfall and plan for contingency.	31/12/2022	Completed.

Non-Compliance Reference	Finding	Action Proposed by Bulga Coal	By When	Action Status
SSD-4960 Schedule 3, Condition 53	Rehabilitation Objectives. Recommendation: Plan and install additional access tracks throughout rehab to provide easy access for rehab inspections and maintenance, especially as the geomorphic landform is being used from this point forward. The site is already planning this but worth mentioning as a support for the idea.	Undertake a review of whether additional access tracks can be installed throughout rehab to provide easier access for rehabilitation inspections and maintenance.	31/12/2022	Completed.
Schedule 3, Condition 53	Rehabilitation Objectives. Recommendation: Ensure topsoil stockpiles are signposted to reduce chance of disturbance or dumping.	Install sign posts for topsoil stockpiles to reduce the chance of disturbance or dumping.	31/12/2022	Will be completed in 2023.
SSD-4960 Schedule 5, Condition 5 **DA-41-03-99 Schedule 2, Condition 10.1**	In September 2019, Bulga Coal received a Show Cause Notice from DPE for failing to operate the CCC in accordance with the CCC Guidelines. Recommendation: Ensure CCC operation is periodically reviewed for compliance against the Department's Community Consultative Committee Guidelines for State Significant Projects (2016, or its latest version).	Undertake a compliance review of the CCC operation against the Department's Community Consultative Committee Guidelines for State Significant Projects (2016, or its latest version).	30/06/2022	Completed.
DA-41-03-99 Schedule 2, Condition 10.1	No overpressure or vibrations results were recorded at the Dawtrey monitor for blasts fired at Bulga Open Cut on 27/04/21 at 14:18 and 29/04/21 at 12:24. Recommendation: Relinquish DA-41-03-99.	Relinquish DA-41-03-99.	30/06/2022	Completed.
DA-41-03-99 Schedule 2, Condition 6.3.5	Cumulative Land Acquisition Criteria. Recommendation: Relinquish DA-41-03-99.			

Non-Compliance Reference	Finding	Action Proposed by Bulga Coal	By When	Action Status
DA-41-03-99 Schedule 2, Condition 6.3.6	Cumulative land acquisition criteria are not provided in the noise management plan. Cumulative mine noise is not measured during regular noise compliance monitoring. It is not possible, based on the information provide, to determine if the cumulative noise impact assessment criteria are being achieved. Recommendation: Relinquish DA-41-03-99.			
DA-41-03-99 Schedule 2, Condition 8.2	The AQMP and WMP have not been updated to include quality assurance/quality control plan and shall require approval from the relevant regulatory agencies. Recommendation: Relinquish DA-41-03-99.			
ML1547 Schedule 00, Condition 2.1	Failure to comply with Condition 2(1) of ML1547 – Conduct operations in accordance with MOP due to spatial data review. Recommendation: Review quality assurance process and ensure data management systems are up to date.	Undertake a review of the quality assurance process for MOP GIS data management and ensure the GIS system is up to date.	30/09/2022	Completed.

11.0 Incidents and Non-Compliances During the Reporting Period

Incidents and non-compliances which are considered as low risk of environmental harm are detailed in this section.

11.1 Discharge of Sediment Laden Water from drain into Clean Water Catchment on 22 February

On 22 February 2022 during a workplace inspection following heavy rainfall, it was observed that the Northern Drain was spilling into a clean water catchment. The spill duration was estimated to be less than 1 hour. The Northern Drain captures dirty water runoff from the Eastern Emplacement Area which is an overburden emplacement to the East of Broke Road. The Northern Drain flows to the Northern Dam, and spills into the Nine Mile Creek catchment that runs adjacent to Broke Road.

It is estimated that approximately 1.7 ML of water spilled out of the Northern Drain into the Nine Mile Creek catchment, which would have been substantially diluted by the flow in Nine Mile Creek. The water quality results indicated that the water spilled from the Northern Drain had:

- A neutral pH consistent with the other samples;
- Low electrical conductivity consistent with high intensity rainfall run off, slightly lower than Upstream Sample 2 electrical conductivity and four and 1/2 times lower than the downstream sample taken in Nine Mile Creek on the 23 February 2022; and
- Higher Total Suspended Solids (TSS) than the other samples. The DPE recorded the incident and required no further information.

There was no evidence of impact on water quality in the downstream sample taken on 23 February 2022.

The Department of Planning and Environment (DPE) recorded the incident and noted the following findings:

- The Northern Drain was designed and constructed in accordance with the guidance series *Managing Urban Stormwater: Soils and Construction – Volume 1* (Landcom, 2004), *2E Mines and Quarries* (DECC, 2008) (Blue Book), the *Bulga Coal Water Management Plan* and the *Bulga Coal Complex Erosion and Sediment Control Plan*. The Northern Drain south of Culvert 082 was designed and constructed to manage the runoff from a catchment of 140 ha. The current catchment that reports to the Northern Drain is 119 ha;
- The site experienced two separate significant rainfall events on 21 and 22 February 2022:
    - The first event occurred during the evening/morning of the 21/22 February where Bulga Coal measured greater than 50 mm of rainfall in all three rain gauges (Complex Weather Station 50 mm, Southern Extension Weather Station 63 mm and Surge Dam Rain Gauge 57.5 mm).

- The second intense rainfall event between 12 pm and 1 pm from a localised storm cell that was predominantly over the eastern area of Bulga Coal as demonstrated by the rainfall measured during that period (Complex Weather Station 13 mm, Southern Extension Weather Station 8 mm and Surge Dam Rain Gauge 48 mm).

- An inspection was undertaken on the morning of 22 February 2022, triggered by greater than 20 mm of rain falling in the preceding 20 hours. The inspection did not identify any excessive silt build up within the drain down to Culvert 082, but did identify some silt build up to the north of Culvert 082 prior to the rainfall event; and

- The 48 mm of rainfall that fell between approximately 12 pm and 1 pm on 22 February was greater than the Northern Drain design 1 in 20 year, 1 hour peak flow rainfall event of 41 mm.

There were no proposed actions taken to prevent future occurrences.

11.2 Discharge of Mine Water from C3 Mine Water Dam into Clean Water Catchment on 8 March

On 7 and 8 March approximately 160 mm of rain fell on Bulga Coal and surrounding catchments during a regional flooding event. This rainfall event caused flooding of all drainage lines between Bulga Coal and Wollombi Brook, Nine Mile Creek and Loders Creek. The Bulga Coal CHPP mine water dam C3 spilled to an un-named tributary of Nine Mile Creek for approximately 6 hours between 5 pm and 11 pm on 8 March. The flooding event also caused Bulga Coal sediment dams S2 and S2A to spill between approximately 9 am on 8 March and approximately 3 pm on 9 March.

The water that spilled from C3 was slightly higher in pH and salinity and moderately higher in TSS in comparison to the receiving water. There was negligible environmental impact associated with these spills given the quality of the water which spilled and the substantial dilution as a result of flooding occurring across all receiving clean water drainage lines before, during and after the spill event.

The S2, S2A and C3 dams, pumps and associated catchments were maintained and operated as described in the Bulga Coal Water Management Plan.

The DPE is currently investigating the C3 dam incident and noted the following findings:

- Table 12 of the WMP states Dam C3 is the main mine water dam at the CHPP area that transfers to CHPP or CHPP Surge Dam;

- Section 5.2.3 of the WMP states Dam C3 is equipped with pumps which enable pumping of water to the clarified water tank in the CHPP or to the CHPP Surge Dam;

- Table 11 of the WMP describes the management (treatment) of mine water as contained within the mine water management system with potential for controlled release from the Northern Dam under the HRSTS and EPL conditions; and

- Further, Schedule 3, Condition 27 of development consent SSD-4960, as modified (the consent) for Bulga Coal states the Applicant must comply with the performance measures in Table 8 to the satisfaction of the Planning Secretary. The performance measures for mine water storages specified in **Table 8** includes “Design, install and maintain mine water storage infrastructure to ensure no unlicensed or uncontrolled discharge of mine water off-site".

There were no proposed actions taken to prevent future occurrences.

11.3 Discharge of Sediment Laden Water from S2 and S2A Dirty Water Dams into Clean Water Catchment on 8 March

On 7 and 8 March approximately 160 mm of rain fell on Bulga Coal and surrounding catchments during a regional flooding event. This rainfall event caused flooding of all drainage lines between Bulga Coal and Wollombi Brook, Nine Mile Creek and Loders Creek. It also caused Bulga Coal sediment dams S2 and S2A to spill between approximately 9 am on the 8 March and approximately 3 pm on the 9 March.

The water that spilled from S2 and S2A was slightly higher in pH, salinity and TSS concentration in comparison to the receiving water but was well within the range observed in the surrounding surface system. There was negligible environmental impact associated with these spills given the quality of the water which spilled and the substantial dilution as a result of flooding occurring across all receiving clean water drainage lines before, during and after the spill event.

The S2, S2A and C3 dams, pumps and associated catchments were maintained and operated as described in the Bulga Coal Water Management Plan.

The DPE recorded the incident and noted the following findings:

- Sediment Dams S2 and S2A have been designed, constructed, maintained, and operated to meet the in accordance with the guidance series *Managing Urban Stormwater: Soils and Construction Volume 1* (Landcom, 2004), *2E Mines and Quarries* (DECC, 2008) (Blue Book) requirements. The rainfall has been greater than the dirty water management system Blue Book design rainfall event of 64 mm;
- The S2 and S2A sediment dams, pumps and associated catchments were maintained and operated as described in the *Bulga Coal Water Management Plan*;
- There was negligible environmental impact associated with these spills, with the quality of the water which spilled and the substantial dilution as a result of flooding occurring across all receiving clean water drainage lines before, during and after the spill event; and
- The EPA extended their Natural Disaster Declaration to include the Singleton Local Government Area during this rainfall event, waiving the need for EPL licensees to report pollution events which have occurred as a direct result of this flooding until 14 March 2022.

There were no proposed actions taken to prevent future occurrences.

11.4 Discharge of Mine Water from Pipeline into Clean Water Catchment on 24 May

On 24 May 2022 mine water was observed to have spilled from a pipeline into a clean water tributary of the Nine Mile Creek catchment. Prior to the incident, on 23 May 2022 Bulga Coal was preparing to clean out the sediment trap on the north-eastern side of C3 dam. A skid mounted pump was placed on the edge of the sediment trap to pump the water away so the settled sediments could then be removed by excavator and trucks. The pump was connected to a temporary pipeline that had been connected to a mine water pipeline during the recent high rainfall events to remove excess flood water from C3 and prevent overtopping into the clean water catchment. The pump was operated at approximately 9 am and 2 pm on 23 May 2022 for approximately half an hour at each time at a rate of approximately 80 L/s. This equates to a volume of approximately 288 kL.

On the morning of 24 May 2022 while conducting a pre work inspection it was identified that the temporary pipeline had been disconnected from the mine water pipeline prior to the 23 May 2022 pumping. As a result, the 288 kL of sediment laden water pumped on the 23 May 2022 had discharged from the open end of the temporary pipeline into the clean water catchment of an ephemeral tributary of Nine Mile Creek. The sediment laden water flowed along a drain adjacent to the rail loop to the top of the ephemeral drainage line and though a culvert under the Bulga Coal rail loop. The sediment laden water then travelled approximately 200 m down that drainage line.

On 24 May 2022 there was no water flowing as a result of the spill however, there was visible sediment deposited in the drainage line. On 24 May 2022 Bulga Coal installed a sandbag weir downstream of the visible sedimentation to prevent further potential migration in the event of rainfall runoff. On 25 May 2022 Bulga Coal received advice from the EPA agreeing to the proposed cleanup method of flushing the drainage line with clean Hunter River water and capturing the sediment in temporary sandbag weirs downstream which was completed between 29 May 2022 and 30 May 2022.

The DPE recorded the incident. The EPA issued a Penalty Infringement Notice and a fifteen thousand dollar fine on 7 December 2022 following an investigation. The EPA investigation noted:

- Condition 01.1 of the licence requires activities including the handling, movement and storage of materials to be carried out in a competent manner. In this case, the investigation findings support the allegations that on 23 May 2022, Bulga Coal failed to comply with condition 01.1 of the Licence by failing to ensure proper end to end connection of the pipeline used in the dewatering of dam C3 causing a discharge of 300 kL of mine water from the Premises.

- Condition 02.2 of the licence requires of the licence requires all plant and equipment used in connection with a licensed activity to be used in a proper and efficient manner. In this case, the investigation findings support the allegation that on 23 May 2022, Bulga Coal failed to comply with condition 01.1 by failing to ensure the proper operation of the pipeline because of not having sufficient knowledge of the pipe connection status causing a discharge of 300 kL of mine water from the Premises.

- Section 120 of the POEO Act makes it an offence to pollute waters. In this case, the investigation findings support the allegation that on 23 May 2022, the Licensee polluted waters by placing in or on water matter that is of a prescribed nature.

The discharge was caused by the disconnection of the temporary mine water pipeline. This pipeline has been removed from service. Bulga Coal conducted environmental awareness refresher training to ensure that potential environmental risks are identified in planning for all work. Bulga Coal also conducted an audit of all pipelines on site that have the potential to discharge into the clean water environment to ensure the appropriate protective measures are in place and that there are no inappropriate temporary installations.

11.5 Discharge of Sediment Laden Water from S2A, S2, S3 and S10 Dirty Water Dams into Clean Water Catchments on 5 July

Between the 3 July and 7 July approximately 257.5 mm of rain fell on Bulga Coal and surrounding catchments. This rainfall event led to substantial flooding in the local Broke, Fordwich and Bulga area. This rainfall event caused flooding of all drainage lines between Bulga Coal Complex and Wollombi Brook, Nine Mile Creek and Loders Creek. It also caused Bulga Coal sediment dams S2 and S2A to spill.

S2A dam spilled between approximately 12:45 pm on 5 July and 9:45 am on 7 July. S2 dam spilled between approximately 8:29 pm on the 5 of July and 11:30 pm on 6 of July. There was negligible environmental impact associated with these spills given the quality of the water which spilled and the substantial dilution as a result of flooding occurring across all receiving clean water drainage lines before, during and after the spill event.

During the rain event, sediment dams S3 and S10 were also reported as having spilled on 5 July 2022. The decision to notify was done remotely based on level sensors in the dams reading greater than 100% capacity. However, the dams were inspected by the CHPP Technician between approximately 10 pm and 11 pm on 5 July, and at 1 am and 3 am on 6 July. No water was observed spilling from these dams at the time of inspections, despite the level sensors reading above 100%. The dam level sensor in S3 dam was reading below 100% capacity at the inspection at approximately 3 am. The CHPP Technician also noted that S10 dam had more capacity before it would spill.

The DPE recorded the incident and noted the following:

- The rainfall event was greater than the dirty water management system Blue Book design rainfall event of 64 mm (95th percentile 5 day rainfall event);
- Water quality monitoring undertaken during the rainfall event showed no significant difference In comparison with the receiving water;
- Section 120 of the POEO Act Sediment dams S3 and S10 were reported as having spilled on 5 July 2022. However, on inspection, no water was observed spilling from these dams, despite the level sensors reading above 100%; and
- The dams, pumps and associated catchments were maintained and operated as described in the Bulga Coal Water Management Plan.

There were no proposed actions taken to prevent future occurrences with regard to the S2 and S2A Dam spills. Regarding the S3 and S10 Dams, level sensors were checked and recalibrated to provide correct dam water levels.

11.6 Discharge of Mine Water from the HRSTS Discharge Point on 8 March 2022

From 11:00 am to 2:00 pm on 8 March 2022, 58 ML of mine water was discharged from the Hunter River Salinity Trading Scheme discharge point (EPA ID No 11). The HRSTS credits from block 67 were previously transferred to another HRSTS participant.

On 8 March at 11 am, following heavy rainfall across the region; Bulga Coal was of the understanding the Bulga Coal HRSTS credits for Block 67 had been transferred back to Bulga Coal, after which Bulga Coal commenced discharging. However, the credits transferred back were for Block 69, not 67.

Bulga Coal subsequently discharged a further 1667 ML in blocks 68 to 90 in accordance with the HRSTS protocols. Bulga Coal was not aware that the credits were not available for the Discharge Block 67 until the 13 December 2022, when the EPA contacted Bulga Coal to request further information about the discharge.

All discharge activities occurred during the significant flooding event included in the Natural Disaster Declaration where the EPA wavered the need for Licences to report events that occurred as a direct result of the flooding until 14 March. Bulga Coal's need to discharge was directly in response to the flooding that was occurring.

The EPA is currently investigating the incident. Bulga Open Cut HRSTS Operating Procedure refresher training was undertaken to help prevent potential recurrence of the incident.

11.7 Administrative Non-Compliances

11.7.1 Failure to Continuously Monitor Air Quality

PM_{10} air quality data was not monitored continuously at EPA Point 9 and Point 10 due to the equipment failure at various times during 2022. For the reporting period 98.2% of valid data was captured for EPA Point 9, and 97.9% of valid data was captured for EPA Point 10.

The cause of the break downs were investigated promptly, and the monitors were fixed. Details were reported to the EPA in the 2021–2022 EPL 563 Annual Return, and are included in the *Annual Air Quality Report* in **Appendix B**.

$PM_{2.5}$ air quality data was not monitored continuously at air quality monitors D2 and D10 due to equipment failure, power outages and planned maintenance at various times during the reporting period. Valid data was recorded for 66.1% and 97.9% of 24-hour events during the reporting period respectively. The low percentage of valid data recorded at D2 was due to an issue identified with the heater which caused the monitor to record abnormally high $PM_{2.5}$ levels from the start of the reporting period until 29 April 2022. Bulga Coal investigated the issue and replaced the heater and temperature sensor cable. The annual average was calculated using the valid data. Given the low PM_{10} annual average results recorded at the adjacent monitor (D1 – Hill St), it is not expected for the D2 annual average to be different from the calculated.

PM_{10} air quality data was not monitored continuously at air quality monitors D1, D3, D5 and D11 due to equipment failure, power outages and planned maintenance at various times during the reporting period.

Valid data was recorded for 97.4%, 99.5%, 96.5% and 99.7% of 24-hour events during the reporting period respectively.

The cause/s of the break downs were investigated promptly, and the monitors were fixed. Further details are included in the *Annual Air Quality Report* in **Appendix B**.

11.7.2 Failure to Monitor Humidity Data

Humidity data was not monitored continuously at EPA Point 23 – Southern Extension Meteorological Station at various times from the start of the reporting period to 17 May 2022.

The cause of the break downs were planned maintenance, power outages and intermittent fault with humidity sensor resulting in invalid humidity data recorded at the logger. The humidity sensor was replaced on 17 May 2022. Details were reported to the EPA in the 2021–2022 EPL 563 Annual Return and further details are included in the *Annual Air Quality Report* in **Appendix B**.

11.7.3 Failure to monitor BCC1 on one instance during the Attended Noise Monitoring

During the May 2022 monthly attended noise monitoring, the monitoring contractor accidentally missed BCC1 (Bulga Village). This was noted by the contractor in June while preparing the report for Bulga Coal.

Given the very low levels at all other monitoring locations during the night it is expected compliance would have resulted at BCC1 as well.

Table 56 $L_{Aeq, 15min}$ and $L_{A1, 1 min}$ Generated by Bulga Coal against Impact Assessment Criteria May 2022

Location	Start Date and Time	$L_{Aeq, 15 min}$ dB		$L_{A1, 1 min}$ dB	
		Criterion	Bulga Coal	Criterion	Bulga Coal
BCC2	17/05/2022 – 23:30	35	<25	45	<25
BCC3	18/05/2022 – 00:00	35	<25	45	25
BCC4	18/05/2022 – 00:31	35	IA*	45	IA*
BCC5	17/05/2022 – 23:24	35	28	45	32
BCC7	17/05/2022 – 22:57	36	IA*	45	IA*
BCC8	17/05/2022 – 22:27	36	IA*	45	IA*
BCC9	18/05/2022 – 00:12	35	IA*	45	IA*
BCC10	18/05/2022 – 00:00	35	<25	45	27

* IA: Inaudible, no site noise was audible at the monitoring location.

The requirement to adhere to the monitoring procedure was reinforced with the noise consultant.

12.0 Activities to Be Completed in the Next Reporting Period

12.1 Bulga Underground Operations

The works listed in **Table 57** have will be completed in 2023 at Bulga Underground Operations to improve the environmental and/or community performance of the operation.

Table 57 Bulga Underground Operations Proposed Activities in 2023

Topic	Proposed Activity	By When
Rehabilitation	Continue weed control, erosion repairs and planting/seeding to meet the requirements of target vegetation communities at Bulga Underground Operations.	Ongoing

12.2 Bulga Open Cut

The works listed in **Table 58** will be completed in 2023 at Bulga Open Cut to improve the environmental and/or community performance of the operation.

Table 58 Bulga Open Cut Proposed Activities in 2023

Topic	Proposed Activity	By When
Noise	Commence operating Komatsu 930e trucks following introduction to site late 2022.	Q1
Visual and Lighting	Install additional visual screening along Broke Road.	Q1
Greenhouse Gas Emissions	Install coal seam gas drainage wells into the Piercefield Seam to enable the safe and productive open cut mining of the seam. The captured gas which is predicted to have a high methane concentration, will be piped to the gas fired power station and associated flares where it will be converted to carbon dioxide to reduce GHG emissions.	Q4
Community	Progress development of the proposed Shared Walk and Cycle Trail between Broke and Bulga.	Q4