Bulga Open Cut

Mining Operations Plan

1 July 2020 – 30 June 2023

Report Number: 630.30025

17 August 2020

Bulga Coal Management Pty Ltd
Locked Bag 2
Singleton
NSW 2330

Version: Final

Bulga Open Cut

Mining Operations Plan

1 July 2020 – 30 June 2023

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DOCUMENT CONTROL

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Bulga Open Cut	
Mining Operations Plan	
Name of Mine	Bulga Open Cut
MOP Commencement Date	1 July 2020
MOP Completion Date	30 June 2023
Mining Authorisations (Lease/Licence No.)	ML 1494, ML 1674, ML 1788, ML 1547, ML 1717, CL 224
Name of Authorisation / Authorisation holder(s)	ML 1494 Saxonvale Coal Pty Ltd and Nippon Steel and Sumitomo Metal Australia Pty Ltd ML 1674 Bulga Coal Management Pty Limited ML 1788 Bulga Coal Management Pty Limited ML 1547 Bulga Coal Management Pty Limited ML 1717 Bulga Coal Management Pty Limited CL 224 Saxonvale Coal Pty Ltd
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Version	Final

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1.0 INTRODUCTION

The Bulga Coal Complex (Bulga Coal) incorporates both the Bulga Open Cut (BOC) and the Bulga Underground Operations (BUO).This Mining Operations Plan (MOP) has been prepared for the proposed operations at the BOC for the period from 1 July 2020 to 30 June 2023 (herein referred to as the MOP Term).

At the time of preparing this MOP, operations at the BUO were covered by the separate *Bulga Underground Operations Mining Operations Plan 2018 to 2023* (SLR 2018). A new BUO MOP is being prepared that will also cover the same MOP term.

1.1 History of Operations

Bulga Coal is located approximately 12 kilometres (km) southwest of Singleton, and approximately 2 km from the townships of Broke and Bulga, in the Upper Hunter Valley of New South Wales (NSW) (refer to **Figure 1**).

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 also is the majority shareholder (87.5%) of the Bulga Joint Venture. Glencore is the majority shareholder of Oakbridge Pty Ltd.

BOC incorporates the Coal Handling and Preparation Plant (CHPP). The CHPP and the rail loading facility are located in the north-east corner of Bulga Coal and service both BUO and BOC (refer **Figure 2**). The BUO ceased mining in May 2018 and the mine was sealed in July 2018.

Coal mining at Bulga Coal commenced in 1982 when BHP opened the Saxonvale Mine. Approval for the Saxonvale Mine was granted by the then Minister for Planning and Environment on 26 March 1981 under Coal Lease (CL) 224. The Saxonvale Mine comprised an open cut coal mine truck and shovel operation, CHPP and rail loading facility with approved production of up to 7 million tonnes per annum (Mtpa) of run of mine (ROM) coal. The Saxonvale Pit is now being used for tailings storage and is referred to as the Deep Pit Tailings Dam (refer to **Figure 2**).

By 1988 the available resource in the Saxonvale Pit was depleting and development work commenced in the Whybrow Pit. In 1989 the Saxonvale Mine was sold with the new owner obtaining Development Consent from the then Minister for Planning and Environment on 21 December 1990 to conduct mining within the Bulga Coal Lease (CL 372). This involved expansion of the Whybrow Pit operations into the Bulga Coal Lease at an approved extraction rate of up to 5.2 Mtpa, development of the Bulga Pit, and continued use of the existing CHPP and rail loading facility. The Whybrow Pit and Bulga Pit are now collectively referred to as the Main Pit (refer to **Figure 2**). A dragline was acquired in 1996 to supplement the truck and shovel mining fleet.

Development Consent DA 41-03-99 was granted by the then Minister of Urban Affairs and Planning on 23 December 1999 and allowed open cut mining to continue until 2025. The consent consolidated previous open cut development consents and allowed for a maximum production rate from the BOC of 12.2 Mtpa ROM coal. The consent has been modified eight times since it was granted in 1999.

On 1 December 2014 Development Consent SSD-4960 was approved by the Planning Assessment Commission (under delegation from the Minister for Planning). The approval allowed for continued open cut mining operations at Bulga Coal at existing production rates until approximately 2035. SSD-4960 has subsequently been modified three times with SSD-4960 Modification 1 (Mod 1) being approved by the Department of Planning Industry and Environment (DPIE) on 17 January 2017. SSD-4960 Modification 2 (Mod 2) was approved by the DPIE on 30 August 2018. SSD-4960 Modification 3 (Mod 3) was approved by the DPIE on 16 July 2020, allowing an extension of the life of mine until 31 December 2039.

SSD-4960 superseded DA 41-03-99 at the granting of the Bulga Optimisation Project approval. DA 41-03-99 is in the process of being relinquished.

1.2 Scope

This MOP has been prepared in accordance with the Department of Planning, Industry and Environment (DPIE) – Resources Regulator (RR) (formerly the Department of Planning and Environment – Division of Resources and Geoscience (DRG)) guideline *ESG3: Mining Operations Plan (MOP) Guidelines* (DRG 2013) and relevant BOC regulatory framework.

This MOP relates to operations at the BOC for the MOP Term. It covers the proposed mining operations as approved by Development Consent SSD-4960 under the *NSW Environmental Planning and Assessment Act 1979* (EP&A Act) and Commonwealth approval (EPBC 2012/6637) under the *Environment Protections and Biodiversity Conservation Act 1999* (EPBC Act). A second Commonwealth approval (EPBC 2018/8300) is being assessed and will be in place prior to the commencement of relevant activities.

This MOP has also been prepared to satisfy the requirements of a Rehabilitation Management Plan as required by Schedule 3, Condition 55 of Development Consent SSD-4960.

A separate MOP prepared by BUO covers underground mining operations and rehabilitation. A new BUO MOP is being prepared to cover the proposed mining operations as approved by DA 376-8-2003 (Mod 7). BUO operations are not considered further in this MOP.

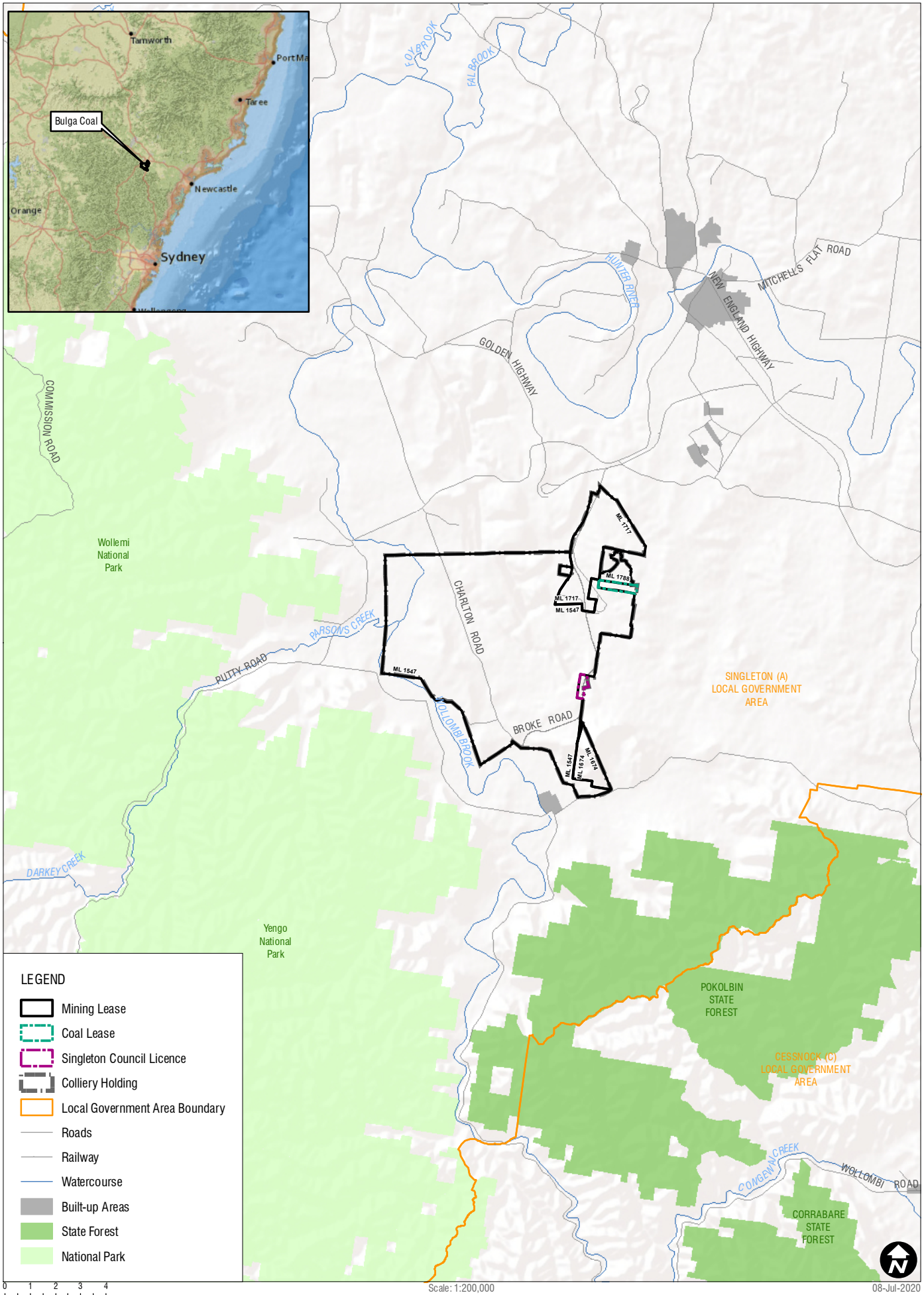
Operations at BOC have been undertaken in accordance with the MOPs outlined in **Table 1**. This document replaces the *Bulga Open Cut MOP – May 2018 to December 2023 (Amendment B)* (SLR 2019).

Table 1 – BOC MOP History

Document Title	Amendment	Status	Issue Date	Expiry Date
Bulga Coal Surface Operations Mining Operations Plan – January 2006 to December 2012	Original MOP	Superseded	December 2006	December 2012
	Vaux Pit	Superseded	30 January 2009	December 2012
	North and South Blakefield Dumps	Superseded	11 January 2010	December 2012
	Clay Stockpile Management	Superseded	15 April 2011	December 2012
	Continuation of Mining in Vaux Pit	Superseded	12 December 2011	December 2013*
	In-Pit Stockpiles and Common Boundary Rehabilitation Plan	Superseded	8 April 2013	December 2013
Bulga Open Cut MOP – November 2013 to December 2015	Original MOP	Superseded	20 December 2013	December 2015
	Amendment 1	Superseded	29 July 2014	December 2015
Bulga Open Cut MOP – December 2014 to December 2021#	Original MOP	Superseded	22 December 2014	December 2021
Bulga Open Cut MOP – May 2018 to December 2023	Amendment A	Superseded	4 July 2019	31 December 2023
	Amendment B	Superseded	13 December 2019	

*As part of the Continuation of Mining in Vaux Pit MOP Amendment (Bulga Coal Management 2011) the BOC sought approval from RR to extend the term of the MOP to December 2013. This extension was approved by RR on 6 June 2012.

#Bulga Open Cut MOP – December 2014 to December 2021 was submitted 22 December 2014 satisfying the requirements of Schedule 3, Condition 54 (b).



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Scale: 1:200,000
GDA 1994 MGA Zone 56

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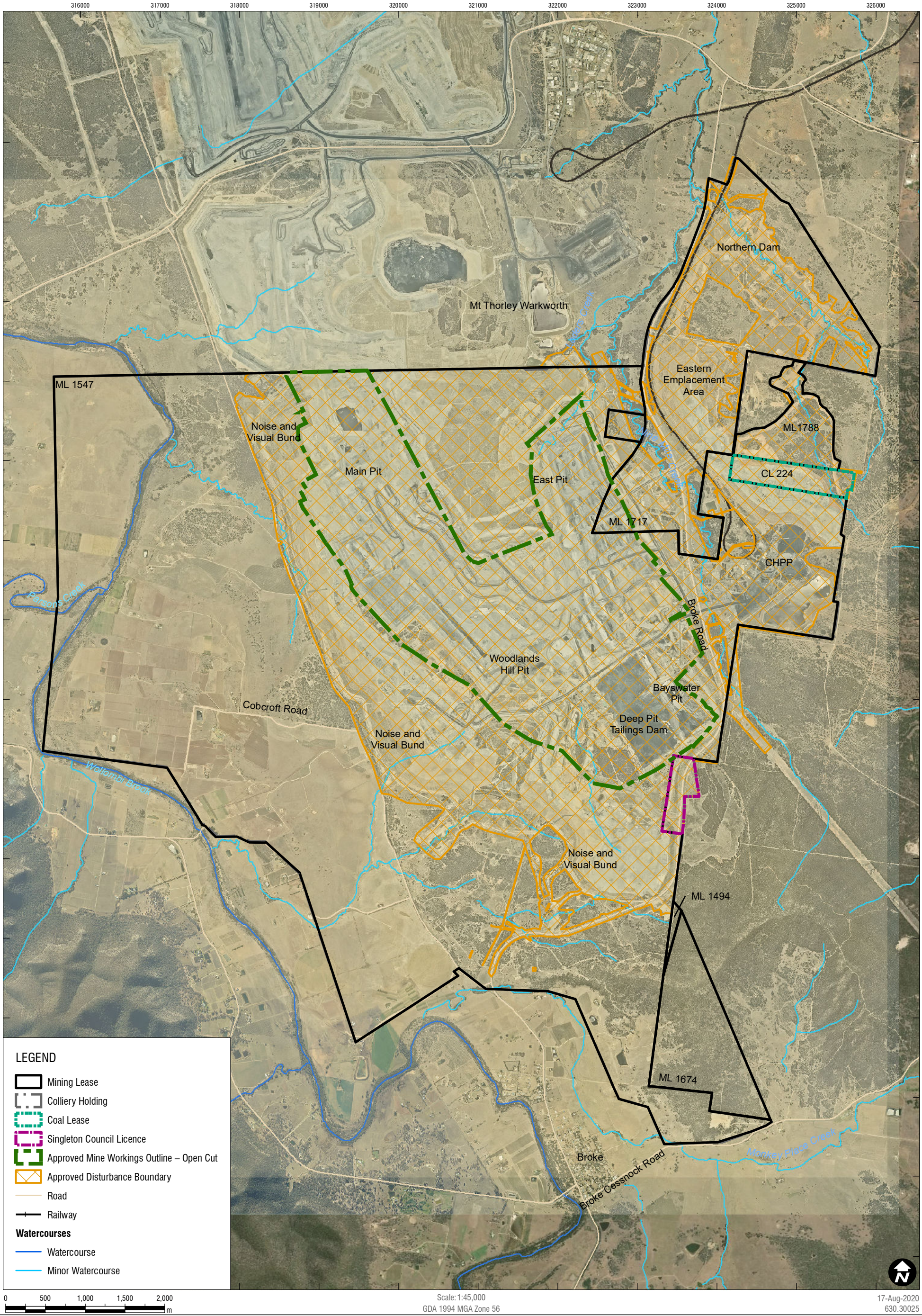
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Locality Plan

FIGURE 1



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Site Layout

FIGURE 2

1.3 Current Consents, Authorisations and Licences

1.3.1 Development Consents

In April 2013, Bulga Coal Management Pty Ltd submitted an Environmental Impact Statement (EIS) titled the *Environmental Impact Statement – Bulga Optimisation Project* (Umwelt 2013a) to the former Department of Planning and Infrastructure (now DPIE). The EIS was prepared to support an application seeking development consent under Part 4 of the EP&A Act to allow the continuation of open cut coal mining operations at Bulga Coal. The EIS was placed on Public Exhibition during May and June 2013. Following the receipt of submissions Bulga Coal Management Pty Ltd submitted a response to submissions titled *Response to Submissions and Revised and Amended Project Application Assessment Report* (RAPAR) (Umwelt, 2013b). The RAPAR responded to the issues raised during the exhibition and also included a number of amendments to the Project which resulted in a reduced footprint.

Development consent SSD-4960 was granted to Bulga Coal Management Pty Ltd on 1 December 2014 and replaced the former BOC development consent DA 41-03-99. DA 41-03-99 will be surrendered during the MOP term.

Development consent SSD-4960 has been modified on three occasions:

- Mod 1 on 17 January 2017. The modification included changes to the design of the approved Eastern Emplacement Area and in pit tailings emplacement.
- Mod 2 on 30 August 2018. This modification extended the completion date of the outer face of the Noise and Visual Bund from 1 December 2018 until 1 September 2019. This modification was requested by Bulga Coal Management Pty Ltd due to a period of extended Protected Industrial Action in 2017 and 2018 which delayed the construction of the Noise and Visual Bund.
- Mod 3 on 16 July 2020. This modification allows:
    - Access to an additional 63 million tonnes of coal and an extension of the mine life until 31 December 2039;
    - Removal and relocation of the tailings material currently stored in the Deep Pit and Bayswater Pit Tailings Storage Facility (TSF) to the Main Pit TSF to enable mining of the underlying coal; and
    - A number of changes to final landform including emplacement area gradients and heights.

A copy of SSD-4960 (Mod 3) is available on the Bulga Coal website: https://www.bulgacoal.com.au . This MOP is generally consistent with SSD-4960, as outlined in **Table 2**.

Table 2 – Cumulative Production, Rehabilitation and Disturbance Numbers

Attribute		Year 1 (2015)[1]	Year 4 (2018)[2]	Year 8 (2022)[3]
ROM Production (Mt)	EIS	9.181	43.937	83.384
	Actual / MOP	9.458	36.649	81.179
Overburden (Mbcm)	EIS	60.854	277.195	527.410
	Actual / MOP	54.067	215.621	460.934
Rehabilitation (Ha)	EIS	140	560	938
	Actual / MOP	93	437.7	1,120.5
Disturbance (Ha)	EIS	398	972	2,660
	Actual / MOP	433	1,108.1	2,367

[1] – Actual numbers provided for 2015.
[2] – Actual numbers provided for years 1 - 4, noting that disturbance is for Bulga Coal.
[3] – Actual numbers provided for years 1- 5, and MOP predictions for Years 6 - 8, noting that disturbance is for Bulga Coal as per the Mod 3 SEE. Noting that EIS disturbance excludes approved BUO gas drainage infrastructure

BOC also operates in accordance with Commonwealth approval EPBC 2012/6637, issued under the EPBC Act. EPBC 2012/6637 was issued by the Department of Industry, Science, Energy and Resources formerly the Department of the Environment and Energy on 9 May 2014. A second Commonwealth approval (EPBC 2018/8300) is being assessed and is required prior to the commencement of relevant activities.

Details relating to BOC approvals have been provided in **Table 3**.

Table 3 – Bulga Open Cut Consents

Consent	Details	Issue Date	Expiry Date
SSD-4960	Bulga Optimisation Project	1 December 2014	31 December 2035
	Mod 1 – Eastern Emplacement Area and Tailings Storage	17 January 2017	
	Mod 2 – Noise and Visual Bund completion date extension	30 August 2018	
	Mod 3 – Tailings relocation and South Pit Extension	16 July 2020	31 December 2039
EPBC 2012/6637	To extend existing open cut mining operations in the Bulga Coal Complex located 12 km southwest of Singleton, between Bulga and Broke in the Upper Hunter Valley, NSW (EPBC Act referral 2012/6637)	9 May 2014	31 December 2036

Development consent SSD-4960 conditions relevant to the preparation of this MOP/Rehabilitation Management Plan have been summarised in **Table 4** along with where each condition has been addressed within this document.

Table 4 - Consent Conditions Relevant to this Document

Condition	Condition Requirement	Section Addressed
Schedule 3, Condition 33 B	**Rehabilitation** Within 10 years of the cessation of mining operations, or other timeframe agreed by the Planning Secretary, the Applicant must make suitable arrangements for the long term protection of the 2,500 ha Rehabilitation Area identified in Table 9, to the satisfaction of the Biodiversity Conservation Trust. If the rehabilitation area does not meet the listing criteria of the targeted EEC or the completion criteria, then the Applicant must retire the relevant deficient biodiversity credits in accordance with the Biodiversity Offsets Scheme of the BC Act, to the satisfaction of the BCT. *Note: The rehabilitation offset performance and completion criteria form a component of the Rehabilitation Management Plan required under condition 55 of Schedule 3 of the consent.*	Section 4
Schedule 3, Condition 47	**Noise and Visual Bund** The Applicant shall design, construct and maintain the proposed noise and visual bund to the satisfaction of the Planning Secretary. This bund must: (a) be completed as soon as practicable after the commencement of development under this consent; (b) be constructed to ensure the western (outer) edge of the bund is at its full design height (up to 165 m AHD) with an initial vegetation cover, within 4 years and 9 months (i.e. 1 September 2019) of the date of this consent (unless otherwise agreed with the Secretary); and (c) be generally consistent with the concept plan in the EIS and the figure in Appendix 12.	Section7.2.2

<table>
<tr><th>Condition</th><th>Condition Requirement</th><th>Section Addressed</th></tr>
<tr><td>Schedule 3
Condition 53</td><td>
Rehabilitation Objectives
The Applicant must rehabilitate the site in accordance with the conditions imposed on the mining leases(s) associated with the development under the Mining Act 1992. This rehabilitation must be generally consistent with the proposed rehabilitation objectives described in the documents listed in condition 2 of schedule 2 (and depicted conceptually in the figures in Appendix 13), and comply with the objectives in Table 10.
Table 10: Rehabilitation Objectives
<table>
<tr><th>Feature</th><th>Objective</th><th></th></tr>
<tr><td>Mine site (as a whole)</td><td>• Safe, stable and non-polluting
• Final landforms to:
o Be designed to minimise the visual impacts of the development;
o Be in keeping with the natural terrain features of the area;
o Be integrated with the rehabilitated landforms of surrounding mines;
o Incorporate macro-relief and micro-relief and drainage features that mimic natural topography and mitigate erosion, to the greatest extent practicable;
o Avoid straight run drainage drop structures;
o Minimise long term groundwater seepage;
o Minimise exposure of tailings material and prevent the occurrence of spontaneous combustion; and
o Be sustainable and compatible with surrounding land uses.</td><td>Section 4</td></tr>
<tr><td>Final void</td><td>• Designed as long term groundwater sinks and to maximise groundwater flows across back-filled pits to the final void;
• Minimise:
o The size and depth of final voids;
o The drainage catchment of final voids;
o Any high wall instability risk;
o Risk of flood interaction for all flood events up to and including the Probable Maximum Flood.</td><td>Section 4.4</td></tr>
<tr><td>Revegetation</td><td>• Restore self-sustaining ecosystems that meet the requirements of the Rehabilitation Area in the Biodiversity Offset Strategy in condition 29 of Schedule 3, plus re-instate at least an additional 121 ha of Central Hunter Grey Box–Ironbark Woodland EEC;
• Establish native vegetation areas that complement and improve local and regional biodiversity.</td><td>Section 7.8</td></tr>
<tr><td>Agriculture</td><td>• Return at least 260 hectares of land within the project disturbance area to be suitable for agricultural use.</td><td>Section 4</td></tr>
<tr><td>Surface infrastructure</td><td>• To be decommissioned and removed, unless RR agrees otherwise.</td><td>Section 6</td></tr>
<tr><td>Community</td><td>• Ensure public safety;
• Minimise the adverse socio-economic effects associated with mine closure.</td><td>Section 6</td></tr>
</table>
Note: The Revegetation objective is satisfied through establishment of the Rehabilitation Area required under condition 29 of schedule 3.
</td><td></td></tr>
<tr><td>Schedule 3
Condition 54</td><td>
Progressive Rehabilitation
The Applicant must rehabilitate the site progressively, that is, as soon as reasonably practicable following disturbance. All reasonable and feasible measures must be taken to minimise the total area exposed for dust generation at any time. Interim rehabilitation strategies must be employed when areas prone to dust generation cannot yet be permanently rehabilitated.
Note: It is accepted that some parts of the site that are progressively rehabilitated may be subject to further disturbance at some later stage of the development.
</td><td>Sections 2.2.8</td></tr>
<tr><td>Schedule 3
Condition 55</td><td>
Rehabilitation Management Plan
The Applicant must prepare and implement a Rehabilitation Management Plan for the development in accordance with the conditions imposed on the mining lease(s) associated with the development under the Mining Act 1992. This plan must:
</td><td>This Document</td></tr>
</table>

Condition	Condition Requirement		Section Addressed
	(a)	be prepared in consultation with the Department, DPI Water, BCD, Council and the CCC.;	Section 1.5
	(b)	be prepared in accordance with any relevant RR guideline and be consistent with the rehabilitation objectives in Table 10;	Section 1.2
	(c)	describe how the rehabilitation of the site would be integrated with the implementation of the biodiversity offset strategy referred to in condition 29 of Schedule 3;	Section 4
	(d)	include detailed performance and completion criteria for evaluating the performance of the rehabilitation of the site, and triggering remedial action (if necessary);	Section 6
	(e)	describe the measures that would be implemented to ensure compliance with the relevant conditions of this consent, and address all aspects of rehabilitation including mine closure, final landform, and final land use;	Sections 4, 6 and 7
	(f)	provide for detailed mine closure planning, including measures to investigate and facilitate post-mining beneficial land uses for the site (including the final void), that: • align with regional and local strategic land use planning objectives and outcomes; • support a sustainable future for the local community; • utilise existing mining infrastructure, where practicable; • avoid disturbing self-sustaining native ecosystems, where practicable; and • includes a description of long-term land management objectives, including bushfire management, weed and feral animal control, water quality and public safety.	Section 4.5
	(g)	include interim rehabilitation where necessary to minimise the area exposed for dust generation;	Sections 2.2.7 and 2.2.8
	(h)	include a program to monitor and report on the effectiveness of the measures, and progress against the detailed performance and completion criteria; and	Section 8
	(i)	build to the maximum extent practicable on the other management plans required under this consent.	Section 3
Schedule 3 Condition 56	**Rehabilitation Strategy** The Applicant must prepare a Rehabilitation Strategy for the development to the satisfaction of the Planning Secretary. This strategy must:		Rehabilitation Strategy being prepared to address requirement
	(c)	be prepared by a suitably qualified and experienced person/s whose appointment has been endorsed by the Planning Secretary;	
	(d)	be prepared in consultation with the RR and Council;	
	(e)	build upon the Rehabilitation Objectives in Table 10 and the Rehabilitation Plan in Appendix 13;	
	(f)	include details of the canopy, sub-canopy, understorey and ground strata species to be established in the rehabilitation areas, with a particular focus on ensuring the achievement of an appropriate level of diversity and mix of functional groups within each target community;	

Condition	Condition Requirement	Section Addressed
	(g) include a program to periodically review the rehabilitation, final landform and land use outcomes to: • identify opportunities for the incorporation of preferred feed trees, foraging resources and habitat features for threatened fauna species; • increasing the areas of woodland and habitat connectivity within the rehabilitated landscape; • identify the location, land use classification and intended future use of the minimum 260 hectares of land within the project disturbance area to be returned to agricultural use, as required by the Rehabilitation Objectives in Table 10; and • identify post-closure land uses that minimise and/or mitigate negative social impacts from the development, both locally and regionally.	
	(h) include an indicative schedule for the staged rehabilitation of the development; and	
	(i) describe how rehabilitation will be integrated with the mine planning process, including a plan to address premature or temporary mine closure. The Applicant must implement the Rehabilitation Strategy as approved by the Planning Secretary.	

1.3.2 Mining and Exploration Authorisations

Mining operations at Bulga Coal are undertaken within Mining Lease (ML) ML 1494, ML 1547, ML1674 ML 1717, ML 1788 and Coal Lease (CL) 224. BOC and BUO are also able to undertake exploration activities in accordance with Exploration Licence (EL) 5277, EL 5461, EL 8315, Authorisations (AUTH) 447 and AUTH 450. Additional details regarding these mining tenements have been provided in **Table 5**.

Relevant conditions of these tenements specify the requirements for a lease holder to prepare and carry out mining operations in accordance with a MOP. This MOP has been prepared in accordance with *ESG3: Mining Operations Plan (MOP) Guidelines* (DRG 2013) to satisfy the requirements of Bulga Coal mining tenements and development consent SSD-4960. MOP Plans as required by *ESG3: Mining Operations Plan (MOP) Guidelines* (DRG 2013) are included in **Appendix 1**.

Table 5 - Bulga Coal Mining Tenements

Mining Title	Company	Issue Date	Expiry Date
ML 1494	Saxonvale Coal Pty Ltd and Nippon Steel and Sumitomo Metal Australia Pty Ltd	21 September 2001	20 September 2027
ML 1674	Bulga Coal Management Pty Ltd	22 March 2012	22 March 2033
ML 1547	Saxonvale Coal Pty Limited	5 April 2004	4 April 2025
ML 1717	Bulga Coal Management Pty Ltd	15 September 2015	15 September 2036
ML 1788	Bulga Coal Management Pty Ltd	19 June 2019	19 June 2040
CL 224	Saxonvale Coal Pty Limited	23 December 1981	23 December 2023
EL 5277	Saxonvale Coal Pty Limited	28 September 2005	7 April 2021
EL 5461	Saxonvale Coal Pty Limited, and Nippon Steel & Sumitomo Metal Australia Pty Ltd (renewal submitted to RR on 28 March 2018)	12 May 2014	2 April 2018
EL 8315	Saxonvale Coal Pty Ltd (renewal currently being sought)	13 October 2014	13 October 2019

Mining Title	Company	Issue Date	Expiry Date
AUTH 447	Saxonvale Coal Pty Limited	4 October 2007	1 September 2022
AUTH 450	Saxonvale Coal Pty Limited (renewal currently being sought)	10 November 2009	30 December 2018

1.3.3 Licences

Environment Protection Licence (EPL)

Bulga Coal currently operates under a single EPL 563, which is renewed annually on 29 July. The licence covers the scheduled activities of 'mining for coal' and 'coal works' and applies to both the BOC and BUO.

EPL 563 outlines air quality, blasting and surface water monitoring criteria. EPL 563 also enables discharges off-site in accordance with the Hunter River Salinity Trading Scheme (HRSTS). Monitoring is reported to the Environment Protection Authority (EPA) as part of the Bulga Coal EPL Annual Return.

Dangerous Good Licence

BOC possesses Dangerous Goods Notification NDG018992. This licence is renewed annually following notification to WorkCover NSW and details are provided in the Annual Review.

The Licence to Store Explosives (XSTR100095) covers the storage of these materials at BOC.

Water Licences

Bulga Coal currently holds the following groundwater licences as shown in **Table 6**.

Bulga Coal does not hold any surface water licences used for mining purposes. The only surface water drawn for the purposes of mining is supplied from the Mt Thorley Water Supply Joint Venture operated by the Singleton Council. All Water Access Licences (WALs) or ongoing and all of the monitoring water licences are for perpetuity.

Table 6 - Groundwater Licences

Water Licences - Groundwater	
Licence	**Details**
WAL41687	Mining: Volume licence limit 500ML. Sydney Basin-North Coast Groundwater Source
WAL41546	Mining: Volume licence limit 365ML. Sydney Basin-North Coast Groundwater Source
WAL41543	Mining: Beltana MG4. Volume licence limit 500ML. Sydney Basin-North Coast Groundwater Source
WAL41544	Mining: South Bulga MGE1. Volume licence limit 500ML. Sydney Basin-North Coast Groundwater Source
WAL41545	Mining: South Bulga MGE4. Volume licence limit 500ML. Sydney Basin-North Coast Groundwater Source
WAL36221	Mining: Wollombi Brook Aquifer leakage to Permian coal measures 300 ML
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.

Water Licences - Groundwater	
20BL169204	Monitoring: Bore – ACARP Project.
20BL169246	Monitoring: Bore – ACARP Project.
20BL167777	Monitoring: V1, V2, F1 and F2.
20BL172659	Monitoring: WBR180 and WBR181.
20BL172660	Monitoring: WBR182 and WBR183.
20BL173014	Monitoring: SBD194, SBD196.
20BL173617	Monitoring Bore - 61//755264
20BL173618	Monitoring Bore - 34//755264
20BL173619	Monitoring Bore - 33//755264
20BL173620	Monitoring Bore - 23//755264
20BL173621	Monitoring Bore - 24//755264
20BL173640	Monitoring Bore - 25//755264
20BL173657	Monitoring Bore - 22//755264
20BL173708	Monitoring Bore - 11//730762

Radiation Density Gauge Licence

Bulga Coal has a consolidated density gauge licence approved by the Department of Premier and Cabinet - Heritage (formerly the Office of Environment and Heritage (OEH)). Details of the density gauge licence and the included sealed source device are provided in **Table 7**.

Table 7 - Radiation Density Gauge Licence

Licence	Issue Date	Expiry Date	Details
RL5061333	1 July 2013	31 August 2020	Serial No: 6230GK – Fixed Radiation Gauge ID No 8929 Serial No: 4421GK – Fixed Radiation Gauge ID No 8934 Serial No: 4412GK – Fixed Radiation Gauge ID No 8935 Serial No: 4376GK – Fixed Radiation Gauge ID No 8938 Serial No: 6218GK – Fixed Radiation Gauge ID No 8939 Serial No: OC519 – Fixed Radiation Gauge ID No 9581 Serial No: 0532/06 – Fixed Radiation Gauge ID No 9582 Serial No: 0528/07 – Fixed Radiation Gauge ID No 9583 Serial No: 0538/07 – Fixed Radiation Gauge ID No 9584 Serial No: 0539/07 – Fixed Radiation Gauge ID No 9585

1.4 Land Ownership and Land Use

The majority of land within the colliery holding boundary is owned by the Bulga Joint Venture and related corporate entities. There are a number of privately owned land parcels within the west and south of the approved colliery holding boundary, a small area of Crown Land to the east of the Blakefield North Dump, and an area owned by the Commonwealth of Australia (the Singleton Military Training Area) in the south east of the holding boundary. Additionally Bulga Coal Management Pty Ltd holds a Commonwealth Access Agreement with the Commonwealth of Australia to undertake surface operations within ML1494 and ML1674 south east of the Deep Pit Tailings Dam.

Land ownership is shown on **Plan 1C** (refer to **Appendix 1**), with a Schedule of Lands located within the colliery holding presented in **Appendix 2**.

1.4.1 Historic Land Use

Historical research shows that large agricultural/pastoral runs were granted in the Broke-Fordwich area from the early 1820s and agricultural development began in earnest shortly afterwards. Pastoralism has been the dominant historical land use as evidenced by the history of clearance of native vegetation and construction of infrastructure such as dams, fences, homesteads and other rural structures associated with grazing enterprises. The colliery holding area was subject to broad scale clearing of native vegetation, primarily for intensive agricultural use prior to the commencement of mining at Bulga Coal in 1982.

Pre-mining land and soil capability within the colliery holding consisted predominantly of Class 4 – Class 5 (moderate-low/moderate capability land), which is consistent with pre-mining land uses (intensive agriculture, grazing and horticulture). Areas of Class 3 land (high capability land) associated with the Wollombi Brook alluvial floodplain, were located to the west of open cut mining activities (Umwelt 2013a).

1.4.2 Current Land Use

Since the commencement of mining at Bulga Coal, portions of land within the colliery holding continue to be utilised for grazing and horticulture (vineyards, olive groves and orchards). These activities are predominantly undertaken to the west of Charlton Road and are not directly affected by open cut mining activities.

Current land capability within areas undisturbed by open cut mining activities is Class 4 – Class 5, with areas of Class 3 land associated with the Wollombi Brook alluvial floodplain. Areas within the colliery holding which have been directly associated with open cut mining are mapped Class 7 and Class 8 (land generally incapable of agricultural land use) (Umwelt 2013a).

1.4.3 Future Land Use

The approval of the Bulga Optimisation Project (SSD-4960 Mod 3) allows for the continuation of open cut mining operations at Bulga Coal until 2039. Subject to recommencement of underground mining, open cut operations would be run in parallel with the approved activities at BUO. Underground mining activities are addressed separately within the BUO MOP; however land and soil capability has been addressed collectively for Bulga Coal.

It is anticipated that following the closure of Bulga Coal the areas disturbed by mining activities will be predominantly native vegetation (open woodlands on spoil dumps and riparian communities along established drainage lines) with a minimum 260 ha being returned to land suitable for agricultural uses. It is expected that the areas disturbed by mining will be predominantly returned to land and soil capability Class 6 and Class 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. Post-mining land and soil capability has been illustrated on **Plan 4** (refer to **Appendix 1**).

1.5 Consultation

1.5.1 MOP Preparation

During the preparation of this MOP, BOC consulted with the RR to confirm the scope and approach. Written correspondence from the RR was provided to BOC on 19 May 2020 and a meeting was held on 26 June 2020. RR confirmed that the BOC MOP should be prepared in accordance with *ESG3 Mining Operations Plan MOP Guidelines* (DRG 2013) and to cover a period of 3 years.

Additionally, BOC received a letter from RR dated 8 May 2020 and titled *Bulga Complex Tailings Assessment Program Assessment*. The letter was in response to an RR inspection of the Bulga Complex Tailings Storage Facilities on 5 February 2020. Following the inpection RR raised some queries regarding SSD-4960 (Mod 3) including potential knowledge gaps associated with the Main Pit TSF final landform design (including long-term settlement risks) and capping design for the TSF. RR also requested that a risk assessment was completed for the new MOP to address items raised.

A summary of items raised by RR has been provided in **Table 8**, along with details of where they have been addressed in this MOP. A copy of the MOP Risk Assessment has been provided as **Appendix 3**.

Table 8 Tailings Assessment Program Assessment Actions

Concern	Section Addressed
An amendment to the current Mining Operations Plan (MOP) will be required as part of the changed activities nominated in the Bulga Optimisation Project Modification 3 if approved.	This MOP
Information on specific risks identified and associated controls to mitigate risk to acceptable levels.	Appendix 3
The performance requirements of capping strategies to support the nominated rehabilitation outcomes.	Section 3.4.7, Appendix 3
Final landform and revegetation design to address issues including long term settlement, stability and surface water erosion, proposed surface water management requirements including spillways if required) in the final landform design. Note: ANCOLD Guidelines on Tailings Dams (July 2019) provides design criteria for closure.	Appendix 3
Maximising / optimising the progressive rehabilitation schedule.	Section 2.2.8, Appendix 3

As stated in **Section 1.2**, the MOP has also been prepared to satisfy the requirements of a Rehabilitation Management Plan as required by Development Consent SSD-4960, Schedule 3, Condition 55. Clause (a) of this condition requires the plan to be prepared in consultation with the DPIE, DPI Water, Biodiversity Conservation Division (BCD) (formerly OEH), Singleton Council and the CCC which occurred for the previous Bulga Open Cut MOPs as approved in December 2014 and July 2019.

1.5.2 Community Consultation

BOC has been operating within close proximity to the Broke and Bulga rural villages and a number of rural properties for more than 20 years. Bulga Coal Management Pty Ltd maintains a strong program of consultation with the community through the Community Consultative Committee (CCC). The CCC is operated jointly by BOC and BUO, and provides a forum for open discussion between Bulga Coal representatives, the community, Singleton Council and other stakeholders on issues directly relating to the mine's operations and environmental performance. In addition, Bulga Coal distributes newsletters/factsheets twice a year to letterboxes in Broke, Bulga, Milbrodale and Mount Thorley, holds community barbeques, and is a major sponsor of the local events.

The Bulga Coal website (www.bulgacoal.com.au) also enables stakeholders to download environmental management plans and the latest environmental monitoring reports from the publications page. The website also provides an overview of the sites operations, along with minutes from the CCC meetings.

Bulga Coal implemented a comprehensive stakeholder engagement program for the Bulga Optimisation Project with the aim to:

- Inform and involve stakeholders during the development of the Bulga Optimisation Project design;
- Identify key issues of interest or concern; and
- Work together with stakeholders to mitigate or address those issues.

Extensive engagement specific to the continuation of open cut mining at Bulga Coal has been undertaken with interested and potentially affected people and groups in the form of one-on-one meetings, open sessions in the local halls of Broke and Bulga, impact specific 'In Focus Workshops' and community barbeques/dinners.

Engagement with the local community was undertaken for SSD-4960 (Mod 3). Engagement consisted of newsletters, phone interviews with potentilly affected residents, CCC briefings, community barbeques, information sessions in the local hall of Broke and a meeting with the Hunter Valley Protection Alliance.

This document will be provided to the CCC for comment to satisfy the requirements of Schedule 3, Condition 52 of SSD-4960.

1.5.3 Statutory Authorities

Bulga Coal regularly engages with various government and other agencies to report on its environmental performance, including:

- Council representation on the CCC;
- Provision of Annual Review to DPIE and other relevant government agencies;
- Liaison and reporting to the EPA on any exceedance of EPL conditions;
- Provision of the EPL Annual Return to the EPA; and
- Provision of the National Pollution Inventory to the Department of Industry, Science, Energy and Resources Commonwealth.

Throughout the design refinement and environmental assessment process of the Bulga Optimisation Project and subsequent modifications there has been ongoing consultation with government authorities including:

- DPIE;
- BCD (formerly OEH);
- Heritage NSW (formerly OEH);
- EPA;
- RR;
- NSW Department of Primary Industries (DPI-Water, Forestry Corporation of NSW, Agriculture and Fisheries, and Catchments and Lands Division);
- Transport NSW;
- NSW Department of Health;
- Roads and Maritime Services (RMS);
- Subsidence Advisory NSW (formerly Mine Subsidence Board);

- Hunter-Central Rivers Catchment Management Authority;
- Dams Safety NSW (DS);
- Singleton Council;
- Department of Defense; and
- The Department of Industry, Science, Energy and Resources).

Consultation undertaken by Bulga Coal during the environmental assessment and refinement process included:

- Briefings on details and design, reducing impacts, and the proposed environmental assessment approach;
- Various meetings to discuss assessment outcomes, the approach to management, mitigation and offset measures, and specific issues relevant to the agency; and
- Regular meetings with Singleton Council through their Coal Advisory Committee to discuss the Bulga Optimisation Project and subsequent modifications in detail and receive feedback on potential impacts and proposed management and mitigation measures.

1.5.4 Other Stakeholders

Consultation has been undertaken between Bulga Coal Management Pty Ltd and a range of other stakeholder groups including:

- Registered Aboriginal Parties (RAPs). Consultation also included discussions with representatives from the Hunter Valley Aboriginal Corporation, Hunter New England Health, the NSW Indigenous Chamber of Commerce and other representitives from the public and private sectors;
- Relevant infrastructure owners/service providers (TransGrid, Ausgrid, ARTC, Broke-Fordwich Private Irrigation District (PID) and Telstra);
- Landowners within the project area (private landholders, Mount Thorley Warkworth Joint Venture, Mushroom Composters Pty Ltd, The Commonwealth of Australia (Singleton Military Training Area), State of New South Wales and Singleton Council); and
- Emergency services (NSW Police, Rural Fire Service (RFS), State Emergency Services (SES) and Ambulance).

1.5.5 Stakeholder Expectations Regarding Post-Mining Land Use and Rehabilitation

Mine closure planning has been a key consideration in the design of the Bulga Optimisation Project, with the objective of maximising opportunities to achieve a sustainable landform post closure. During the preparation of the EIS (Umwelt, 2013a), BOC implemented a comprehensive stakeholder engagement program including a large number of community and government stakeholders as part of the planning process for the Project. Specifically relating to rehabilitation and mine closure, the following issues were raised by stakeholders during the initial consultation phase:

- Risks to public safety associated with the final landform and post-mining land use;
- The visual amenity of the area and the need to minimise the engineered profiles so as to create landforms that are commensurate with the surrounding natural landform;
- The size of the final void;
- The types of land use that the site may be used for post-closure; and

- The revegetation strategy and what will the site look like post-closure.

These issues were considered in the development of a draft final landform design and rehabilitation strategy, which was subsequently presented to the government and community stakeholders for further feedback. This included holding an 'In Focus Workshop' with interested community members on the final landform. As a result of this process the following key issues regarding final landform and land use were identified by stakeholders as matters that should be considered as part of the detailed mine closure planning:

- Post-mining land uses that are consistent with relevant strategic plans and the values of the areas at the cessation of mining. Potential options that were tabled for future consideration included:
  - Alternative power generation activities including solar;
  - Opportunities for the creation of lifestyle blocks on native rehabilitation areas;
  - Opportunities for tourism related activities, including walking trails and picnic areas on native rehabilitation areas; and
  - Sustainable agriculture activities;
- Responsibility for ongoing management of rehabilitated land (i.e. management in perpetuity) following the relinquishment of mining leases;
- Public safety in relation to the final void and highwall; and
- Socio-economic impacts of mine closure and the implications on land value in the area (including sale of buffer land following mine closure).

BOC implemented a comprehensive stakeholder engagement program for SSD-4960 (Mod 3) as discussed in **Section 1.5.2**. The following were raised by stakeholders as issues that should be considered:

- Development of an End Land Use Strategic Management Plan, in consultation with key community stakeholders, including landholders, businesses, community groups and government agencies;
- Continued progressive development of the Noise and Visual Bund, and overburden emplacement areas and community engagement in this regard; and
- Monitoring of visual change over time.

Bulga Coal will continue to investigate options for post-mining land use that aligns with local and regional strategies, supports sustainable land use opportunities and utilises existing infrastructure, where practical.

2.0 PROPOSED MINING ACTIVITIES

2.1 Project Description

The approval of SSD-4960 (Mod 3) allows the BOC to continue open cut mining operations at rates of up to 12.2 Mtpa ROM coal until approximately 2039, with subsequent rehabilitation and closure works. Open cut mining will continue to be undertaken using a combination of overburden stripping by dragline, shovel and excavators and coal extraction by excavators and front end loaders. It is expected that the existing dragline utilisation will be decreased as the focus moves to a truck and shovel operation in the East Pit, Main Pit and Southern Extension Pit near completion.

In summary, BOC will undertake the following activities as approved by SSD-4960 (Mod 3) during the MOP term:

- Open cut mining in the Main Pit, Southern Extension and East Pit at a rate up to 12.2 Mtpa ROM coal. BOC will extend the mining areas to the south and west;
- Out of pit emplacement areas established along the western and southern limits of open cut operations and to the north east of the open cut operations (the Eastern Emplacement Area). Overburden will also be emplaced in-pit;
- Realignment of the western highwall;
- Tailings material currently stored in the existing Deep Pit and Bayswater Pit TSF will be pumped to the Main Pit TSF (which will be expanded) via the Tailings Relocation System. Coarse rejects and paste thickened tailings will be co disposed with overburden;
- On-going use of existing Bulga Coal infrastructure including some modifications associated with the change to tailings management and mining (refer to **Section 2.2.2**);
- Continued use of the Saxonvale Rail Spur; and
- Changes to water management structures including the expansion of Dam S6 and constructions of a supplementary Dam (Dam S53).

The locality of open cut mining and emplacement areas in relation to the approved BOC disturbance boundary have been shown on **Figure 2.**

The approval of SSD-4960 also enables the construction of new ventilation facilities, underground mining support infrastructure and coal transport; however these aspects have been addressed separately within the BUO MOP.

2.2 Activities over the MOP Term

2.2.1 Exploration

Bulga Coal Management Pty Ltd will continue to undertake exploration drilling within the mining lease area to obtain further information regarding resources to be mined as well as geological and geotechnical information relevant to the mining and construction activities that will be undertaken.

Drilling will also be undertaken into the former underground workings of Bulga Underground Operations to monitor conditions and potentially drain gas and emplace grout plugs in workings to enable the open cut to mine through these workings safely.

2.2.2 Construction

Construction activities during the MOP term include:

- Construction of new sheds at the main workshop to provide additional useable crane space;
- Resurfacing and widening of the CHPP access road;
- Construction of infrastructure associated with the relocation of tailings from the existing Deep Pit TSF and Bayswater Pit TSF and reprocessing infrastructure collectively reffered to as the Tailings Relocation System (refer to **Section 2.2.4)**. Infrastructure includes access tracks, pumps, pipelines, 11 kV power supply between pumps, dredges and a floculant plant. A rehabilitatted earth bund will be constructed to visually screen the pipelines (Line 1) where they are exposed on the top of the Noise and Visual Bund. The adjacent section of road will be treated with suitable products to prevent excessive generation of visible dust;
- Construction of new water management structures to manage changes to the site surface water catchments including the conversion of an existing borrow pit into a water dam (Dam S22A) to manage runoff from disturbed areas during the operations, relocation of Dam S7 and S53 and enlargement of Dam S6A;
- Installation of several vibrating wire piezometers (VWPs);
- Upgrade to S2A Intersection;
- Relocation of the 66kV and 11kV;
- Relocation of Mobile Substation TX045;
- Construction of temporary site facilities for the contractors close to the working areas for crib breaks and material stockpiles; and
- Construction of an Aboriginal cultural teaching place and artefact storage facility in 2020.

2.2.3 Mine Operations (Including Mining Purposes)

Mining at BOC involves the following general sequence:

- Pre-stripping the topsoil;
- Removing the overburden (by dragline, shovel and excavators);
- Coal mining (coal extraction by excavators and front end loaders); and
- Coal transport and processing.

Land preparation ahead of mining involves the construction of appropriate erosion and sediment control structures, clearing of vegetation, stripping and stockpiling of topsoil.

Thin horizons of overburden and interburden (less than 2 m thick) and coal are generally ripped by tracked dozers and pushed into heaps for removal. Thicker interburden is drilled and blasted prior to excavation by dragline, shovel and excavators. The existing dragline will be phased out during the MOP term. Although more expensive, the use of truck and shovel mining methods provides for greater flexibility for mining operations. This work method is also suited to the progressive backfilling and rehabilitation of pit areas behind the active working areas as mining advances improving dust and amenity outcomes.

Following the removal of coal from the seam, it is then hauled by rear dump trucks along in-pit and surface haul roads. Coal is dumped in the ROM coal receival bin near the CHPP, or onto temporary ROM ground stockpiles within the in-pit coal stockpile domain (refer to Plan 1C – **Appendix 1**).

During the MOP term the open cut resources will be mined in three main contiguous pit areas (refer to **Figure 2**):

- Main Pit area, which involves an extension of the existing Bulga Pit to the existing Whybrow highwall and down to the base of the Woodlands Hill Seam;

- East Pit area, an extension to the east of the previously mined open cut pit area predominately mining the outcropping steeply dipping seams in the Wittingham Measures; and
- Woodlands Hill Pit, which is the south-western area of the mining operations down to the Woodlands Hill Seam.
- Some mining around the Bayswater Pit will occur once the emplaced tailings has been relocated to maintain geotechnical stability.
- The progression of mining during the MOP term is shown in **Plans 3A – 3D** (refer to **Appendix 1**).

Overburden will be emplaced in either out-of-pit emplacement areas (Noise and Visual Bund, and Eastern Emplacement Areas) or in-pit, filling previously mined areas. The sequence of mining and development of emplacement areas has been designed to allow early and progressive final rehabilitation. Overburden emplacement during the MOP term has been shown in **Plans 3A – 3D** (refer to **Appendix 1**).

The out-of-pit overburden emplacement areas will be developed progressively over the life of the mine to a typical height of approximately RL 150 mAHD with selected areas emplaced to 165 m AHD. In-pit emplacements will be developed to approximately 160m AHD with selected areas emplaced to 175 m AHD. Outer slopes of in-pit emplacement areas will be battered to a (toe to crest) slope of up to 14°. BOC is progressing towards natural landform design for in-pit and out-of-pit overburden emplacement areas, emphasising macro/micro-relief where practical. The overburden emplacement areas will be progressively shaped and rehabilitated to minimise visual impacts, dust generation and prevent erosion.

2.2.4 Processing Residues and Tailings

Coarse and fine rejects are produced during the coal preparation process at the CHPP. Approximately two-thirds of the reject material produced from mining operations at Bulga Coal is coarse reject, with one third consisting of fine reject or tailings. Coarse rejects are placed in the active dumping areas. The coarse reject material will be placed at a minimum of 20 m depth within the final landform to minimise any potential interference to rehabilitation establishment as well as minimise the potential for spontaneous combustion or ignition of carbonaceous material in the event of a bushfire occurring within the revegetated landscape. Fine rejects are thickened in the CHPP and currently pumped to the Main Pit TSF.

Emplacement of tailings within the Main Pit TSF commenced in January 2019, and now has an approved capacity sufficient to recieve all of the CHPP produced tailings and the tailings that will be relocated from the Bayswater and Deep Pit TSFs. The tailings emplacement will ultimately be enveloped by spoil and encapsulated in the final landform. The design and management of the Main Pit TSF will be undertaken in accordance with the relevant provisions of the *Work Health and Safety (Mines and Petroleum Sites) Act 2013*.

Emplacement of tailings in the Deep Pit TSF and Bayswater Pit TSF ceased when the capacities were reached in November 2016 and in January 2019, respectively. Subsequant consolidation of the tailings has now enabled further emplacement of tailings in these TSFs.

The approved tailings emplacement strategy at Bulga Coal includes the disposal of tailings in underground workings. Mining will not be sufficiently advanced to implement the previously planned and approved underground placement of tailings in the quantities previously envisaged, although underground placement of tailings may still be used through the life of the mine.

During the MOP term tailings will be progressively rehabilitated (where practical).

Talings Relocation

During the MOP term, the existing Bayswater Pit and the Deep Pit TSF will be dredged to enable extraction of underlying coal resources. Tailings located in the Bayswater Pit and Deep Pit (approximately 29,032,848 Bank Cubic Metres) will be extracted utilising dredging (or similar) techniques to recover the tailings which will be pumped to the Main Pit TSF for disposal. Dredging will be started in the Bayswater Pit TSF, and will progress to Deep Pit North and then to Deep Pit South (refer to **Plan 3A – 3D**). Dredging is scheduled to begin in 2022 and be completed during 2027. Tailings is currently pumped into the Main Pit TSF Cell A and will soon be pumped into Cell B (shown in Plan 3A). It is expected that in 2022 the tailings will reach a height where the two cells will combine.

The Tailings Relocation System will consist of a series of pump stations from existing TSFs to the Main Pit TSF, and return water pumps from the Main Pit TSF to existing TSFs. The system will also include water supply pumps from the Surge Dam to existing TSFs, and process water supply pumps and pipes from the Surge Dam to the Line 1 pump stations and the Flocculant Plant. A 11 kV will supply power to each pump station and the flocculant plant. The Tailings Relocation System is shown in **Figure 3**.

During the MOP term a dredge trial will be undertaken to; confirm the dredge output slurry and pumping characteristics used for the design of the Tailings Relocation System; trial the proposed anchoring system on the dredge; verify the Deep Pit TSF south void depth and tailings insitu density; collect tailings samples for pumpbility and coal recovery testing; and review and update existing BOC Health Safety Environmrnt and Community (HSEC) management plans and procedures to include dredging activities.

The tailings will be pumped to the Main Pit TSF where further water extraction and thickening processes can be utilised if the tailings characteristics are suitable. Should sufficient fine coal be recoverable from the tailings being relocated, it may be redirected to the CHPP for processing. In accordance with SSD-4960 (Mod 3) paste thickened tailings can be co-disposed with coarse reject in the overburden emplacement areas.

Note that any reprocessed coal extracted from tailings would form part of the 20 Mt of product coal approved from Bulga Coal, and not included in the BOC annual limit of ROM coal mined.

316000 317000 318000 319000 320000 321000 322000 323000 324000 325000 326000

6389000 6388000 6387000 6386000 6385000 6384000 6383000 6382000 6381000 6380000 6379000 6378000 6377000 6376000 6375000 6374000

Mt Thorley Warkworth

Northern Dam

Eastern Emplacement Area

ML 1547

Noise and Visual Bund

Main Pit TSF

Dam S6a

ML1788

CL 224

East Pit

East Pit Muster Area

ML 1717

CHPP

Parsons Creek

Broke Road

Dam 53

Proposed BUO Equipment Surface Storage

Woodlands Hill Pit

Existing BUO Workshop

Existing BUO Substation

Cobcroft Road

Deep Pit Tailings Dam

Bayswater Pit

Noise and Visual Bund

9MW Gas Power Generator

Wollombi Brook

Existing BUO Bore Pumps

Proposed BUO Equipment Surface Storage

Gas Power Generator & BUO Substation

Noise and Visual Bund

ML 1494

Existing Bulga Powerline

ML 1674

Monkey Place Creek

Broke

Broke Gessnock Road

LEGEND

- Mining Lease
- Colliery Holding
- Coal Lease
- Singleton Council Licence
- Additional Disturbance Area
- Additional Dam Construction
- End of MOP Tailings Dams
- Existing Facility Proposed to be Upgraded
- Existing Facility to be Demolished
- New Facility
- Relocated Facility
- Road
- Railway

Watercourses

- Watercourse
- Minor Watercourse

0 500 1,000 1,500 2,000 m

Scale: 1:45,000
GDA 1994 MGA Zone 56

14-Aug-2020
630.30025

H:\Projects-SLR\630-Srv\NTL\630-NTL\630.30025.00000 Bulga Open Cut 2020 MOP\06 SLR Data\01 CAD\GIS\GIS\SLR630300025_Fg3_Activities_02.mxd

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Activites During the MOP Term

FIGURE 3

2.2.5 Waste Management

General Waste

Waste management at Bulga Coal is undertaken in accordance with the *Bulga Coal Waste Management Plan*. This Plan implements mechanisms to achieve the following:

- Maintain compliance with the conditions of Development Consent SSD-4960, EPL and relevant waste management legislation;
- Identify all types and quantities of waste generated;
- Minimise waste generation and encourage and facilitate reuse and recycling of waste streams where possible;
- Ensure appropriate segregation, storage, transportation and disposal of waste generated onsite;
- Ensure correct hydrocarbon management, treatment of wastewater and sewage; and
- Provision of education and training programs to site personnel and contractors regarding waste minimisation measures and correct handling and disposal of waste.

Waste is removed by a licensed contractor and where appropriate, the waste is recycled. Wastes removed from site include batteries, light vehicle tyres, scrap metal, domestic waste, fuel and oil filters, solvent, radiator coolant, wooden pallets, oily rags and hydrocarbon contaminated spoil.

Sewage

The treatment and disposal of sewage associated with the BOC is undertaken through one extended aeration sewage treatment plant. Effluent from this plant goes to two maturation ponds before it is returned to the CHPP circuit water.

Any deactivated sludge is transported to the Singleton Council Treatment Works Depot.

Hydrocarbon Waste Disposal

Hydrocarbons at BOC can include (but are not limited to) diesel, hydraulic fluid/oil, grease and lubricating oil. All waste oil and grease removed from equipment is stored in large bunded tanks. Waste oil and grease is collected by a licenced waste contractor and taken offsite for recycling. Wastewater generated from the workshop areas is treated through hydrocyclone oily water separators. Waste oil and oily water from oil water separators is removed by an authorised waste contractor for recycling.

Any hydrocarbon spills that occur at BOC are contained, and contaminated materials are transported and disposed off-site by licensed waste transporters to facilities licensed to receive such materials.

Management of hydrocarbons is undertaken in accordance with the following documents:

- *Bulga Coal Hydrocarbon Management Pla*n, incorporating spill response and bioremediation procedure;
- *Bulga Coal Pollution Incident Response Management Plan*; and
- *Bulga Surface Operations Remedial Action Plan*.

2.2.6 Decommissioning and Demolition Activities

During the MOP term Bulga Coal will continue to use existing infrastructure and new infrastructure detailed in **Section 2.2.2**.

Some minor open cut infrastructure may be demolished during the MOP term.

2.2.7 Temporary Stabilisation

Where rehabilitation is delayed due to changes or delays in the mining schedule, and/or poor conditions, overburden areas will be shaped to final landform as close as reasonably practicable behind the active mining operation and suitable cover crops applied on exposed areas to minimise dust and erosion.

Temporary rehabilitation by seeding with non-invasive cover crops and perennial grasses may be undertaken on disturbed areas during construction activities (such as road batters and temporary laydown areas).

Temporary revegetation may also be undertaken on unshaped overburden dumps and other disturbed areas that are planned to be inactive for over 2 years. Temporary revegetation of these areas will improve both visual amenity and the control of dust emissions.

2.2.8 Progressive Rehabilitation and Completion

Rehabilitation will be undertaken both progressively as areas become available, and at the end of the mine life to allow maximum opportunities for the development of vegetation prior to mine closure. Progressive rehabilitation of disturbed areas is an important aspect of the mining operations at BOC. The objective of this rehabilitation is to rehabilitate the land to meet the closure criteria provided in **Section 6**. Disturbed areas will be progressively rehabilitated over the life of the mine. The indicative sequence for progressive rehabilitation is shown on **Plans 3A – 3D** (refer to **Appendix 1**).

BOC is progressing away from traditional rehabilitation methods, such as contour banks and drop structures, and developing natural landform designs for overburden emplacement areas. However, contour banks and non-linear rock structures will be constructed in 2020.Rehabilitation at Bulga Coal generally consists of the following:

- Develop overburden emplacement area natural landform design, integrated into the mine dump plan.
- Overburden dump slopes are battered down to the design limits, including non-linear drainage lines. Continuous review of dump slopes and drainage lines occurs during construction, including fly-over volumes comparing to original design. If volume variations differ such that bulk push is significantly increased then a redesign of the landform will occur to ensure appropriate stability and drainage.
- Non-linear drainage lines are lined with rocks between 200 mm and 400 mm. The size of rock is determined from catchment size and slope length calculations;
- Where possible salvaged features such as logs, hollows and larger rock piles are placed within the rehabilitation area to aid with habitat creation;
- Deep ripping occurs along the contours over the entire area. Any large rocks brought to the surface are raked aside and then removed or used to create habitat;
- Topsoil is spread at an average thickness of 100 mm over shaped overburden areas;
- Where required, the ground is selectively treated with gypsum to combat the high clay content and to prevent surface sealing, thus enabling water penetration into the overburden;
- After ameliorant application, the area is then deep ripped on the contour; and
- The area is then seeded with a mix of local native species from a targeted vegetation community and non-invasive cover crop.

Details of the rehabilitation activities expected during the MOP term are provided further in **Section 7.2**. In summary, BOC will undertake rehabilitation activities in the following areas during the MOP term, as shown on **Maps 3A** to **3D**:

- Noise and Visual Bund;
- Main Pit Dumps; and
- Eastern Emplacement Area.

2.2.9 Material Production Schedule during the MOP Term

The material production schedule during the MOP term is provided in **Table 9**. Any proposed changes to this schedule will be outlined in the Annual Review.

Table 9 - Material Production Schedule during the MOP Term[1]

Material	Unit	2020	2021	2022	2023
Stripped topsoil	m^3	59,500	71,300	10,402	41,500
Rock/overburden	Mbcm	59.295	63.497	58.164	63.777
ROM coal	Mt	10.593	11.388	10.349	10.404
Reject material[#]	Mt	3.350	4.465	3.464	3.665
Product	Mt	6.778	7.241	7.115	7.063

[1] All years in the table align with calender years ie January to December. Noting MOP term 1 July 2020 – 30 June 2023.

[#]Includes coarse reject, tailings and co-disposed paste thickened tailings.

2.3 Primary Domains

For the purpose of this MOP, operational (primary) domains have been defined as the set of discrete areas that have a particular operational or functional purpose. All areas previously disturbed by mining, or proposed to be subject to the activities described in **Sections 2.1** and **2.2**, have been assigned to an appropriate primary domain. Primary domains at Bulga Coal are defined in **Table 10**. The footprint of each primary domain at the commencement of the MOP term is depicted on **Plan 2**.

Table 10 - Primary Domains

Code	Domain	Description
1	Infrastructure	Existing infrastructure and facilities including the tailings relocation infrastructure, pit top, workshops, administration buildings, access roads, haul roads, hardstand/laydown areas, topsoil stockpiles, and underground infrastructure (ventilation shafts and boreholes). Note: This domain excludes public infrastructure including the Broke Road realignment, water pipelines, transmission lines and associated easements as they will remain the property of the infrastructure owner/provider following the cessation of mining operations and will remain in the final landform.
2	Emplacement Area	The footprint for the BOC out of pit and in-pit emplacement areas.
3	Active Mining	The footprint of the BOC active mining areas.
4	Tailings Emplacement	Includes all current tailings emplacement areas.
5	Rehabilitation Woodland	Includes all lands that have undergone rehabilitation using woodland vegetation species.

Code	Domain	Description
6	Rehabilitation Pasture	Includes all lands that have undergone rehabilitation using selected grass and pasture species.
7	Surface Water / Dams	Network of dams and associated water management infrastructure.
8	Conservation Area	Includes the Warkworth Sands Woodland conservation area, Weeping Myall Management Area, offsite offsets (the Condran Property Biodiversity Offset Area, Vere Offset Site and the Reedy Valley Offset Areas) and the River Red Gum Woodland Offset Area.
9	Vegetation Re-establishment Area	Includes the River Red Gum restoration area.
10	Subsidence Management Area	Areas to be actively managed for potential subsidence related impacts during the MOP term. The domain area is defined by the combination of the subsidence areas (defined by subsidence predictions and/or the 26.5˚ angle of draw).

2.4 Asset Register

The asset register included as **Table 11** provides a summary of the key features of each primary domain (refer to **Section 2.3**), and principal activities required for rehabilitation. This asset register is intended to provide a suitable level of context for the Bulga Coal Rehabilitation Cost Estimate (RCE) (refer **Section 2.5**).

The BOC share a RCE with the BUO because facilities, such as the CHPP and rail loop, are shared and the activities predominantly take place on the same mining lease (ML 1547). Accordingly the asset register includes a summary of key Bulga Coal facilities.

The areas for each primary domain outlined in **Table 11** represent the total disturbance footprint for each Bulga Coal domain at the commencement of the MOP term, as depicted on **Plan 2** (refer to **Appendix 1**).

Table 11 - Asset Register

Major Assets	Use	Demolition / Rehabilitation Activities	Approvals Required	Quantity	Unit
Domain 1 – Infrastructure: 488.8 ha					
BOC Administration Office, workshops and buildings	Administration and staff facilities/workshops – currently utilised	Disconnect services; demolish and remove infrastructure; remove concrete pads; and remove potentially contaminated material.	None	5,734.8	m^2
BUO Pit Top Building	Not currently utilised	Disconnect services; demolish and remove infrastructure; remove concrete pads; and remove potentially contaminated material.	None	3,900.0	m^2
Hardstand/Laydown Areas	Storage of equipment – currently used.	Remove plant and material; and remove concrete pads.	None	1	item
Access roads	Access tracks across site – currently utilised	Remove roadside tyres/markers/signs; remove carbonaceous material; and remove bitumen.	None	*	item
Haul roads	Internal haul routes – currently utilised	Remove roadside tyres/markers/signs; and remove carbonaceous material.	None	*	item
Substation transformers	Power supply – currently utilised	Remove substation transformers for BOC.	None	1	item
9 MW power station, pre-drainage flares and associated infrastructure	Methane gas management and power generation – currently utilised	Demolish and remove 9 MW power station and pre-drainage flare and associated infrastructure.	None	1	Item
Goaf suction plant and goaf flares	Methane gas management – currently utilised	Demolish goaf suction plant and goaf flares.	None	1	Item
Workshop and stores	Workspace and storage facilities – currently utilised	Demolish and remove industrial buildings.	None	5,940.8	m^2

Major Assets	Use	Demolition / Rehabilitation Activities	Approvals Required	Quantity	Unit
Water treatment plant	Treatment of waste water/sewage from amenities onsite – currently utilised.	Remove water treatment plant including and concrete footings and pads.	None	193.8	m^2
CHPP	Coal crushing, sizing and washing – currently utilised	Disconnect and terminate all services; demolish and remove CHPP buildings; demolish and remove CHPP; remove carbonaceous material.	None	18,376.2	m^2
Bitumen car parks and roads	Entry to site and office car park – currently utilised	Remove Bitumen car parks and roads.	None	61,057	m^2
Conveyors, gantries and concrete reclaim tunnel	Transporting coal to the CHPP and product stockpile – currently utilised	Demolish and remove conveyors and gantries demolish and remove coal clearance conveyor and concrete reclaim tunnel.	None	3,555	m
ROM dump hoppers	Operational and decommissioned ROM dump hoppers	Demolish and remove ROM dump hopper including concrete aprons.	None	260.4	m^2
Rejects bins	Reject bins #1 and #2 – currently utilised	Remove reject bins #1 and #2.	None	2	item
Rail loop and spur	Coal train loading and coal transport – currently utilised	Remove Rail Loop and spur.	None	6,696.85	m
Train loading facility	Coal train loading – currently utilised	Remove train loading facility.	None	80	m^2
Rail refuelling facility	Train refuelling – currently utilised	Remove rail refuelling facility.	None	1,150	m^2
Heavy vehicle washdown pad (at BOC Area Station)	Wash down for heavy vehicles – currently utilised	Demolish & remove heavy vehicle wash down pad.	None	520.9	m^2

Major Assets	Use	Demolition / Rehabilitation Activities	Approvals Required	Quantity	Unit
Workshop (at BOC Area Station)	Workshop for staff – currently utilised	Demolish and remove.	None	464	m^2
Open Cut Area Station	Currently utilised	Disconnect and terminate services; remove lube, waste oil storage area at Area Station; remove concrete pads and footings; remove separator and infrastructure; excavate potential contaminated soil; classify and treat contaminated material as required; disposal of remediated material to deep pit; remove and remediate hydrocarbon contamination (on-site).	None	1,497.9	m^2
Light vehicle wash-down bay	Wash down for light vehicles – currently utilised	Remove light vehicle wash-down bay; and remove and remediate hydrocarbon contamination.	None	217	m^2
Oil-water separator	Oil-water separator – currently utilised	Demolish and remove oil water separator (including concrete apron); and remove and remediate hydrocarbon contamination.	None	2	item
Tanks, pipes, pump station and bunds	Storage area (including sewage storage) – currently utilised	Remove sewage storage tanks, pipes and pump station; remove fuel, lube, waste oil storage area.	None	644.5	m^2
Vehicle wash down and associated oil water separator	For wash down of vehicles – currently utilised	Demolish and remove vehicle wash down and associated oil water separator; and remove and remediate hydrocarbon contamination (on-site).	None	301.5	m^2

Major Assets	Use	Demolition / Rehabilitation Activities	Approvals Required	Quantity	Unit
Open cut fuel farm	8 tanks, underground pipes and bunds – currently utilised	Disconnect and terminate services; remove fuel farm including tanks, underground pipes and bunds; remove refuelling station/fill point outside bund; remove separator and infrastructure; excavate potential contaminated soil; classify and treat contaminated material as required; disposal of remediated material to deep pit; remove and remediate hydrocarbon contamination (on-site).	None	1,261.8	m^2
Product coal and ROM coal stockpiles	Storage of ROM coal, and product coal awaiting transport offsite – currently utilised	Remove carbonaceous material and dispose of onsite within tailings dam or in the disused underground workings.	None	323,341	m^2
Reclaim tunnels under stockpiles	Currently utilised	Excavate and expose the ROM and product stockpile reclaim tunnels; demolish reclaim tunnels under ROM and product stockpiles.	None	480	m^2
SIS gas wells, pre-drainage wells and goaf wells	Methane gas management – currently utilised	Decomission SIS gas wells, pre-drainage wells and goaf wells in accordance with relevant guidelines	None	36	item
De-watering bores and compounds	Water management – currently utilised	Remove dewatering bore and compounds and grout with concrete, cap and seal.	RR approval for sealing	3	item
Service bores/goaf wells and compounds	Transfer of mine service to underground workings – currently utilised	Remove service bpre and compounds and grout with concrete, cap and seal	RR approval for sealing	11	item
Water truck fill points	Water supply – currently utilised	Dismantle and remove water truck fill points	None	2	m^2
Overpasses	Mine vehicle transport – currently utilised	Demolish and remove Broke Road and Haul Road overpasses.	None	2	item

Major Assets	Use	Demolition / Rehabilitation Activities	Approvals Required	Quantity	Unit
Flood levee	Water management – currently utilised	Demolish flood levee and rehabilitate site.	As a State Significant Development the operations are exempt from requiring a Controlled Activity Approval from DPIE Water, however consultation is recommended.	1	item
Pipework	Transport of tailings, water, gas etc. – currently utilised	Remove surface pipelines; removal of pipework associated with tailings; remove buried water and gas pipelines. If pipelines are to remain buried in-situ, make safe.	None	75,500	m
Thickener tanks	Tailings management – currently utilised	Deconstruct thickener tanks #1 (North) and #2 (East)	None	2	item
Domain 2 – Emplacement Area: 664.0 ha					
No building or plant located within this domain	N/A	N/A	Nil	N/A	N/A
Domain 3 – Active Mining: 693.9 ha					
No building or plant located within this domain	N/A	N/A	Nil	N/A	N/A

Major Assets	Use	Demolition / Rehabilitation Activities	Approvals Required	Quantity	Unit
Domain 4 – Tailings Emplacement: 113.9 ha					
Deep Pit Tailings Dam	Receive tailings – currently utilised	Dewater Deep Pit Tailings Dam; blast and doze highwall of Deep Pit void (<18°); dozer to reshape all other batters to <18° eastern side; blast and doze Highwall of Extended Vaux Pit void (<18°); cap tailings dam to enable free draining surface.	Section 101 Approval under the *Coal Mine Health and Safety Act 2002*	711,900	m^2
Domain 5 – Rehabilitation Woodland: 895.4 ha					
No building or plant located within this domain	N/A	N/A	N/A	N/A	N/A
Domain 6 – Rehabilitation Pasture: 169.1 ha					
No building or plant located within this domain	N/A	N/A	N/A	N/A	N/A
Domain 7 – Surface Water / Dams: 183.9 ha					
CHPP Surge Dam	Water storage – currently utilised	Drain and remove contaminated sediments from the floor of the dam to enable it to be converted into a clean water structure.	Dam Safety Committee sign off for rehabilitation design, de-prescription	196,023	m^3

Major Assets	Use	Demolition / Rehabilitation Activities	Approvals Required	Quantity	Unit
Industrial Dam C2	Water storage – currently utilised	Disconnect and terminate services; remove separator and infrastructure; desilt dam; treat highly impacted soil via land farming; temporary erosion controls/nutrients; classify waste and treat as needed; dispose of silt material to Deep Pit; validation sampling under former Biopad; and dewater and fill/cap Industrial Dam.	None	*	m^2
Northern Dam	Water storage – being constructed	Drain and remove sediments from the floor of the dam to enable it to be converted into a clean water structure.	None	717,000	m^3
All other onsite dams	Water storage – currently utilised	Remove contaminated sediments from the floor of the dams to be decommissioned and bury material in spoil; fill dam voids.	None	443,588.5	m^3
Domain 8 – Conservation Area: 2,058.1 ha					
No building or plant located within this domain	N/A	N/A	Nil	N/A	N/A
Domain 9 – Vegetation Re-establishment Area: 24.1 ha					
No building or plant located within this domain	N/A	N/A	Nil	N/A	N/A

*These items have been allocated a site specific provision sum for closure and subsequently a measurement is not available.

2.5 Rehabilitation Cost Estimate

The RCE prepared for this MOP submission has been calculated to undertake the necessary works to achieve the desired final land use (refer to **Section 4** and **Plan 4**). In accordance with the *ESG1: Rehabilitation Cost Estimate Guidelines* (Resourses Regulator 2017), the RCE has been prepared based upon a "snapshot" of disturbance at the end of December 2020.

The RCE provides for the following across BOC and BUO:

- Decommissioning and demolition of all surface infrastructure;
- Rehabilitation of all areas disturbed by mining as depicted in **Plan 2**, with the exception of dams to be retained for post-mining use; and
- Mobilisation costs, project management and contingencies.

Elements subject to further detailed design (such as the final void design) have uncertain costs and have therefore been costed based on industry and RR accepted practices and the current approved final landform.

3.0 ENVIRONMENTAL ISSUES MANAGEMENT

3.1 Environmental Risk Assessment

In 2020, a new MOP risk assessment for Bulga Coal was undertaken to identify the risks associated with rehabilitation and closure. The risk assessment was undertaken in accordance with the Glencore Coal Assets Australia (GCAA) - *Risk Management Standard (CAA FIN STD 0001)*, which establishes a qualitative risk assessment methodology in accordance with the requirements of the Joint Australian & New Zealand Standard *AS/NZS 31000:2018 Risk Management- Principles and Guidelines.*

The workshop assessed 62 key environment and community risks which are summerised as:

- 32 risk were ranked as low.
- 30 risks were ranked as medium.
- No risks were ranked as high.

A copy of the Risk Register developed in this workshop is attached as **Appendix 3**. It should be noted that this Risk Register contains risks associated with the operation of Bulga Coal, not only BOC.

Further details of the existing and proposed environmental management controls are provided in **Section 3.2**.

3.2 Environmental Risk Management

The environmental management of the BOC is undertaken in the context of Bulga Coal, which includes BUO. Bulga Coal has developed and implemented a comprehensive Environmental Management Strategy (EMS), which provides a framework for managing all environmental and community aspects, impacts and performance of the mining operations.

As a part of the EMS, management plans, procedures and standards have been developed to manage activities onsite to minimise the risks of impact to the environment and to continually improve the performance of operations. The following management plans have been developed and approved to satisfy the requirements of SSD-4960:

- *Bulga Coal Aboriginal Cultural Heritage Management Plan*;
- *Bulga Coal Historic Heritage Management Plan*;
- *Bulga Coal Air Quality Management Plan;*
- *Eastern Emplacement Area Management Framework;*
- *Bulga Coal Biodiversity Management Plan*;
- *Bulga Coal Erosion and Sediment Control Plan*;
- *Bulga Coal Water Management Plan*;
- *Bulga Coal Blast Management Plan*;
- *Bulga Coal Visual Impact Management Plan*;
- *Bulga Coal Blast Fume Management Plan*; and
- *Bulga Coal Noise Management Plan*.

Copies of the most current versions of these management plans are available on the Bulga Coal website, www.bulgacoal.com.au. All of these management plans will be revised and submitted to the Planning Secretary for approval. Bulga Coal will manage all aspects of the operation in accordance with the revised conditons included in Mod 3 even before the revised management plans are approved.

3.3 Environmental Issues Management

3.3.1 Air Quality

Dust/air quality was deemed to be a medium risk element at the MOP risk assessment for Bulga Coal in 2020 (refer to **Appendix 3**).

Air quality at BOC is managed in accordance with the *Air Quality Management Plan* (Bulga Coal 2020 submitted for approval in February 2020) and measured against the Mod 3 air quality criteria.

As required by SSD-4960 Bulga Coal was also required to develop the *Eastern Emplacement Area Management Framework* (EEAMF) for inclusion within the Air Quality Management Plan. The EEAMF describes specific air quality monitoring and management measures implemented to minimise air quality impacts on the Mushroom Composting Facility during the operation and rehabilitation of the Eastern Emplacement Area.

Air quality at BUO is managed together with BOC in accordance with the *Bulga Coal Air Quality Management* Plan (Bulga Coal 2020). The air quality monitoring system consists of:

- Ten Dust Deposition Gauges (DDGs) (three 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;
- Two HVAS's that monitor particulate matter less than 10µm in diameter (PM_{10}) over a 24-hour period every sixth day, known as D10 and Dawtrey;
- 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);
- 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 ($PM_{2.5}$); and
- Two E-BAM monitors (which replaced the former E-SAMPLER in July 2019) continuously measuring PM_{10}, at EPA Point 9 and EPA Point 10 at the north and south-east of the EPL premises, respectively.

Air quality monitoring is undertaken in accordance with DA 376-8-2003, SSD-4960 and EPL 563. Air quality monitoring results are documented in the Annual Review, EPL Annual Return and Quarterly Environmental Monitoring Reports.

3.3.2 Erosion and Sedimentation

Water/erosion and sediment control was also deemed to be a medium risk element at the MOP risk assessment for Bulga Coal in 2020 (refer to **Appendix 3**).

Erosion and sedimentation controls for Bulga Coal are undertaken in accordance with the *Bulga Coal Complex Erosion and Sediment Control Plan* (Bulga Coal 2019), which includes the following key principles:

- Conducting best practice land clearing procedures for all proposed disturbance areas including:
  - Coordinating mining sequences to minimise exposure of disturbed soils to the elements; and
  - Topsoil stripping procedures to reduce deterioration in topsoil quality and dust generation.
- Appropriate storage of topsoil stockpiles in areas away from roadways and other drainage lines;
- Appropriate design of any new fire trails, access tracks and haul roads;
- Ensuring exposed dispersive soils that are very susceptible to erosion are covered (vegetation establishment, topsoil, etc.) or runoff from these areas is directed to water containment structures that prevent them from flowing offsite;
- Use of diversion structures to separate 'clean' water runoff from disturbed areas runoff, to minimise volumes of sediment-laden and mine water for management;
- Ensuring sediment-laden runoff is treated via designated sediment control devices;
- Revegetation of disturbed areas as soon as possible following the completion of construction activities;
- Temporary erosion and sediment controls to be in place prior to any construction activity outside of an existing dirty water management system;
- Subsidence impacts to be remediated to address erosion issues as a result of subsidence; and
- Implementing an effective maintenance program for the site. This includes the regular draw down of sediment dams following rainfall and potentially the need for flocculation to achieve acceptable water quality if the water is to be released from site.

Monitoring and inspections associated with erosion and sediment control include:

- Regular surface water monitoring in accordance with the approved Bulga Coal *Water Management Plan* (Bulga Coal 2020);
- Monthly inspections for temporary erosion and sediment control structures, fire trails and access tracks;
- Weekly inspections for works in progress; and
- Event based inspections of all erosion and sediment control structures, rehabilitated areas and road drainage works based on rainfall intensities (i.e. > 20 mm in 24 hour period).

For additional details regarding the management of erosion and sedimentation at Bulga Coal, please refer to the *Erosion and Sediment Control Plan.*

3.3.3 Surface Water

The 2020 MOP risk assessment for Bulga Coal identified surface water as a medium risk element (refer to **Appendix 3**).

Bulga Coal has a comprehensive *Water Management Plan* (Bulga Coal 2017) which deals with managing water supply, consumption, storage, disposal, monitoring and hydrological interception. BUO water management is fully integrated with the Bulga Coal water management system. The *Water Management Plan* objectives are to:

- Minimise the contamination of clean water runoff from catchment areas upstream of the operations by directing clean water around the disturbance footprint, where possible;
- Minimise the potential effects of erosion and its associated impacts, resulting from mining operations changing flows or conditions downstream;

- Prevent the discharge of pollutants from the disturbed area, except where discharges are licenced, or where the discharge will not cause environmental harm (i.e. water suitable for release from rehabilitated areas);
- Maximise the reuse of mine water to meet onsite water consumption requirements to reduce the need for water from the Hunter River;
- Secure access to water for the operations during periods when there is insufficient water from the Integrated Water Management System (IWMS); and
- Manage the disposal of excess water in line with relevant licence and Hunter River Salinity Trading Scheme (HRSTS) conditions when excess water volumes are stored onsite, beyond projected future requirements.

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

Monitoring of surface water quality is undertaken at locations around the Bulga Coal mining operations and the surrounding catchment areas. Surface water monitoring sites are sampled monthly and include streams, creeks and dams. Water quality parameters including temperature and depth are tested onsite, whilst others including pH, EC, and total suspended solids (TSS) are undertaken by a NATA accredited laboratory.

Results of surface water monitoring undertaken are reported in the Quarterly Environmental Reports, Annual Review and in the EPL Annual Return (in the event of discharge).

During the MOP term changes to mining operations in accordance with SSD-4690 (Mod 3) will result in changes to the site surface water catchments. This will require the modification of fresh water diversion structures and sediment control structures to manage runoff and to minimise the impacts of erosion from disturbed areas. The eastern dams will continue to manage dirty water from the north of Main and East Pits.

Additional details regarding the existing management of surface water at Bulga Coal are available in the *Water Management Plan*.

3.3.4 Groundwater

Groundwater was deemed to be a medium risk element at the MOP risk assessment for Bulga Coal in 2020.

Groundwater is managed in accordance with the approved *Water Management Plan* (Bulga 2017). Mapping of the deep and shallow depressurisation of the hard rock (coal measures) strata is undertaken to identify 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 groundwater monitoring program is designed to provide early warning of the potential changes in groundwater levels and quality which exceed trigger levels determined for the site and are outside of the predicted (modelled) values. Activities can be modified if monitoring shows that the mining operation is likely to cause, or is causing, adverse impacts.

The Bulga Coal groundwater monitoring network consists of a total of 54 groundwater monitoring points. The monitoring network comprises both standpipe piezometers (47) and multilevel vibrating wire piezometers (7).

The groundwater monitoring program currently comprises:

- Bi-monthly water level monitoring in all standpipe piezometers including the measurement of EC and pH;
- Continuous monitoring of pressure heads in 7 multi-level vibrating wire piezometers;
- Continuous monitoring of water levels in 22 standpipe piezometers which are equipped with dataloggers; and
- Comprehensive geochemical sampling and analysis undertaken on a half yearly basis in all 47 standpipe piezometers (including major ions and metals).

The groundwater monitoring system is designed to effectively monitor the two general types of groundwater located within the vicinity of Bulga Coal. These groundwater resources are the alluvial aquifers of Wollombi Brook and Monkey Creek Place, and the typically saline and low yielding hard rock aquifers associated with the Whittingham and Wollombi Coal Measures (various coal seams within these).To record the potential occurrence of seepage to the north and west of the Main Pit TSF, BOC has installed threel vibrating wire piezometers (VWPs).

3.3.5 Contaminated Land

During the 2020 MOP risk assessment for Bulga Coal (refer to **Section 3.1**), hazardous material management was considered a low risk to the environment.

Control strategies by Bulga Coal to manage the risk of hydrocarbon related impacts are conducted under the following documents:

- *Bulga Coal Hydrocarbon Management Plan*, incorporating spill response procedure and Bulga Open Cut Hydrocarbon TARP;
- *Bioremediation Area Management Plan* (Bulga Coal 2019) to specifically manage hydrocarbon contaminated soil onsite;
- *Bulga Underground Operations Spill Management Response Procedure*; and
- *Bulga Coal Pollution Incident Response Management Plan*.

All facilities used for the storage of hydrocarbons at Bulga Coal 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 where required.

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 current monitoring program involves:

- Regular inspections of hydrocarbon infrastructure to identify losses or leakages;
- The regular surface water monitoring sites have an analysis for oils and grease included each month; and
- Hydrocarbon monitoring includes surface water sites being monitoring quarterly, while the groundwater sites are monitored six-monthly.

3.3.6 Acid Mine Drainage

Acid mine drainage was identified as a low risk at the 2020 MOP risk assessment for Bulga Coal (refer to **Section 3.1**). A study was undertaken by Environmental Geochemistry International Pty Ltd as part

of the Bulga Optimisation Project to assess the acid mine drainage, salinity, and metal/metalloid leaching potential of the materials to be mined at Bulga Coal. The study indicated that the vast bulk of overburden, interburden and floor materials represented by the samples tested are unlikely to be acid producing or release significant salinity and will be acid consuming. There were however multiple zones of higher acid rock drainage risk identified associated with the the base of the Archerfield Sandstone, a number of the Foybrook seam roof and floors (LL05, LL06, LL11, AU01, UL01, ML02, LD05, BA01) and the Foybrook rejects. Dynamic testing indicated that PAF materials with moderate buffering capacity had lag times of around 6 to 12 months before the onset of acid conditions. The SEE (Umwelt 2019) found the vast bulk of overburden, interburden and floor materials in the new mining areas (as approved by Mod 3) were unlikely to be acid producing or release significant salinity and be acid. In zones of higher acid rock drainage it was found there is substantial buffering capacity available. Furthermore, the SEE (Umwelt 2019) found drainage from the bulk of the overburden/interburden was unlikely to contain significant metal/metalloid concentrations.

Management measures include:

- PAF material placement at least 5 m above natural ground level at out-of-pit emplacement areas to avoid water contact between the PAF material and natural ground;
- Mixing of acid consuming materials (limestone and/or overburden/interburden) with PAF material to increase lag times before the onset of acid conditions; and
- Selective placement of PAF material at least 100 m horizontally back from the outer perimeter of the emplacement area with a thick (not less than 20 m) outer zone of non-acid forming materials (preferably acid consuming material) and incorporate strategies to limit oxygen transfer into, and fluctuating moisture conditions in, PAF materials.

PAF material will be reconciled on a monthly basis and the results will be included within the monthly Reconciliation Presentation. This will identify any issues from the previous month that need to be rectified and to help ensure that PAF is emplaced according to management strategies.

Bulga Coal will routinely sample and test overburden/interburden materials during operations to confirm the low salinity and better define the acid rock drainage potential and the variability of rejects. To check for acid mine drainage, a programme of routine sampling and testing of seepage and runoff from pit walls and floors, overburden emplacements, ROM stockpiles and washery waste disposal areas will be undertaken. This monitoring will assess the performance of the above mentioned management strategies, and determine and/or refine blending ratios and limestone treatment requirements (if needed).

3.3.7 Flora and Fauna

Existing vegetation communities at Bulga Coal are shown on **Plan 1B** with the location of offsite offset areas included on **Plan 4** (refer to **Appendix 1**). The 2020 MOP risk assessment for Bulga Coal categorised flora and fauna as a low risk element (refer to **Appendix 3**).

Impacts to flora and fauna are managed across Bulga Coal in accordance with the approved *Bulga Coal Biodiversity Management Plan* (Bulga Coal 2018). This Plan outlines the specific procedures for vegetation clearance, rehabilitation and enhancement of woodland remnants, management within conservation and offset areas, salvage and re-erection of habitat material and the management of weeds. The plan also details the monitoring required to check that the management procedures are successfully being implemented.

Any ground disturbance activities (including vegetation clearing) at Bulga Coal are required to be completed in accordance with a Ground Disturbance Permit (GDP). The purpose of the GDP is to identify potential environmental or community hazards associated with the proposed scope of works and list controls to be implemented to control and minimise the hazards. Flora and fauna considerations within the GDP include:

- Presence of threatened species;
- Presence of endangered ecological communities (EECs);
- Restriction on felling of habitat trees; and
- Reuse or stockpiling of cleared vegetation.

Controls that will be implemented to minimise the potential impact on flora and fauna include:

- Use of the GDP for all clearing activities;
- Delineation of areas to be cleared in the field;
- Installation of erosion and sediment controls;
- Pre-clearance surveys prior to clearing any native vegetation (including grasslands);
- Tree-felling procedure for remnant native woodland;
- Training and communication with personnel undertaking the clearing; and
- Regular inspections.

As part of Mod 3, SEE (Umwelt 2019) undertook a comprehensive Biodiversity Assessment Report (BAR) for the 20.2 ha of additional disturbance area (a disconnected island located within the South Pit Extension Area (refer to **Plan 2**) required for extension of the mining areas to the south east and west.

Bulga Coal currently manage a number of offsets in relation to the approved disturbance areas, as well as operating in accordance with the approved *Biodiversity Management Plan*. The Vere Offset Site will be included in the revised biodiversity offset strategy to offset disturbance associated with Mod 3. The Vere Offset Site will be managed as a conservation area and a conservation agreement will be put in place for the offset within two years of Mod 3 being granted, or as otherwise agreed with the Secretary. The conservation agreements will provide for the management and in-perpetuity conservation of the offset site. The offset site will be established and until such time as the conservation agreements are in place, Bulga Coal will manage the offsets as a conservation area.

Bulga Coal also prepares an annual *Weed Action Plan* which identifies the key weed areas that require treatment, and the recommended timeframes and methods for control, based on the type of weeds present. This plan is monitored via regular inspections of mining and non-mining lands to determine the effectiveness of control programs and to identify any new infestations. The presence of weeds is also identified during annual rehabilitation and ecological monitoring programs which are conducted on both mining and non-mining lands. Weed management activities are reported on an annual basis in the Annual Review.

3.3.8 Blasting

Blasting was deemed to be a medium risk element in the 2020 MOP risk assessment for Bulga Coal (refer to **Appendix 3**).

Blasting at Bulga Open Cut is carried out according to the approved *Blast Management Plan* (Bulga Coal 2019). Monitoring is carried out to assess air blast overpressure and ground vibration impacts to the nearest privately owned residences. The management and monitoring of blast fume at the Bulga Open Cut is undertaken in accordance with the approved *Blast Fume Management Plan* (Bulga Coal 2019) with the gound vibration and overpressure being measured againsted the revised Mod 3 blasting criteria .

Bulga Coal will implement the following measures during the MOP term to achieve compliance with the conditions outlined in EPL 563 and SSD-4960:

- Implementation of the BOC Blast Management System, incorporating; Site Safety Management Plans, Shotfiring and Explosives Management Plan, *Blast Management Plan* and associated site based procedures;
- Use of blast design, in consideration of both safety and environmental requirements to manage potential impacts;
- Completion of a pre-blast environmental assessment that consids wind speed, wind direction and inversions prior to each blast;
- Use of initiation systems that minimise overpressure;
- Use of adequate stemming (type and quantity) to maximise confinement of explosive charges for the management of flyrock and overpressure;
- Provide for charge distributions suited to observed face burden;
- Blasts designed around identified geological features (to reduce the risk of a face burst and excessive airblast emissions);
- Blasts designed to account for the presence of geologically affected rock strata to avoid a potential flyrock incident around the identified geological features;
- Blast designed to account for the presence of underground workings or subsidence affected rock strata to avoid a potential flyrock and/or fume incident;
- Engage in communication with neighbouring mines including Mount Thorley Warkworth to minimise cumulative impacts and manage safety risks; and
- Evaluate new technology and alternative blasting methodologies via a continual improvement methodology.

Every blast is monitored at four approved monitoring locations which have a permanent, remotely controlled blast monitor installed at a location that is representative of an offsite receptor. These are Dawtry (within ML 1547 and owned by Bulga Coal Management Pty Ltd), Charlton (within the ML 1547), Hedley (northeast of ML 1547 and owned by Bulga Coal Management Pty Ltd) and Bulga (west of ML 1547 and owned by Bulga Coal Management Pty Ltd).

Information that is recorded from the nearest affected sensitive receiver includes:

- Measured air blast overpressure; and
- Measured ground vibration.

Additional information that is recorded during blasting activities includes:

- Maximum instantaneous charge;
- Volume of explosives used;
- Distance from blast to monitoring location;

- Blast type;
- Fume category rating;
- Video footage;
- Number of holes; and
- Weather conditions.

Blasting will be managed to minimise ground vibration at the following heritage sites, Mt Leonard Homestead', BH14 – 'Charlton', B13 – Stone Wall alongside Monkey Place Creek St, Andrews Anglican Church, BH6 – Broke Cemetery and Murinbin House Group in accordance with the Mod 3 blast criteria and *Blast Management Plan* (Bulga Coal 2019). Vibrations will be recorded by the Bulga, Charlton and Dawtrey blast monitors to prevent exceedances of criteria specified in the *Blast Management Plan* (Bulga Coal 2019).

Vibration predictions will be conducted for various infrastructure during the MOP term in accordance with vibration criteria in the *Blast Management Plan* (Bulga Coal 2019). For further details refer to the *Blast Management Plan* (Bulga Coal 2019).

3.3.9 Noise

The MOP risk assessment for Bulga Coal in 2020 identified noise as a medium risk element (refer to **Appendix 3**).

Noise management at Bulga Coal is undertaken in accordance with the *Bulga Coal Noise Management Plan* (Bulga Coal 2019).

Control strategies undertaken to effectively manage noise levels associated with operations at Bulga Coal include:

- Active management of mobile equipment to reduce noise impacts, including the placement of quieter rear dump trucks on exposed haul routes, the relocation of louder equipment to shielded locations during adverse weather conditions and avoid unnecessary dropping of dragline buckets;
- Assessment of the equipment fleet against the indicative equipment list outlined in the EIS every 3 years to confirm that noise impacts have not significantly changed. If noise impacts are deemed to have changed the 'change management process' will be triggered;
- Overburden emplacement strategies will be implemented to meet relevant noise criteria;
- Haul road bunds will be constructed to a height of 3 metres above road level, where safe and practicable, in strategic locations on the exposed side of long-term haul roads;
- Retention of the hydraulic snubber on the face shovel so the noise source does not cause sleep disturbance;
- Allocation of day time and night time dumping locations within the mining schedule where applicable to provide unexposed locations for night time dumping;
- Installation of noise bunds above RL 80 m where feasible to a height of approximately 5 m above the existing level to effectively reduce noise emanating to the west of the operations, where it is safe to do so; and
- Utilisation of the real time noise monitoring network to pro-actively manage noise impacts. This includes noise monitoring alarms that are set to trigger a staged review and modification to the operation prior to noise levels reaching 34 decibels (dB) at residential receivers. Level 1 and Level 2 alarms operate from 7:00 pm to 7:00 am and are not triggered when wind speeds are measured above 3 m/s or rain is recorded at the monitor. Noise alarms do not operate between 7:00 am and

7:00 pm. This is because it is difficult to quantify the mine only contribution over this period due to the frequent occurrence of extraneous noise sources (traffic, wildlife, farm machinery, wind etc.).

Noise monitoring is undertaken in accordance with the *Bulga Coal Noise Management Plan* (Bulga Coal 2019) which addresses the requirements of SSD-4960 and DA 376-8-2003. Additionally, noise from gas drainage construction works for the Blakefield North Mine is managed under the *Blakefield North Construction Noise Management Plan*.

The noise monitoring program includes:

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

The real-time monitoring network is operated at five locations, which are representative of the Fordwich, Bulga, Broke and Milbrodale localities. The data is recorded continuously and is reported real-time via an internal website, which is then used to assist with the pro-active management of noise impacts from Bulga Coal operations. Dispatch is notified of noise levels that are approaching or exceeding the Development Consent noise criteria. Dispatch and Open Cut Examiners investigate noise sources and make changes to reduce noise, where required. The real-time monitoring network is calibrated and maintained by a noise consultant.

Sound power testing is conducted in accordance with the *Bulga Coal Noise Management Plan* (Bulga Coal 2019), where a representative sample of the open cut fleet is tested annually with every item of mobile equipment tested at least once every three years. Measured sound power levels are compared to the 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. Exceedances are investigated and actioned as required. 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.

Fleet-wide (logarithmic) averages for each make/model of mobile plant are calculated on a rolling basis at the end of each annual testing campaign using the most recent result available for each item. Fleet averages will remain within 2 dB of the most recent specification for each type of mobile plant.

For additional details regarding the management of noise at Bulga Coal, please refer to the *Noise Management Plan* (Bulga Coal 2019).

3.3.10 Visual and Lighting

Visual impact was identified a medium risk element at the 2020 MOP risk assessment for Bulga Coal (refer to **Appendix 3**).

A diverse selection of control strategies are used at Bulga Coal to reduce potential visual and light related impacts associated with mining operations and to prevent external lights shining above the horizon. Management is undertaken in accordance with the *Bulga Lighting Management Plan, the Visual Impact Management Plan* and recommendations of the *Lighting Audit and Report* (Webb Australia Group, 2010).

Visual and lighting related impacts associated with Bulga Coal are assessed through a variety of monitoring, inspection regimes and via the Visual Impact Consultation Committee. Onsite monitoring includes assessments of lighting impacts and compliance with development consent conditions as well as the angle at which light is emitted from lamps and luminaries, glare, spill and sky glow.

3.3.11 Heritage (Aboriginal and European)

Aboriginal Heritage

Aboriginal cultural heritage is managed in accordance with the approved *Bulga Coal Aboriginal Cultural Heritage Management Plan* (ACHMP) (Bulga Coal 2019). The ACHMP has been developed in consultation with RAPs to address the management of Aboriginal cultural heritage sites across Bulga Coal.

As evident in **Appendix 3**, the 2020 MOP risk assessment for Bulga Coal categorised Aboriginal heritage as a medium risk element.

A number of archaeological sites and items of Aboriginal heritage have been identified throughout Bulga Coal including artefact scatters, grinding grooves, isolated finds and scarred trees. Some of these sites have been the subject of sub-surface investigation and/or salvage activities undertaken with relevant permits under the *National Parks and Wildlife Act 1974* (NPW Act). Aboriginal Heritage Impact Permits (AHIPs) have been granted by the National Parks and Wildlife Service to allow artefacts to be destroyed or collected at Bulga Coal. All artefacts, excluding the grinding grooves and the designated conservation areas are allowed under the AHIP to be destroyed or collected.

Any artefacts not contained within the specified AHIP areas are perceived as important and must be managed appropriately in accordance with the ACHMP, which includes the following controls:

- Ground Disturbance Permit – a GIS system is used prior to ground disturbance to determine whether proposed disturbance will occur in the vicinity of recorded sites, whether the area proposed has been surveyed and if the sites are within the Conservation Area or Conservation Zones. The outcomes of this process will then inform the Bulga Coal Environment and Community Department if work is approved under the ACHMP.
- Management of Potential Human Skeletal Remains – in the event that human/possible human skeletal material is exposed, the following procedure will be followed:
    - Works in the immediate vicinity will cease to allow assessment and management;
    - The material will be inspected to determine if animal or human, and advice sought from a forensic specialist if necessary; and
    - If the material is human or thought to be human, the NSW Police and the OEH will be contacted, and a physical or forensic anthropologist will inspect the remains in situ and make a determination of ancestry and antiquity. If the remains are identified as forensic the area is deemed a crime scene. If the remains are identified as Aboriginal, the site will be secured, with the OEH and all registered Aboriginal parties advised. If the remains are non-Aboriginal (historical) remains, the site will be secured and the Heritage Office contacted.
- Interim Protection of Sites – temporary fencing and signage will be placed around any newly identified Aboriginal heritage sites, and staff and contractors will be notified of their obligations to avoid harm to the object or site. This will act as an interim protection measure until permanent signage can be established and the object or site is added to the site GIS database.
- Management of the Conservation Area and Conservation Zones:
    - Erosion and sediment controls will be undertaken in accordance with the general strategies in the *Erosion and Sediment Control Plan*;

- Should any ground disturbance works be required within a conservation zone for the purpose of environmental management (such as feral animal control or bushfire hazard reduction), it will be subject to consultation with the relevant Aboriginal parties. Ground disturbance works associated with the maintenance of existing approved infrastructure in the Swan Lake Conservation Zone are permissible under the ACHMP; and
- The conservation zones will be subject to annual inspections and monitoring in consultation with the relevant Aboriginal parties. The results of annual monitoring will be included in the Annual Review.

SEE (Umwelt 2019) recorded two new Aboriginal sites and located four previously recorded Aborignal Heritage Information Management System (AHIMS) sites. The newly recorded sites are isolated finds and were recorded within the eastern portion of the additional disturbance area.

BOC will not undertake any disturbance within the additional disturbance areas approved under Mod 3 until a revised Heritage Management Plan is approved by the Planning Secretary.

The induction given to all visitors, employees and contractors prior to accessing Bulga Coal includes information about Aboriginal cultural heritage management to ensure that everyone is made aware of these controls, along with their obligations under the NPW Act.

European Heritage

In accordance with the requirements of SSD-4960 Bulga Coal have prepared a *Historic Heritage Management Plan* (Bulga Coal 2016) which outlines the management of European heritage sites. This Plan provides details regarding a number of European heritage sites that have been identified within Bulga Coal and that may be indirectly affected by ground vibration associated with blasting; or directly impacted as a result of activities during the MOP term. These heritage items include a dairy cottage, a stone wall, a cemetery, homesteads, a church, a post and rail fence, and a former Royal Australian Air Force (RAAF) landing ground.

BOC will not undertake any disturbance within the additional disturbance areas approved under Mod 3 until a revised Heritage Management Plan is approved by the Planning Secretary.

European heritage was deemed a medium risk element at the 2020 MOP risk assessment for Bulga Coal (refer to **Appendix 3**).

3.3.12 Spontaneous Combustion

Spontaneous combustion management is undertaken in accordance with the approved *Spontaneous Combustion Management Plan*. Spontaneous combustion was identified as being a medium risk in the 2020 MOP risk assessment for Bulga Coal . Additionally, a specific Spontaneous Combustion Risk Assessment is reviewed annually at Bulga Coal.

Strategies and controls implemented by the BOC include:

- An assessment will be completed to determine what coal seams in the final highwall and end wall will need to be treated;
- Underground mined coal seams exposed in final highwalls will be capped with inert material and rehabilitated;
- Coal work areas are kept clean and tidy to minimise the accumulation of coal;
- ROM and product stockpiles are minimised in size to reduce residence time and therefore the potential for oxidation;

- Awareness of spontaneous combustion onsite and training of personnel to identify and report spontaneous combustion;
- Coarse rejects are incorporated into the overburden within the BOC and buried so as to prevent spontaneous combustion. Carbonaceous material must not be dumped within 10 m of the final landform level; and
- Alarm management systems.

Response and recovery strategies include (in order of preference):

1. Dig the material out, spread it out, water and track roll it and cover within inert material. This removes the fuel and is the most successful way of dealing with self-heating or spontaneous combustion;
2. Cover it in-situ with inert material, shape the surface so it drains and then track roll the surface and batters. This removes the oxygen and is dependent on the integrity of the seal. This is governed by the clay and water content of the sealing material and the absence of surface cracking due to settlement or erosion. This option may require on-going maintenance of the seal; and
3. Cool the area with the application of water. This aims to reduce the temperature and hence slow rather than halt the process. This option may be used as a short-term solution until either of the two options above can be implemented.

The monitoring of spontaneous combustion is undertaken at Bulga Coal on a regular basis, including during shift inspections. This monitoring is focused upon potentially affected areas including CHPP and BUO.

Monitoring of BUO includes continuous gas monitoring. This is undertaken to monitor systems for the purpose of monitoring the status of spontaneous combustion and to identify any potential increase in risk. This includes continuous gas monitoring of mine airway and goaf atmospheres, minimum standards for monitoring, and analysis of sample results and trends.

Additional details regarding the BUO management of spontaneous combustion will be provided in the BUO MOP.

3.3.13 Bushfire

Bulga Coal operates in accordance with an approved *Bushfire Management Plan* (BMP). Bushfire monitoring activities at Bulga Coal include:

- Monitoring of tracks and trails at Bulga Coal to ensure these remain accessible by checking for fallen logs, erosion or other signs of trail degradation;
- Monitoring of weather conditions;
- Monitoring of the maintenance of fire equipment; and
- Monitoring of the requirement for hazard reduction measures to be completed, particularly for areas associated with boundaries of adjoining land holdings.

Bushfire management strategies undertaken at Bulga Coal include the following:

- Mechanical reduction of fuel levels including mowing, slashing, ploughing, flailing and manual removal;

- Maintenance of firebreaks to minimise the risk of a bushfire reaching mine owned assets, and tenanted and private properties;
- Restriction of ignition sources;
- Maintenance of firefighting equipment; and
- Implementation of hazard reduction measures.

3.3.14 Public Safety

Bulga Coal implements a variety of control strategies to minimise the potential for public safety incidents at the site. These include the implementation of the following:

- Implementation of a security system to ensure public and employee safety is maintained during all aspects of the operation. 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;
- During hazardous activities such as blasting, sentries are posted throughout the site to prevent unauthorised entry into the blasting zone;
- Use of the Damstra electronic visitors book;
- Fencing surrounds the perimeter of the Bulga Coal mining operations;
- Security patrols; and
- Employee and contractor inductions regarding mine safety and environmental management issues prior to commencement of work at the site.

3.3.15 Socio-Economic Impact Management

The Bulga Coal *Social Involvement Plan* contains detail on the consultation process during mine closure for each identified stakeholder group. It has been developed to ensure that the social impact of Bulga Coal's activities, community concerns, needs and social risks to its operations are identified and addressed through effective implementation of community relations strategies which uphold and promote human rights and respect cultural considerations and heritage.

During the life of operations, Bulga Coal will continue to collect social data including:

- Key areas of predicted impact, including perceived and experienced social impacts, through engagement with near neighbours and other proximal landowners to determine if experience of the social impacts of the operations are in line with predicted impacts; and
- Evaluation of community contributions to ensure benefits are to local stakeholders, e.g. local community organisations, schools and tourism events.

In addition, the Glencore Coal Assets Australia (GCAA) Mine Closure Planning Standard requires a social impact assessment to be undertaken leading up to the development of a detailed mine closure plan (e.g. within five years of life of mine). Bulga Coal will complete this social impact assessment at the appropriate time in the mine closure planning process.

3.4 Operational Issues Which Affect Rehabilitation

3.4.1 Geology and Geochemistry

Bulga Coal is located in the central coal producing region of the Hunter Coalfield. The many seams of this coalfield were formed in the Permian period and are similar in age to the Illawarra Coal Measures south and west of Sydney, and the Newcastle and Tomago Coal Measures of the Newcastle/Maitland area. The coalfield strata in the Hunter Coalfield generally dip to the west-south-west under the prominent sandstone escarpments of the Sydney Basin. A series of folds, superimposed upon the regional dip, form large north-south trending anticlines, synclines and monocline structures. The coal seams within Bulga Coal, which form part of the Wittingham Measures, dip steeply in the east from where they outcrop. The seams have been folded by the Mount Thorley Monocline to level out forming part of the gently dipping strata of the Singleton Super Groups (Umwelt 2013a).

In the event that any material that is not appropriate for rehabilitation activities is identified during mining activities, it will be handled in such a way that it is buried and not exposed. Detailed studies seeking understanding of overburden and reject materials on specific characteristics, such as potential for spontaneous combustion, PAF materials, salinity, sodicity and metals have been undertaken as part of the Bulga Optimisation Project. Further information regarding the outcomes of these studies is contained in **Section 3.4.3**.

The BOC is currently undertaking mining operations within areas that have been previously mined or that have had spoil placed on them. During the MOP term BOC will clear approximately 32 ha of existing vegetation to expand open cut mining areas and to continue dumping in the Eastern Emplacement Area.

3.4.2 Material Prone to Spontaneous Combustion

Spontaneous combustion management is undertaken in accordance with the *Spontaneous Combustion Management Plan*. Spontaneous combustion is not considered a risk to rehabilitation at the BOC during the MOP term, as the following strategies and controls (as discussed in **Section 3.3.13**) will continue to be implemented by the BOC:

- An assessment will be completed to determine what coal seams in the final highwall and end wall will need to be treated;
- Underground mined coal seams exposed in final highwalls will be capped with inert material and rehabilitated;
- Coal work areas are kept clean and tidy to minimise the accumulation of coal;
- ROM and product stockpiles are minimised in size to reduce residence time and therefore the potential for oxidation;
- Awareness of spontaneous combustion onsite and training of personnel to identify and report spontaneous combustion;
- Coarse rejects are incorporated into the overburden within the BOC and buried so as to prevent spontaneous combustion. Carbonaceous material must not be dumped within 10 m of the final landform level; and
- Alarm management systems.

3.4.3 Material Prone to Generating Acid Mine Drainage

There are no acid mine drainage issues at BOC, therefore this aspect is not a major consideration in relation to rehabilitation onsite during the MOP term.

A study titled *Geochemical Assessment of the Bulga Complex Optimisation Project* was undertaken by Environmental Geochemistry International Pty Ltd in 2012 to support the EIS (Umwelt, 2013a). This study assessed the acid mine drainage, salinity, and metal/metalloid leaching potential of the materials to be mined at Bulga Coal. The study indicated that the vast bulk of overburden, interburden and floor materials represented by the samples tested are unlikely to be acid producing or release significant salinity and will be acid consuming.

However multiple zones of higher acid rock drainage risk were identified, associated with the the base of the Archerfield Sandstone, a number of the Foybrook seam roof and floors (LL05, LL06, LL11, AU01, UL01, ML02, LD05, BA01) and the Foybrook rejects. Dynamic testing indicated that PAF materials with moderate buffering capacity had lag times of around 6 to 12 months before the onset of acid conditions.

Bulga Coal will routinely sample and test overburden/interburden materials during operations to confirm the low salinity and better define the acid rock drainage potential and the variability of rejects. To check for acid mine drainage, a programme of routine sampling and testing of seepage and runoff from pit walls and floors, overburden emplacements, ROM stockpiles and washery waste disposal areas will be undertaken. This monitoring will assess the performance of the abovementioned management strategies, and determine and/or refine blending rations and limestone treatment requirements (if needed).

A study conducted to assess acid rock drainage (ARD), salinity and metal/metalloid leaching potential of the materials to be mined indicated that the general buffering nature of most of the overburden and interburden material and the small proportion of PAF material provides considerable flexibility in mine material management. Operational mixing of PAF and high acid neutralising capacity (ANC) materials is expected to be sufficient to control any ARD from most of these materials. Further investigation during operations will be required to confirm ratios and blending methods and to demonstrate the effectiveness of the management techniques proposed.

The following management strategies have been put in place:

- PAF material placement at least 5 m above natural ground level at out-of-pit emplacement areas to avoid water contact between the PAF material and natural ground;
- Mixing of acid consuming materials (limestone and/or overburden/interburden) with PAF material to increase lag times before the onset of acid conditions;
- Selective placement of PAF material at least 100 metres horizontally back from the outer perimeter of the emplacement area with a thick (not less than 20 metre) outer zone of NAF materials (preferably high acid consuming material) and incorporate strategies to limit fluctuating moisture conditions in PAF materials; and
- Selective placement of PAF materials in-pit below the long term recovery water table to allow inundation at closure and prevent long term exposure to atmospheric oxidation.

3.4.4 Mine Subsidence

The Noise and Visual Bund has been established along the eastern side of Charlton Road, the majority of this emplacement is located above BUO underground mining areas.

The design of the Noise and Visual Bund has considered the effects of future subsidence during the life of the operations.

Over the life of the operation Bulga Coal will undertake ongoing maintenance and stabilisation works to remediate potential subsidence impacts on the Noise and Visual Bund. The Noise and Visual Bund has been constructed with traditional drop structures and contour banks to assist with the potential maintenance and repairs required post subsidence.

3.4.5 Erosion and Sediment Control

Management of erosion and sediment at BOC will be undertaken in accordance with the approved *Erosion and Sediment Control Plan* (Bulga Coal 2019), as discussed in **Section 3.3.2**.

During and following ground disturbance, structures such as sediment ponds, sediment fences and catch drains will be utilised as appropriate to manage runoff water and manage erosion and sedimentation. Inspections will be carried out to ensure that the effectiveness of erosion and sediment control structures are maintained. Additional stabilisation works for these areas may include reshaping, amelioration of dispersive soil, revegetation, fencing, and weed control.

Topsoil stockpiles which will be kept longer than three months are seeded immediately with a cover crop to reduce erosion and weed growth.

3.4.6 Land Clearing and Resource Salvage

Clearing of remnant native vegetation will be required for the ongoing operation of the BOC. The controls that will be implemented to minimise the potential impact from these clearing activities include:

- Use of the GDP for all clearing activities;
- Delineation of areas to be cleared in the field;
- Installation of erosion and sediment controls;
- Pre-clearance surveys prior to clearing any native vegetation (including grasslands);
- Tree-felling procedure for remnant native woodland;
- Training and communication with personnel undertaking the clearing; and
- Regular inspections.

The controls will be utilised for all remnant native vegetation (including grasslands). Where disturbance of previous mine rehabilitation is required, pre-clearance surveys and the tree felling procedure will not be utilised as vegetation is not of sufficient age to provide habitat to native fauna. However, resources such as topsoil and vegetation will be salvaged where appropriate.

Resources that will be salvaged from clearing activities include topsoil, vegetation and hollow-bearing trees/logs and native seed. These resources will be re-used in rehabilitation areas to improve revegetation outcomes and to augment habitat features.

Cleared vegetation will be salvaged and stockpiled. Vegetation may either be mulched and incorporated into the topsoil, or stockpiled separately and spread over rehabilitation areas to provide additional habitat.

Where habitat trees are felled, or significant hollow-bearing logs are identified, these will be stockpiled separately to other vegetation stockpiles. Where appropriate habitat trees may be re-erected on rehabilitation areas, or alternatively they will be placed on the ground along with hollow-bearing logs to provide habitat for ground dwelling species.

Additionally, the seed resources within areas to be cleared will be identified during pre-clearance surveys. Where practical, this seed will be collected from trees after they have been felled, but prior to them being stockpiled or mulched. Collected seed will be stored and either propagated to create tubestock for rehabilitation activities, or incorporated into the seed mix used on rehabilitation areas (refer to **Section 7.8.1**).

3.4.7 Tailings

As discussed in **Section 2.2.4,** Bulga Coal will relocate tailings from the Deep Pit TSF and Bayswater Pit TSF to the Main Pit TSF, allowing future extraction of deeper resources in the Southern Extension Area. The tailings to be stored in Main Pit TSF will also include tailings produced from the ROM coal processing during the life of the mine (as well as the tailings being removed by dredging from Deep Pit TSF).

As part of the ongoing tailings deposition modelling for the Main Pit TSF, SRK Consulting (Australasia) Pty Ltd (SRK) updated the consolidation models using site data to develop benchmarked parameters for deposition consolidation modelling.

The study (SRK 2020) used the following scenarios:

- 8% open pit and underground ROM - one consolidation model to be undertaken to model the deposition into the Main Pit TSF, with the addition of underground tailings to the deposition (8% RoM for both open cut and underground tailings);
- 10% open pit and underground ROM - one consolidation model to be undertaken to model the deposition into the Main Pit TSF, with the addition of underground tailings to the deposition (10% RoM for both open cut and underground tailings); and
- 11% open pit and underground ROM - one consolidation model to be undertaken to model the deposition into the Main Pit TSF, with the addition of underground tailings to the deposition (11% RoM for both open cut and underground tailings).

The study indicated the maximum tailings deposition level for each scenario are: 8% - 74 m RL; 10% - 81 m RL; and 11% - 85 m RL. Final tailings surface elevations (after 150 years of consolidation) for each scenario of 57 m, 63 m and 66 m derived for 8%, 10% and 11% models respectively which equate to, approximately 17.1 m (8% model), 18.0 m (10% model) and 18.3 m (11% model) of settlement. Further details are included in **Appendix 4.**

The MOP risk assessmnent specifically assessed potential risks associated with tailings management (refer **Section 1.5.1**) and associated rehabilitation risks. A copy of the risk assessment and all actions to be completed by Bulga Coal to address these potential risks has been included as **Appendix 3**.

BOC will monitor the tailings emplacement settlement during and post tailings relocation to provide the data to refine the consolidation modelling. This work will continue for the period of tailings emplacement and will be used to develop the tailing emplacement facility capping methodology and design of the overlying landform.

The overburden emplacement east of the TSF will be used to provide the material required to cap and build the overlying landform.

4.0 POST MINING LAND USE

4.1 Regulatory Requirements

The regulatory requirements related to the post-mining land use, landscape and rehabilitation outcomes at BOC are listed in **Table 12**.

Table 12 – Regulatory Requirements Relating to Post-mining Land Use and Rehabilitation

Condition	Requirement	Applicable Area	Status
SSD-4960 (Mod 3)			
Schedule 3 Condition 53	Mine site (as a whole) is to be safe, stable and non-polluting. Final landforms to be designed to minimise the visual impacts of the development; be in keeping with the natural terrain features of the area; incorporate macro-relief and micro-relief and drainage features that mimic natural topography and mitigate erosion, to the greatest extent practicable; avoid straight run drainage drop structures; minimise long term groundwater seepage; minimise exposure of tailings material and prevent the occurrence of spontaneous combustion; and be sustainable and compatible with surrounding land uses.	Entire site	In progress
	Final void to be designed as long term groundwater sinks and to maximise groundwater flows across back-filled pits to the final void; and to minimise: the size and depth of final voids; the drainage catchment of final voids; any high wall instability risk; risk of flood interaction for all flood events up to and including the Probable Maximum Flood.	Final void	To be undertaken at mine closure
	Revegetation – Restore self-sustaining ecosystems that meet the requirements of the Rehabilitation Area in the Biodiversity Offset Strategy in condition 29 of Schedule 3, plus re-instate at least an additional 121 ha of Central Hunter Grey Box–Ironbark Woodland EEC. Establish native vegetation areas that complement and improve local and regional biodiversity.	Entire site	In progress
	Agriculture – Return at least 260 hectares of land within the project disturbance area to be suitable for agricultural use.	Entire site	In progress
	Surface infrastructure to be decommissioned and removed, unless RR agrees otherwise.	Entire site	To be undertaken at mine closure
	Community – Ensure public safety; minimise the adverse socio-economic effects associated with mine closure.	Entire site	To be undertaken at mine closure
Schedule 3 Condition 54	Progressive Rehabilitation **–** The Applicant must rehabilitate the site progressively, that is, as soon as reasonably practicable following disturbance. All reasonable and feasible measures must be taken to minimise the total area exposed for dust generation at any time. Interim rehabilitation strategies must be employed when areas prone to dust generation cannot yet be permanently rehabilitated.	Entire site	In progress
Schedule 3 Condition 55	Rehabilitation Management Plan – The Applicant must prepare and implement a Rehabilitation Management Plan for the development in accordance with the conditions imposed on the mining lease(s) associated with the development under the *Mining Act 1992.* *Note: Specific requirements of the Rehabilitation Management Plan have been addressed in **Table 3**.*	Entire site	In progress.

Condition	Requirement	Applicable Area	Status
ML 1547 and CL 224			
Condition 21	If so directed by the Minister, the lease holder shall rehabilitate to the satisfaction of the Minister any lands within the subject area which may have been disturbed by the lease holder	ML/CL area	In progress
Condition 22	Upon completion of operations on the surface of the subject area or upon the expiry or sooner determination of this authority or any renewal thereof, the lease holder shall remove from such surface such buildings, machinery, plant, equipment, constructions and works as may be directed by the Minister and such surface shall be rehabilitated and left in a clean, tidy and safe condition to the satisfaction of the Minister.	ML/CL area	To be undertaken at mine closure
Condition 23	If so directed by the Minister the lease holder shall rehabilitate to the satisfaction of the Minister and within such time as may be allowed by the Minster any lands within the subject area which may have been disturbed by mining or prospecting operations whether such operations were or were not carried out by the lease holder.	ML/CL area	To be undertaken at mine closure
ML 1717 and ML 1788			
Condition 2	Any disturbance resulting from the activities carried out under this mining lease must be rehabilitated to the satisfaction of the Minister.	ML area	In progress
ML 1788			
Condition 3 (f)	The lease holder must prepare a Rehabilitation Report to the satisfaction of the Minister. The report must: (i) provide a detailed review of the progress of rehabilitation against the performance measures and criteria established in the approved MOP; (ii) be submitted annually on the grant anniversary date (or at such other times as agreed by the Minister); and (iii) be prepared in accordance with any relevant annual reporting guidelines published on the Department's website at https://www.resourcesandgeoscience.nsw.gov.au/miners-and-explorers/rules-and-forms/pgf/environmental-guidelines	ML area	To be undertaken annually
ML 1494 and ML 1674			
Condition 7	Disturbed land must be rehabilitated to a sustainable/agreed end land use to the satisfaction of the Director-General.	ML area	In progress

Condition	Requirement	Applicable Area	Status
AUTH 450, AUTH 447, EL 5277, EL 5461, EL 8315			
Condition 27 (a)	Land disturbed must be rehabilitated to a stable and permanent form suitable for a subsequent land use acceptable to the Department so that: (i) There is no adverse environmental impact outside the disturbed areas and the land is properly drained and protected from soil erosion; (ii) The state of the land is compatible with the surrounding land and land use requirements; (iii) The landforms, soils, hydrology and flora require no greater maintenance than that in or on the surrounding land; (iv) In cases where native vegetation has been removed or damaged, and where vegetation is required, species endemic to the area must be re-established. If the previous vegetation was not native, any re-established vegetation must be appropriate to the area or to the satisfaction of the landholder. Any re-established vegetation must be at an acceptable density and diversity; and (v) The land does not pose a threat to public safety.	AUTH/EL area	To be undertaken at mine closure
Condition 27 (b)	Any topsoil that is temporarily removed from an area of prospecting operations must be stored, maintained and returned as soon as possible in a manner acceptable to the Department.	AUTH/EL area	In progress
Condition 27 (c)	Any shafts, drill holes, and excavations, that remain abandoned from previous mining or exploration, which are opened up or used by the licence holder must be filled in or otherwise rehabilitated to a standard acceptable to the Department.	AUTH/EL area	To be undertaken at mine closure
Condition 27 (d)	All rehabilitation of disturbed areas should be completed before the expiry of the licence or immediately following termination of the licence.	AUTH/EL area	To be undertaken at mine closure
Condition 28 (a)	An Environmental and Rehabilitation Report must be submitted to the Department as follows: (i) The reports must be prepared according to Departmental Guidelines for environmental and rehabilitation reporting on exploration licences. (ii) The reports must be lodged within one month of expiry or earlier termination of the licence or whenever part of the licence ceases to take effect. (iii) The reports must be prepared to the satisfaction of the Department and include information on all surface disturbing prospecting operation and rehabilitation carried out in the licence areas or in the part of the licence that has ceased to have effect. They should include sufficient information to demonstrate the requirements of Conditions 1 to 6 and 9 to 27 or those of them included in the licence have been satisfied.	AUTH/EL area	To be undertaken at mine closure

Condition	Requirement	Applicable Area	Status
Commitments in Environmental Impact Assessments			
EIS (Umwelt, 2013a)			
Section 2.4.5.1	Disturbed areas which will not form part of the active mining operations for periods of 12 months or more will be seeded with groundcover to reduce potential wind erosion and associated dust emissions.	Entire site	In progress
Section 2.4.5.2	Rehabilitation will generally take the form of direct seeding of endemic tree, shrub and grass species into a growing medium established using soil removed during pre-stripping operations and/or imported material and, where conditions permit, directly into overburden. Tree and shrub seedlings will also be used either instead of or in addition to direct seeding where direct seeding alone is deemed unsuitable or past experience has produced suboptimal results. 'Cover crops' of exotic grasses and non-local shrub species may also be used where considered appropriate to provide protection for emerging shrub and tree seedlings, and for rapid establishment of erosion and sediment control and to minimise dust.	Entire site	In progress
Section 2.4.5.3	Soils within and surrounding former infrastructure areas will be assessed for potential contamination. Any contamination present will be remediated and contaminated material treated or appropriately disposed of. Former infrastructure areas will be revegetated unless proposed for other land uses.	Entire site	To be undertaken at mine closure
Section 2.4.5.4	Dams forming part of the mine water management system will be removed unless utilised for habitat purposes or subsequent land uses.	Entire site	To be undertaken at mine closure
Section 5.14	The rehabilitated area will provide native vegetation corridors linking surrounding remnant vegetation areas to the south and east of the project area (including the Singleton Military Training Area) and to the north through the proposed native rehabilitation areas of Mount Thorley and Warkworth mines.	Entire site	In progress
Section 5.14	The detailed mine closure planning process will be commenced at least 5 years prior to the planned cessation of mining. The detailed mine closure plan will be developed in consultation with community, government and other stakeholders with the majority of closure works expected to be completed within 2 years of cessation of mining.	Entire site	To be undertaken at mine closure
Section 5.14.1.1	As part of the ongoing operations of the BCC, the existing Conceptual Closure Plan will be revised as part of the implementation of the Project.	Entire site	In progress
Section 5.14.1.2	The indicative post mining land use for the BCC following completion of the Project, will primarily involve the establishment of native vegetation communities impacted by the Project.	Entire site	In progress
Section 5.14.2.1	The highwall benches will be revegetated with a suitable native vegetative mix using local species; the low wall will be reshaped to an average of 10 degrees and revegetated with native species; a surface drainage network will be established to divert the bulk of surface water away from the final void so as to maximise replenishment of the local catchment areas. *Note: The commitements in this section have supersceeded by Section 6 of the Mod 3 SEE (Umwelt, 2019).*	Established areas	To be undertaken at mine closure

Condition	Requirement	Applicable Area	Status
Section 5.14.2.1	The proposed highwall benches will be progressively revegetated where practicable with native species over the life of the operation as mining progresses to the lower seams to minimise visual impact and provide habitat.	Entire site	In progress
Section 5.14.2.2	All final landform slopes [of the overburden emplacement areas] will be battered to an average of 10 degrees (except the north-western extent of the Noise and Visual Bund which has been designed to balance noise and Warkworth Sands Woodland EEC impacts) to minimise erosion risk. *Note: The commitements in this section have supersceeded by Section 6 of the Mod 3 SEE (Umwelt, 2019).*	Established areas	In progress
Section 5.14.2.3	The final landform will generally be designed to direct runoff away from the final void and into the Loders Creek and Wollombi Brook catchments.	Entire site	In progress
Section 5.14.2.3	Drainage structures will be designed to minimise scouring associated with anticipated runoff. Where practicable, drainage lines will be designed to be commensurate with natural landforms.	Entire site	In progress
Section 5.14.4	Rehabilitation will be undertaken in accordance with a Mining Operations Plan (MOP) that will be prepared for the Project and submitted to DRE for approval.	Entire site	In progress
Section 5.14.4	Disturbed areas will be progressively rehabilitated over the life of the Project. Where rehabilitation is delayed, overburden areas will be shaped to final landform as close as reasonably practicable behind the active mining operation and suitable cover crops applied on exposed areas to minimise dust and erosion.	Entire site	In progress
Section 5.14.4	Temporary revegetation will also be undertaken on unshaped overburden dumps and other disturbed areas that are planned to be inactive for one to two years.	Entire site	In progress
Section 5.14.4.1	The tailings emplacement areas onsite will be filled and shaped to the conceptual final landform plan and subsequently capped.	Entire site	In progress
Section 5.14.4.1	Coarse reject material will be co-disposed with overburden material and incorporated into the final landform. The coarse reject material will be placed at a suitable depth within the final landform to minimise any potential interference to rehabilitation establishment as well as minimise the potential for spontaneous combustion or ignition of carbonaceous material in the event of bushfire occurring within the revegetated landscape.	Entire site	In progress
Section 5.14.4.1	Surface preparation activities for rehabilitated areas will commence as soon as practicable following the completion of mining activities.	Entire site	In progress
Section 5.14.4.1	After surface soil amelioration and tillage is completed for any given area, revegetation will commence as soon as practicable.	Entire site	In progress

Condition	Requirement	Applicable Area	Status
Section 5.14.4.1	A seed collection and handling program aimed at maximising the viability and diversity of local seed in the revegetation mix will be implemented as part of the rehabilitation program, however, endemic species will also be sourced from other sources.	Entire site	In progress
Section 5.14.4.1	Revegetation will primarily involve direct seeding of native species along with a suitable cover crop or other organic material (e.g. mulch, brush matting or biosolids etc.) as required to prevent soil loss and add biomass to the profile.	Entire site	In progress
Section 5.14.4.5	At the end of the operational life of the mine, BCM proposes to decommission all onsite infrastructure and associated facilities as part of the mine closure process with the exception of any required as part of the final land use.	Entire site	To be undertaken at mine closure
Section 5.14.4.5	A detailed mine closure plan will be developed at least two years prior to the anticipated mine closure date (e.g. cessation of mining), in accordance with XCN standards for mine closure. During the development of the mine closure plan, consultation will be undertaken with relevant government agencies and the local community.	Entire site	To be undertaken at mine closure
Section 6	A detailed mine closure plan will be developed at least five years prior to the anticipated mine closure date (i.e. cessation of mining).	Entire site	To be undertaken at mine closure
Section 6	At least 7 years prior to planned closure of the mine, BCC will undertake groundwater impact assessments associated with detailed planning for mine closure to assist with refinement of the final landform to minimise long term impacts associated with mine closure.	Entire site	To be undertaken at mine closure
RAPAR (Umwelt, 2013b)			
Section 3.17.2	BCM will focus on the emplacement and rehabilitation of the outer face of the Noise and Visual bund in the early years of the Project, with the outer face planned to be established by Year 4. The external face of the Bund is planned to be progressively completed within the first three [3] years of the project, although allowances have been made for this timeframe to be increased. The outer face of the Noise and Visual Bund will take approximately four years to complete.	Noise and Visual Bund	During the MOP term
Section 3.17.2	Where final rehabilitation cannot be completed in timely manner for operational reasons or other factors (e.g. poor climatic conditions), temporary revegetation will be used to assist in stabilising areas (reducing water and wind erosion) and reducing visual impacts.	Entire site	In progress
Section 3.17.2	The final landform will be reviewed and finalised at least 7 years prior to the planned closure date with a detailed assessment of predicted water quality and void recharge undertaken as part of this process.	Entire site	To be undertaken at mine closure

Condition	Requirement	Applicable Area	Status
Section 4.14	A minimum of 2500 hectares will be revegetated as woodland vegetation as part of the ecological mitigation commitments. Approximately 250 hectare of the woodland area has been identified as being suitable for Central Hunter Ironbark – Spotted Gum – Grey Box Forest with remaining areas predominantly Central Hunter Grey Box – Ironbark Woodland. The void area will also be planted to these woodland communities, noting however that this area will be progressively flooded as water levels in the void rise over approximately 500 years.	Entire site	In progress
Section 4.14	The remaining 800 hectares of rehabilitated project disturbance footprint will comprise a mixture of grassland associated with the 330kV Transmission Line Easement (approximately 43 hectares), additional woodland revegetation and other land uses identified during the closure process. The areas identified as having potential for agricultural productivity comprise approximately 260 hectares.	Entire site	In progress
Mod 3 SEE (Umwelt, 2019)			
Section 8	Post-mining, the additional disturbance of 20.2 ha will be rehabilitated and whilst the predominant post-mining land use will be native vegetation, that land (outside the final void) will be capable of being used for other purposes.	Southe Pit Extension Area	To be undertaken at mine closure
Section 8	Progressive rehabilitation will be undertaken on the outer faces of overburden emplacement areas to reduce the duration of visible soil exposure, including the use of temporary rehabilitation as appropriate.	Entire Site	In progress
Section 6	Outer slopes of in-pit emplacement areas will battered to a (toe to crest) slope of up to 14°.	In-pit emplacement areas	In progress
Section 6	Eastern Emplacement Areas will be developed to a (toe to crest) slope of up to 14°.	Eastern Emplacement Area	In progress
Section 6	In-pit emplacement areas will be emplacement to approximately 160 m AHD with selected areas emplaced to 175 m AHD to accommodate the incorporation of micro-relief landform features.	In-pit emplacement areas	In progress
Section 6	The western highwall will be retained in final landform, while lower sections of northern highwall will be retained in final landform below pit lake equilibrium level.	Western and Northern Highwalls	To be undertaken at mine closure
Section 6	The northern and southern internal slopes of the final void will be battered to (toe to crest) with slopes ranging between 10° and 18°.	Final void	To be undertaken at mine closure
Section 6	Establish native woodland vegetation across majority of the operation including highwall benches and battered low wall slopes (except where benches used for drainage flows or safety constraints restrict access to benches).	Entire Site	In progress

4.2 Post-Mining Land Use Goal

The goal of post-mining land use at Bulga Coal is establishment of open woodlands on spoil dumps and riparian communities along established drainage lines. The final void will also be revegetated using woodland species however it is noted that the void will progressively fill (to approximately -40 mAHD) with water over a 500 year period. A minimum of 260 ha of land within the BOC disturbance area will be returned to a landform suitable for agricultural use. The post-mining landform and land capability is shown on Plan 4 (refer to **Appendix 1**).

The proposed land use has been developed in consideration of a number of factors including existing strategic land use objectives and site opportunities/constraints.However, in recognition of the long operational life of the project (approximately 19 years), the potential for other sustainable and economically productive post-closure land uses will be investigated in light of the local and regional land use strategies that may have further evolved towards the end of mine life. This process will be undertaken as part of the Glencore detailed mine closure process and in consultation with relevant stakeholders.

The post-mining land use goal is the combination of objectives contained in the Bulga Optimisation Project approval (for the BOC), the BUO 2003 EIS and Mod 3 SEE (Umwelt, 2019). In summary, the land associated with BUO to the east of Charlton Road is either contained within the footprint of the BOC 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.

4.3 Rehabilitation Objectives

The rehabilitation of the site will primarily involve the establishment of the Central Hunter Grey Box – Ironbark Woodland community with smaller areas of Central Hunter Ironbark – Spotted Gum – Grey Box Forest in the southern portion of the site. Suitable riparian species will also be established in drainage lines in the post-mining landform.

The rehabilitation objectives for Bulga Coal are to:

- Provide for the safety of employees and the public during and following the closure of the mining operations;
- Provide a sustainable, natural looking final landform that can co-exists with surrounding land uses, including the final landforms of surrounding mines;
- Create a final void that is stable and creates a range of potential end land uses;
- Adequately cap and rehabilitate all tailings storage facilities;
- Establish the following sustainable vegetation communities in rehabilitation areas;
    - 2,321 ha of Central Hunter Grey Box – Ironbark Woodland;
    - 250 ha of Central Hunter Ironbark – Spotted Gum – Grey Box Forest;
    - 50 ha of Central Hunter Swamp Oak Forest; and
    - 260 ha of suitable agricultural land.
- Develop native vegetation corridors linking remnant areas (including biodiversity offset areas) to the south and east and to the north with the proposed native vegetation areas of Mount Thorley and Warkworth mines.

In achieving these objectives, Bulga Coal Management Pty Ltd will also aim to:

- Minimise the potential environmental impacts from closure activities;
- Comply with relevant regulatory requirements and attain regulatory consensus on the successful closure and rehabilitation of the site; and
- Reduce the need for long term monitoring and maintenance by achieving effective rehabilitation.

4.4 Proposed Post-Mining Landform

The post-mining landform was developed as part of the planning process for the EIS (Umwelt, 2013a), RAPAR (Umwelt, 2013b) and revised with Mod 3. This approved final landform is presented in Plan 4 (refer **Appendix 1**).

4.4.1 Final Void and Highwall

Three different treatments of the final void were considered in the project planning process. Of all the void options considered, the proposed indicative final landform is considered to be the most sustainable option due to the following:

- The footprint of the final void is the smallest of the options considered;
- Based on geotechnical investigations benching the highwall is considered the most stable option;
- In consideration of the alignment of the final highwall and the screening effect of the Noise and Visual Bund and other rehabilitated overburden areas, views from public viewing locations will be limited. Further, given the revegetation strategy of establishing trees on the benches, there will be minimal impacts to the aesthetic value of the local area; and
- The quantity of earthworks and associated environmental impacts required to reshape the highwall and low walls at cessation of mining to achieve the required profile is significantly less that that required for other options evaluated.

The final void will retain the western highwall and lower sections of northern and southern highwall below pit lake equilibrium level. The proposed selected highwall benches will be progressively revegetated where practicable with native species over the life of the operation as mining progresses to the lower seams to minimise visual impact and to provide habitat. Potential safety issues associated with the retained highwall are also considered to be manageable through the development of a bund or berm at the top of the highwall to prevent inadvertent access.

Bulga Coal Management Pty Ltd will validate and re-calibrate (if needed) the groundwater model on a three yearly basis as per the Site Water Management Plan. With each revision of the groundwater model the water balance model (that includes groundwater inflows) will be used to simulate the final void water level recovery to assist in refining the final landform. The revised water balance model and water quality data will also be used to refine the long term pit lake hydrochemistry predictions.

Based on the mine design and depth of coal seams, a single void will remain at the completion of mining. The key design features and processes associated with the final void, particularly to minimise impacts to public safety as well as reduce the sterilisation of land available for future post-mining land uses include:

- The highwall will comprise a series of benches that will be constructed progressively as mining operations commence in the lower seams. The stability of the highwall will be assessed by a suitable qualified geotechnical engineer and appropriate stabilisation measures will be installed (where required) progressively;

- Geotechnical assessments of the highwalls and highwall benches will be undertaken and armouring/ highwall shaping undertaken where necessary to improve long term stability;
- Low wall slopes will be established in stages. Battering and the establishment of areas of the low wall forming the final landform will occur as the stages are progressively established. Drainage across battered slopes will also be established progressively;
- A trench and/or safety berm will be established along the top of the retained section of the highwalls or the top of the battered section of overburden emplacement slopes above the highwalls. The bunds will be designed to divert surface water runoff away from the highwall and restrict inadvertent access to the highwalls. This berm and associated drainage will also prevent runoff from the Noise and Visual Bund landform from flowing over the face of the highwalls, whilst diverting the bulk of surface water away from the final void and maximising replenishment of the local catchment areas;
- Where feasible, opportunities to direct water flows to hard rock and vegetated areas will be used to limit erosion risks and reduce long term management associated with constructed drop structures on spoil.
- The detailed design of the drainage on the highwalls in the final landform will be defined in the MOP/RMP developed for the mine closure process. The development of the detailed drainage design for the final landform will have regard to erosion modelling and geotechnical assessments to confirm long term stability of the high walls;
- Battered slopes will be revegetated to suitable woodland species mix generally consistent with the remainder of the rehabilitated landform having regard to soil characteristics;
- Internal void slopes will be progressively topsoiled and vegetated as the final landform slopes are established (i.e. rehabilitation will commence as the final landform slopes are established);
- Seeding will be undertaken using safe methods appropriate for the slope conditions for both initial and infill seeding;
- The hydrological simulation of the final landform (at closure) indicates that the void will be a long-term hydraulic sink with the void lake equilibrium level (-40 mAHD) being approximately 100 m below the potential spill level (64 mAHD). This system will comprise an open water pit lake within the confines of the final pit shell open void; and
- Note access along the highwalls may be retained for maintenance purposes.

A Final Void Management Plan will be developed and included in the Final Mine Closure Plan. The Final Mine Closure Plan will be submitted to the appropriate regulatory agencies for approval two years prior to cessation of mining.

The anticipated location of the final void has been provided on Plan 4 (refer **Appendix 1**). The final void is anticipated to have a surface area of approximately 297 ha.

4.4.2 Overburden Emplacement Areas

During the life of the operations overburden emplacement areas will be established in accordance with design considerations including:

- All emplacement within in-pit emplacement areas will be developed to approximately 160 mAHD with selected areas emplaced to 175 mAHD;
- The out-of-pit emplacements (Noise and Visual Bund and Eastern Emplacement Area) will be developed to approximately 150 mAHD with selected areas to 165 mAHD;

- All final landform slopes will be battered to an average of 10˚ (except some areas of the Noise and Visual Bund (>10° but <14˚), the Eastern Emplacement Area (14°) and outer slopes of in-pit emplacement areas (toe to crest slope of up to 14°) to minimise erosion risk. Concave convex profiles will be incorporated into the landform design;
- Overburden emplacement areas will include variation in vertical relief to prevent ponding of surface water and create a profile that is commensurate with the natural local topography; and
- The footprint of the overburden emplacement areas, in particular the Noise and Visual Bund, has been designed to create a more natural profile.

4.5 Detailed Mine Closure Planning

Bulga Coal Management Pty Ltd will commence the detailed mine closure planning process at least 5 years prior to the anticipated mine closure date (i.e. the planned cessation of mining). Based upon current approvals mining operations at Bulga Coal will cease in 2039. Detailed mine closure planning will include:

- The final landform will be reviewed and finalised at least 7 years prior to the planned closure date with a detailed assessment of predicted water quality and void recharge undertaken as part of this process;
- Groundwater impact assessments associated with detailed planning for mine closure will be undertaken at least 7 years prior to planned closure of the mine to assist with refinement of the final landform to minimise long term impacts associated with mine closure;
- In accordance with the GCAA Mine Closure Planning Standard, a social impact assessment will be undertaken leading up to the development of a detailed mine closure plan (e.g. within five years of life of mine);
- A detailed mine closure plan will be developed at least two years prior to the anticipated mine closure date, in accordance with Glencore standards for mine closure. During the development of the mine closure plan, consultation will be undertaken with relevant government agencies and the local community;
- Prior to the site being placed on care and maintenance, Bulga Coal will investigate and facilitate post-mining beneficial land uses for the site (including the final void), that addresses requirements of SSD-4960 Schedule 3 Condition 55(f); and
- A final void management plan will be developed and included in the mine closure plan. The final closure plan will be submitted to the appropriate regulatory agencies for approval two years prior to cessation of mining.

5.0 REHABILITATION PLANNING AND MANAGEMENT

Rehabilitation planning and management at BOC is an integrated component of the Life of Mine (LOM) process. Rehabilitation planning is undertaken on a long-term, annual (medium-term) and short-term basis through the execution of a site-specific rehabilitation process map that has been developed to facilitate achievement of rehabilitation objectives and targets on a day to day basis.

The following sections outline the rehabilitation planning processes and objectives/criteria for BOC, in accordance with the requirements of SSD-4960 and *ESG3: Mining Operations Plan (MOP) Guidelines* (DRG 2013).

5.1 Domain Selection

In accordance with *ESG3: Mining Operations Plan (MOP) Guidelines* (DRG 2013), Bulga Coal has been categorised into a series of primary (operational) domains and secondary (post-mining land use) domains, as outlined in **Table 13**. Primary domains at the commencement of the MOP term have been illustrated on **Plan 2** and the proposed post-mining land use (secondary domains) that these operational areas will be rehabilitated to following the cessation of mining at Bulga Coal have been shown on Plan 4 (refer to **Appendix 1**). The primary domains have been defined on the basis of existing land management units within the mine site which have similar operational purposes and therefore similar geophysical characteristics. The secondary domains have been defined as land management units characterised by similar post-mining land use objectives.

Table 13 - Primary and Secondary Domains

Primary Domain	Code	Secondary Domain	Code
Infrastructure – Existing infrastructure and facilities including the tailings relocation infrastructure, the pit top, workshops, administration buildings, access roads, haul roads, hardstand/laydown areas, topsoil stockpiles, and underground infrastructure (ventilation shafts, and boreholes). Note: This domain excludes public infrastructure including the Broke Road realignment, water pipelines, transmission lines and associated easements as they will remain the property of the infrastructure owner/provider following the cessation of mining operations and will remain in the final landform.	1	**Final Void** – The void will be rehabilitated with woodland communities, noting however that this area will be progressively flooded as water levels in the void rise over approximately 500 years.	A
Emplacement Areas – The footprint for the BOC out of pit and in-pit emplacement areas.	2	**Rehabilitation/Woodland** – Areas to be rehabilitated with woodland species commensurate with adjacent remnant vegetation. Includes rehabilitation to be undertaken on some subsidence areas, some existing infrastructure areas, and open cut mining areas.	B
Active Mining – The footprint of the BOC active mining areas.	3	**Pasture** – Areas to be rehabilitated with selected grasses and pasture species. Includes rehabilitation to be undertaken on some subsidence areas.	C
Tailings Emplacement – Includes all current tailings emplacement areas.	4	**Water Management Area** – Various dams and surface water management structures to be retained in perpetuity.	D

Primary Domain	Code	Secondary Domain	Code
Rehabilitation Woodland – Includes all lands that have undergone rehabilitation using woodland vegetation species.	5		
Rehabilitation Pasture – Includes all lands that have undergone rehabilitation using selected grass and pasture species.	6		
Surface Water / Dams – Network of dams and associated water management infrastructure.	7		
Conservation Area – Includes the Warkworth Sands Woodland conservation area, Weeping Myall Management Area, offsite offsets (the Condran Property Biodiversity Offset Area, 'Vere Offset Site' and the Reedy Valley Offset Areas) and the River Red Gum Woodland Offset Area.	8		
Vegetation Re-establishment Area – Includes the River Red Gum restoration area.	9		
Subsidence Management Area – Areas to be actively managed for potential subsidence related impacts during the MOP term. The domain area is defined by the combination of the subsidence areas (defined by subsidence predictions or if unavailable, the 26.5˚ angle of draw).	10		

The Subsidence Management Area primary domain is specific to the BUO MOP. Although domain areas are included for consistency across Bulga Coal, the domain is not considered further within this document.

5.2 Domain Rehabilitation Objectives

Rehabilitation domains require specific management objectives to realise the desired final land use outcome due to the distinct geophysical features associated with the current land function. The rehabilitation objectives for the domains identified in **Section 5.1** are defined in **Table 14**.

Table 14 – Domain Rehabilitation Objectives

Domain	Rehabilitation Objectives
Primary Domains	
Domain 1 – Infrastructure	• All infrastructure removed; • All portals sealed to RR standards; • All hazardous materials and contaminated materials removed; • Gas drainage infrastructure removed and bore holes sealed; • Groundwater piezometers sealed; • Landform generally blends in with surrounding landscape and is stable; • Water quality non-polluting and appropriate for conservation end land use; • Native woodland ecosystems or native grass pastures established consistent with analogue vegetation communities; • Land and Soil Capability Class 6 – 8; • Pre-disturbance land capability to be maintained; • Ecosystem health satisfying completion criteria; • Ecosystem structure satisfying completion criteria; and • Ecosystem composition satisfying completion criteria.

Domain	Rehabilitation Objectives
Domain 2 –Emplacement Area	• All open cut and underground mining infrastructure removed; • All hazardous materials and contaminated materials removed; • Landform generally blends in with surrounding landscape and is stable; • Water quality non-polluting and appropriate for conservation end land use; • Native woodland ecosystems established consistent with analogue vegetation communities; • Land and Soil Capability Class 6 or 7; • Ecosystem health satisfying completion criteria; • Ecosystem structure satisfying completion criteria; and • Ecosystem composition satisfying completion criteria.
Domain 3 – Active Mining	• All open cut and underground mining infrastructure removed; • All hazardous materials and contaminated materials removed; • Landform generally blends in with surrounding landscape and is stable; • Water quality non-polluting and appropriate for conservation end land use; • Native woodland ecosystems established consistent with analogue vegetation communities; • Land and Soil Capability Class 6 – 8; • Ecosystem health satisfying completion criteria; • Ecosystem structure satisfying completion criteria; and • Ecosystem composition satisfying completion criteria.
Domain 4 – Tailings Emplacement	• All hazardous materials and contaminated materials removed; • All tailings infrastructure removed; • Landform generally blends in with surrounding landscape and is stable; • Water quality non-polluting and appropriate for conservation end land use; • Native woodland ecosystems established consistent with analogue vegetation communities; • Land and Soil Capability Class 7; • Ecosystem health satisfying completion criteria; • Ecosystem structure satisfying completion criteria; and • Ecosystem composition satisfying completion criteria.
Domain 5 – Rehabilitation Woodland	• All hazardous materials and contaminated materials removed; • Landform generally blends in with surrounding landscape and is stable; • Water quality non-polluting and appropriate for conservation end land use; • Native woodland ecosystems established consistent with analogue vegetation communities; • Land and Soil Capability Class 6 – 8; • Ecosystem health satisfying completion criteria; • Ecosystem structure satisfying completion criteria; and • Ecosystem composition satisfying completion criteria.
Domain 6 – Rehabilitation Pasture	• All hazardous materials and contaminated materials removed; • Landform generally blends in with surrounding landscape and is stable; • Water quality non-polluting and appropriate for conservation end land use; • Native grass pastures established consistent with analogue vegetation communities; • Land and Soil Capability Class 6; • Ecosystem health satisfying completion criteria; • Ecosystem structure satisfying completion criteria; and • Ecosystem composition satisfying completion criteria.

Domain	Rehabilitation Objectives
Domain 7 – Surface Water/Dams	• All hazardous materials and contaminated materials removed; • Landform generally blends in with surrounding landscape and is stable; and • Water quality non-polluting and appropriate for conservation end land use; • Native woodland ecosystems established consistent with analogue vegetation communities; • Land and Soil Capability Class 6 – 8; • Ecosystem health satisfying completion criteria; • Ecosystem structure satisfying completion criteria; and • Ecosystem composition satisfying completion criteria.
Domain 8 – Conservation Area	• All hazardous materials and contaminated materials removed; • Gas drainage infrastructure removed and bore holes sealed; • Groundwater piezometers sealed; • Landform generally blends in with surrounding landscape and is stable; • Water quality non-polluting and appropriate for conservation end land use; • Native ecosystems established consistent with analogue vegetation communities • Ecosystem health satisfying completion criteria; • Ecosystem structure satisfying completion criteria; and • Ecosystem composition satisfying completion criteria.
Domain 9 – Vegetation Re-establishment Area	• This domain is associated with voluntary enhancement of River Red Gum Woodland along Wollombi Brook. Accordingly there are no rehabilitation objectives relevant to this domain.
Secondary Domains	
Domain A – Final Void	• All open cut and underground mining infrastructure removed; • All hazardous materials and contaminated materials removed; • Risk of coal seam spontaneous combustion minimised; • Risk of acid rock drainage is minimised; • Landform generally blends in with surrounding landscape and is stable; • Water quality non-polluting and appropriate for end land use; • Vegetation ecosystems established consistent with analogue vegetation communities; • Land and Soil Capability Class 8; • Ecosystem health satisfying completion criteria; • Ecosystem structure satisfying completion criteria; and • Ecosystem composition satisfying completion criteria.
Domain B – Rehabilitation/Woodland	• All hazardous materials and contaminated materials removed; • Gas drainage infrastructure removed and bore holes sealed; • Groundwater piezometers sealed; • Landform generally blends in with surrounding landscape and is stable; • Water quality non-polluting and appropriate for conservation end land use; • Native woodland and riparian ecosystems established consistent with analogue vegetation communities; • Land and Soil Capability Class 6 – 8; • Ecosystem health satisfying completion criteria; • Ecosystem structure satisfying completion criteria; and • Ecosystem composition satisfying completion criteria.

Domain	Rehabilitation Objectives
Domain C – Pasture	• All hazardous materials and contaminated materials removed for areas of mine infrastructure; • Gas drainage infrastructure removed; • Groundwater piezometers sealed; • Landform generally blends in with surrounding landscape and is stable; • Water quality non-polluting and appropriate for conservation end land use; • Maintenance of existing agricultural land use; • Drainage along tracks to be stable; • Pre disturbance land capability to be maintained; • Land and Soil Capability Class 6; • Ecosystem health satisfying completion criteria; • Ecosystem structure satisfying completion criteria; and • Ecosystem composition satisfying completion criteria.
Domain D – Water Management Area	• All hazardous materials and contaminated materials removed for areas of mine infrastructure; • Landform generally blends in with surrounding landscape and is stable; and • Water quality within EPL criteria and rehabilitation performance criteria established within this document.

5.3 Rehabilitation Phases

The ultimate rehabilitation objective for Bulga Coal is to create stable, non-polluting post-mining landforms that are cognisant of site constraints and allow the achievement of the agreed post-mining land uses. This will be achieved through a series of conceptual stages which are described as:

1. **Decommissioning** – removal of hard stand areas, buildings, contaminated materials, hazardous materials;
2. **Landform Establishment** – incorporates slope, aspect, drainage, substrate material characterisation and morphology;
3. **Growth Medium Development** – incorporates physical, chemical and biological components of the growing media and ameliorants that are used to optimise the potential of the media in terms of the preferred vegetative cover;
4. **Ecosystem and Land Use Establishment** – incorporates revegetated lands and habitat augmentation, species selection, species presence and growth together with weed and pest animal control /management and establishment of flora;
5. **Ecosystem and Land Use Sustainability** – incorporates components of floristic structure, nutrient cycling recruitment and recovery, community structure and function which are the key elements of a sustainable landscape; and
6. **Land Relinquishment** – completion criteria for rehabilitation are met and the land is determined to be suitable to be relinquished from the mining tenement.

These rehabilitation phases have been based on the rehabilitation monitoring undertaken at Bulga Coal against the performance criteria discussed below. The progression of rehabilitation phases as outlined in this MOP and illustrated on **Plans 3A – 3D**.

Plates 1 - 3 provide examples of the range of growth in vegetation in rehabilitation phases 3 and 4 at Bulga Coal at the commencement of the MOP. These examples have been taken from recent rehabilitation monitoring, further details of which are included in **Section 8**. It is noted that although rehabilitation monitored at a particular site may have satisfied performance indicators for a particular

rehabilitation phase, a site has only been considered to have reached a rehabilitation phase once all criteria have been satisfied.



Plate 1 – Phase 3 Rehabilitation at NB6



Plate 2 – Phase 4 Rehabilitation at NVB1



Plate 3 – Phase 4 Rehabilitation at NVB2

Table 15 provides a summary of the expected completion of rehabilitation phases for each relevant primary domain at the end of the MOP term. The project rehabilitation phases in year 2023 have been shown on **Plan 3D** (refer to **Appendix 1**).

Table 15 – Summary of Rehabilitation Phases Proposed for Completion at end of the MOP Term

Domain / Rehabilitation Phase	Infrastructure - Final Void (1A)	Infrastructure - Rehabilitation/Woodland (1B)	Infrastructure - Pasture (1C)	Infrastructure – Water Management Area (1D)	Emplacement - Final Void (2A)	Emplacement - Rehabilitation/Woodland (2B)	Active Mining - Final Void (3A)	Active Mining - Rehabilitation/Woodland (3B)	Tailings Emplacement - Final Void (4A)	Tailings Emplacement - Rehabilitation/Woodland (4B)	Rehabilitation/Woodland - Rehabilitation/Woodland (5B)	Rehabilitation/Woodland – Pasture (5C)	Pasture - Rehabilitation/Woodland (6B	Pasture - Pasture (6C)	Surface Water/Dams – Final Void (7A)	Surface Water/Dams - Rehabilitation/Woodland (7B)	Surface Water/Dams - Pasture (7C)	Surface Water/Dams - Water Management (7D)	Conservation Area - Rehabilitation/Woodland (8B)	Vegetation Enhancement - Rehabilitation/Woodland (9B)	Subsidence Management - Rehabilitation/Woodland (10B)	Subsidence Management - Pasture (10C)
Active	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Phase 1 – Decommissioning	×	×	×	×	×	×	×	×	×	×	✓	✓	✓	✓	×	×	×	×	✓	✓	×	×
Phase 2 – Landform Establishment	×	×	×	×	×	×	×	×	×	×	✓	✓	✓	✓	×	×	×	×	✓	✓	×	×
Phase 3 – Growth Medium Development	×	×	×	×	×	×	×	×	×	×	✓	✓	✓	✓	×	×	×	×	✓	✓	×	×
Phase 4 – Ecosystem and Land Use Establishment	×	×	×	×	×	×	×	×	×	×	✓	✓	✓	✓	×	×	×	×	✓	✓	×	×
Phase 5 – Ecosystem and Land Use Sustainability	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	✓	×	×	×
Phase 6 – Land Relinquishment	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×

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6.0 PERFORMANCE INDICATORS, AND COMPLETION/RELINQUISHMENT CRITERIA

The completion criteria are objective target levels or values that can be measured to quantitatively demonstrate the progress and ultimate success of a biophysical process. These criteria have been developed for each phase of the rehabilitation so that the rehabilitation success can be tracked throughout the life of the mine.

The performance measures quantify the rehabilitation and land management program in terms of efficiency or effectiveness and establish the indicative timeframes for completion. The performance indicators are used to define and evaluate the program, typically in terms of making progress towards the development of sustainable ecosystems whilst also providing a framework for the implementation of key activities. These indicators provide the basis for the procedural context of the site work practices. The performance indicators are attributes of the biophysical environment (e.g. pH and slope) that can be used to approximate the progression of a biophysical process and can be measured to demonstrate and track the progress of an aspect of rehabilitation towards desired completion criteria.

The criteria, measures and indicators which provide the framework for this MOP are underpinned by a range of documents which relate to land management. These include industry standards, as well as Glencore standards and procedures. The on-going development of these documents will provide the basis for the review of this MOP with resultant amendments being recorded in documents such as the Bulga Coal Annual Review.

The performance measures and associated indicators have been designed based on the template provided by the RR, and modified to suit Bulga Coal's specific requirements and approvals.

6.1 Rehabilitation Tables

The rehabilitation indicators, performance measures and completion criteria for each of the rehabilitation phases are included in **Appendix 5**. Secondary Domain D, Water Management Area, refers to the surface water management structures (dams) that will be retained in the final landform following mine closure. On this basis, none of the rehabilitation phases apply to this secondary domain.

The criteria and indicators listed in **Appendix 5** are based on the Biodiversity Assessment Methodology (BAM) as recommended by RR and BCD.

The recorded criteria, including an assessment of each rehabilitation monitoring site against the criteria, will be reported annually in the Annual Review.

7.0 REHABILITATION IMPLEMENTATION

Rehabilitation activities have been occurring at BOC (formerly Saxonvale Colliery) for more than 30 years, and as such there is considerable site history and experience with rehabilitation methods. The methodology outlined below and in the following sections represents the current practices utilised by Bulga Coal which have been developed over a number years. As outlined in **Section 12**, the annual review process provides a mechanism to review current methodologies in light of rehabilitation monitoring results, to continuously improve the way rehabilitation is undertaken at Bulga Coal.

Rehabilitation of disturbed land within Bulga Coal is designed around returning the majority of the disturbed areas to woodland habitat generally consistent with the surrounding ecological communities. Rehabilitation to achieve this objective will generally take the form of direct seeding of locally occuring tree, shrub and grass species into a growing medium established using soil removed during pre-stripping operations and/or imported material and, where conditions permit, directly into overburden. Tree and shrub seedlings may also be used in addition to direct seeding where direct seeding alone has produced suboptimal results. 'Cover crops' of non-invasive perrenial grass species will be used to provide protection for emerging shrub and tree seedlings, for rapid establishment of erosion and sediment control, and to minimise dust. Additional soil preparation works will be undertaken in flatter areas of the proposed final landform considered to have potential for grazing or other agricultural activities in the future.

Further information on the rehabilitation process is provided in **Sections 7.1** – **7.8**.

7.1 Status at MOP Commencement

The proposed state of each operational (primary) domain at the start of this MOP term is shown on Plan 2, whilst the secondary domains (post-mining land use) (Domains A – D) following the cessation of mining at Bulga Coal have been shown on Plan 4, and described in the following sections. The rehabilitation status of domains that are active, i.e. subject to on-going mining operations, is not described.

7.1.1 Domain 1 – Infrastructure

This domain includes existing infrastructure and facilities including the pit top, workshops, administration buildings, access roads, haul roads, hardstand/laydown areas, topsoil stockpiles, and underground infrastructure (ventilation shafts and boreholes). The domain is currently active, and subject to on-going operations.

7.1.2 Domain 2 – Emplacement Areas

This domain is currently active and subject to ongoing operations.

7.1.3 Domain 3 – Active Mining

This domain is currently active and subject to ongoing operations.

7.1.4 Domain 4 – Tailings Emplacement

This domain is active, and subject to on-going operations. Deep Pit and Bayswater Pit are largely full with the Main Pit TSF being the current and future TSF.

7.1.5 Domain 5 – Rehabilitation Woodland

This domain is currently active. Rehabilitation has been undertaken to date on the Noise and Visual Bund, Old Tailings Dam, Southern Extension Dump, Eastern Emplacement Area and Old BHP Rehabilitation Area.

7.1.6 Domain 6 – Rehabilitation Pasture

Currently the following areas can be associated wit rehabilitated pasture:

- Areas of the noise and visual bund;
- Small sections of the Eastern Emplacement Area;
- Sections adjacent to Broke Road (south east of the Bayswater Pit);
- Around CHPP SD-C8; and
- Other small areas around BOC.

7.1.7 Domain 7 – Surface Water/Dams

This domain is active and subject to on-going operations. Water management infrastructure at Bulga Coal at MOP commencement consists of:

- Northern Dam;
- Beltana Stat Dam;
- Blakefield South Stat Dam;
- Fill Point 1 Storage Dam;
- 60 ML Dam;
- CHPP Surge Dam;
- Dams C1, C2, C11, C12;
- Dams C4, C7, C9, C10, X, Y and Billabong;
- Dam C3;
- Vaux Pit;
- Bayswater Pit;
- Whybrow Void;
- Dam 13;
- Sediment Dams S1, S2, S2a, S3, S6a, S10 and S22;
- Dam S7;
- Dam MW22; and
- ROM B Dam

7.1.8 Domain 8 – Conservation Area

This domain is active and will be monitored by Bulga Coal during the MOP term.

7.1.9 Domain 9 – Vegetation Re-establishment Area

This domain is active and will be monitored through quarterly rehabilitation inspections by Bulga Coal during the MOP term.

7.1.10 Domain A – Final Void

There is currently no final void at Bulga Coal, and this will not exist during the MOP term.

7.1.11 Domain B – Rehabilitation/Woodland

Bulga Coal has been largely cleared of native woodlands in the past for grazing, cultivation and mining, resulting in the presence of extensive grasslands interspersed with scattered remnants and areas of regenerating woodland communities.

Excluding BUO and Old Tailings Dam rehabilitation, all rehabilitation to the east of Charlton Road is associated with this domain. Rehabilitation undertaken at MOP commencement by BOC has predominantly been associated with the Noise and Visual Bund, Old Tailings Dam, South Blakefield Dump, North Blakefield Dump, Southern Extension Dump, Eastern Emplacement Area and Old BHP Rehabilitation Area. Rehabilitation of drainage lines in this domain has also occurred, including the reshaping of gully sides, construction of sediment dams, stabilisation of the gully floor, and the planting of Swamp Oak Forest species.

7.1.12 Domain C – Pasture

This domain generally includes the rehabilitation to be undertaken within existing agricultural lands located to the west of Charlton Road, excluding existing areas of woodland vegetation and some areas east of Charlton Road (BUO and Old Tailings Dam rehabilitation). Additionally this primary domain is also associated with a number of small areas above the southern extent of the Blakefield South Mine, to the east of Broke Road. The locality of this domain in the context of the final landform has been shown on Plan 4 (refer to **Appendix 1**).

Rehabilitation undertaken at MOP commencement predominantly involved gas drainage rehabilitation and subsidence remediation. Details for these activities have been included in the BUO MOP.

7.1.13 Domain D – Water Management Area

This domain refers to the surface water management structures (dams) that will be retained in the final landform following mine closure. This domain is active and subject to on-going operations. The locality of these structures that will retained in the final landform have been shown on Plan 4 (refer to **Appendix 1**).

7.2 Proposed Rehabilitation Activities this MOP Term

Short to medium term mining and rehabilitation activities (the term of this MOP) are shown in Plans 3A – 3D (refer to **Appendix 1**).**Table 16** summarises the forecast rehabilitation progress at Bulga Coal (including BOC and BUO) during the MOP term.

Long term rehabilitation management measures are identified through the annual rehabilitation planning process, annual monitoring program and annual review process.

Table 16 – Rehabilitation and Disturbance Rates during the MOP Term

	Bulga Coal (BOC and BUO)			
	Total Disturbance Area (ha)	**Total Rehabilitation Area (ha)**	**Cumulative Rehabilitation Areas (ha)**	**Comments**
Start of MOP term (July 2020)	2,380.9	-	1,040.9	Refer to Plan 2
2020 (July - December)	32.1	86.2	1,114.3	Disturbance associated with increase to the Eastern Emplacement Area. Rehabilitation associated with the Eastern Emplacement Area. Refer Plan 3A
2021	24.0	35.5	1,106.6	Disturbance associated with extension of the open cut pit and powerline relocation. Rehabilitation associated with the Eastern Emplacement Area/Noise and Visual Bund. Refer Plan 3B
2022	0.4	25	1,120.5	Rehabilitation associated with the Eastern Emplacement Area. Refer Plan 3C
2023 (January - June)	0	58.9	1,143.7	Rehabilitation associated with the Eastern Emplacement Area. Cumulative rehabilitation areas reflect disturbance of rehabilitation at Blakefield Dumps to allow emplacement. Refer Plan 3D
Total	**2,339**	**205.6**	**1,143.7**	

Note: The total disturbance and cumulative rehabilitation areas consider annual disturbance to existing rehabilitation. The total rehabilitation area is only new rehabilitation undertaken in the respective calendar year. Additionally, 16.1 ha of clearing in 2021 has not been captured in this table as it only includes tree removal to allow relocation of overhead powerlines (no disturbance of groundcover or soil).

The following sections provide additional details of the proposed rehabilitation activities relevant to each domain during the MOP term.

7.2.1 Domain 1 – Infrastructure

The existing BOC infrastructure will remain in place during the MOP term with the exception of the changes decribed in **Section 2.2.2 and 2.2.6**.To accommodate the extension of mining to the southeast and west during the MOP term, construction, relocation and demolition of some open cut infrastructure will occur. Infrastructure to be constructed and relocated including the Tailings Relocation System is described in **Section 2.2.2**.

Infrastructure to be demolished and decommissioned including the Bayswater Pit and Deep Pit Tailings storage facilities will occur during the MOP term (Refer to **Section 2.2.6**). The surface water diversion bunds established prior to and throughout the MOP term will be seeded using a cover crop to provide protection from erosion and to mitigate visual impacts from the structures. These structures will remain in place throughout the MOP term and will be subject to final rehabilitation at mine closure.

7.2.2 Domain 2 – Emplacements Areas

All rehabilitation within this domain is undertaken as outlined in **Sections 7.4 – 7.8**. The following information has been provided in accordance with the requirements of *ESG3: Mining Operations Plan (MOP) Guidelines* (DRG 2013).

Key Design Considerations

Key design considerations associated with the overburden emplacement areas are outlined below:

- The out-of-pit emplacements (Noise and Visual Bund and Eastern Emplacement Area) will be developed to approximately 150 mAHD with selected areas to 165 mAHD).
- Emplacement within in-pit emplacement areas will be developed to approximately 160m AHD with selected areas emplaced to 175 m AHD to accommodate the incorporation of micro-relief landform features.;
- A natural landform design will be developed for emplacement areas. Continuous review of dump slopes and drainage lines will occur during the construction phase, including fly-over volumes comparing as-built to the original design: and
- The footprint of the overburden emplacement areas, in particular the Noise and Visual Bund, have been designed to be irregular in shape to provide a more natural profile.

Timing and Activities Involved in Decommissioning

There will be no decommissioning associated with this domain during the MOP term.

Physical and Chemical Characteristics of Mining and Process Waste of Emplaced Material (Relevant to Rehabilitation)

As detailed in **Section 3.4.1**, the chemical properties of the overburden at Bulga Coal (sodic and dispersive with low OC) make it inherently poor to support the rehabilitation works. However, the application of ameliorants such as gypsum has been successful in the past to allow both trees and pastures to be established and maintained. Therefore this treatment process will continue to be applied to areas within this domain to be rehabilitated throughout the MOP term.

Method of Landform Establishment

BOC is progressing towards natural landform design for in-pit and out-of-pit overburden emplacement areas, emphasising macro/micro-relief where practical. Non-linear rock drainage lines will be constructed in these areas to control water movement across the landform. Drainage structure designs will be based on catchment size and slope length. Drainage in relevant in-pit areas will incorporate macro-relief and micro-relief and drainage features that mimic natural topography and mitigate erosion.

Following shaping, habitat augmentation and topsoil spreading, areas will be contour ripped to a nominal depth of 450 mm and seeded with species from targeted locally occurring vegetation communities and non-invasive perennial cover crops.

Final Landform Profile and Slopes

The final landform profile is shown in **Plan 4**, with external slopes regraded to 10˚ within this domain, except some areas of the Noise and Visual Bund (>10° but <14˚) and the Eastern Emplacement Area (14°) and outer slopes of in-pit emplacement areas (toe to crest slope of up to 14°).

The northern and southern internal slopes of the final void will be battered to (toe to crest) with slopes ranging between 10° and 18°.

Characteristics of all Cover Material Including Sealing/Drainage Layers, Subsoil/Topsoil

The existing topsoil stockpiles at Bulga Coal are generally in a moderate to poor condition and often contain weeds species however continue to provide value for rehabilitation purposes. Where suitable quality topsoil is available, it is stripped, stockpiled and revegetated with cover crop. Wherever practicable, topsoil will be transferred directly from stripping location to areas that have been reshaped for rehabilitation, eliminating the need for storage and rehandling.

Thickness of Cover Layers and Methods of Laying and Compaction Including Topsoil, Imported Substrate Material

Topsoil is spread over the rehabilitation, generally to a depth of 100 mm. The depth of topsoil depends on the topsoil quality, availability and use of other organic matter. Additionally, testing of the topsoil and overburden is undertaken to determine any amelioration requirements. This normally includes the application of gypsum to treat the topsoil which is generally of poor quality (low OC, sodic and dispersive).

Following application of the topsoil and required ameliorants, the rehabilitation area is ripped to a depth of 450 mm. This allows for the partial mixing of topsoil, ameliorants and overburden, as well as creating a softer, furrowed surface for seeding.

Drainage and Erosion Control Methods

BOC is progressing towards natural landform design for in-pit and out-of-pit overburden emplacement areas, however contour banks and non-linear rock structures will be constructed in 2020. Drainage will be managed through natural drainage design to safely convey run-off down the slope at non-erosive velocities.

Soil Amelioration/Treatment Methods

Application of soil ameliorants such as gypsum or compost is used to facilitate woodland and grass establishment. The area is treated at rates determined by soil testing to ameliorate dispersion, increase nutrients and OC levels to those needed to sustain cover crops, woodland species and grasses.

Vegetation Species and Establishment Techniques

Locally collected seed will be supplemented with seed purchased from external suppliers when necessary as discussed in **Section 7.8.1**. The seed mix will consist of species listed in **Appendix 6** subject to seasonal variation in seed availability.

The majority of revegetation works will be via direct seeding using a rotary spreader towed by tracked machinery, or a drone. Hydroseeding and hydromulching techniques will be utilised where required by specific site conditions in this domain. For additional detail on revegetation methods refer **Section 7.8**.

Management of Cleared Vegetation

During the MOP term approximately 32 ha of existing vegetation will be cleared for the continued establishment of the the Eastern Emplacement Area and the extension of mining areas to the south and west. Progressive re-disturbance of mine rehabilitation on the in-pit emplacement area, behind the noise and visual bund will begin during the MOP term. The re-disturbance of an eventual 200 ha of

existing rehabilitation is required to raise the height of the in-pit emplacement area to accommodate the incorporation of natural relief landform features. Following the raising of the in-pit emplacement area to the revised final height, the newly formed area will be shaped in accordance with the final landform design and rehabilitated. This process is expected to be undertaken in phases, taking approximately two to four years after re-disturbance and overburden emplacement to rehabilitate (therefore outside of the current MOP term). Conceptual progressive re-disturbance and re-establishment is shown in Plans 3A – 3D. Cleared vegetation will be mulched and incorporated into topsoil stockpiles in cases where it will be stored for more than 12 months (with the exception of hollow bearing trees which will be salvaged and used for habitat). This will allow time for the mulch to compost and not adversely affect seed. If the topsoil will be used within 12 months, the mulch will be stored separately, or the vegetation will be not mulched and used as woody debris for habitat.

Habitat Establishment Techniques

Rock or woody debris (where available) will be included in rehabilitation in this domain to encourage habitat establishment.

Following ripping, the area is rock raked to remove rocks greater than 200 mm. On flatter areas, these rocks are pushed into sporadic piles to create habitat within the rehabilitation areas. Rock piles will not be utilised on slopes as they have the potential to concentrate runoff and cause erosion problems. Rocks less than 200 mm are left on the surface to provide surface protection until vegetation is established and micro-habitats are formed.

Maintenance Activities/Requirements

Maintenance of rehabilitated lands within this domain will be undertaken as required. This will include, but not be limited to, control of weeds and pests, stabilisation and rehabilitation of any eroded or degraded areas, infill planting and/or seeding to meet vegetation community requirements and management of erosion and sediment control.

7.2.3 Domain 3 – Active Mining

During the MOP term the current mining areas will migrate to the southeast and west. For further details on the progression of active mining areas refer to **Section 2.2.3**, Plan 3A - 3D and Plan 5.

This domain is active and subject to on-going operations during the MOP term.

7.2.4 Domain 4 – Tailings Emplacement

To accommodate the progression of mining to the southeast tailings currently located in the Deep Pit TSF and the Bayswater Pit TSF (approximately 29,032,848 bcm in total) will be pumped to the Main Pit TSF. This will require the Tailings Relocation System (consisting of a series of pipes, pumps and dredges) to be installed and operated during the MOP term. Dredging/ pumping will be started in the Bayswater Pit TSF, and will progress to Deep Pit North and then to Deep Pit South. Dredging/ pumping is scheduled to begin in 2022 and is expected to be completed in 2027. The infrastructure required for the transfer of tailings is detailed in **Section 2.2.2** and shown on **Figure 3**.

Tailings management methods during the MOP term are outlined in **Section 2.2.4**.

7.2.5 Domain 5 – Rehabilitation Woodland

Existing rehabilitation areas at MOP commencement will undergo monitoring and maintenance during the MOP term. The annual rehabilitation inspections will continue, with results reported in the Annual Review for submission to government agencies and relevant stakeholders.

Note some disturbance of existing rehabilitated woodland will be disturbed on the North and South Blakefield Dump, and Southern Extension Dump areas during the MOP term to accommodate the pit extension and associated overburden emplacement.

Specific details of rehabilitation monitoring undertaken at Bulga Coal are included in **Section 8**.

7.2.6 Domain 6 – Rehabilitation Pasture

Temporary pasture rehabilitation will be undertaken during the MOP term to reduce the duration of visible soil exposure associated with planned operations. Note temporary pasture rehabilitation will not be differentiated from 'permenant' pasture rehabilitation on the MOP Plans. Rehabilitation within this domain has been undertaken by BUO, however this will be addressed separately in the BUO MOP.

7.2.7 Domain 7 – Surface Water/Dams

During the MOP term a number of existing dams will be relocated or expanded to allow the establishment of new emplacement areas and the expansion of the open cut mining area associated. For further details refer to **Section 2.2.2**.

The landform for the out-of-pit emplacement areas (Eastern Emplacement Area and Noise and Visual Bund) has been designed to direct runoff away from the final void and into a series of new dams that have been constructed around the extent of the emplacements. Drainage structures will be designed to minimise scouring associated with anticipated runoff. Where practicable, drainage lines will be designed to be commensurate with natural landforms.

Dams forming part of the mine water management system will be removed unless utilised for habitat purposes or subsequent land uses. De-silting of sediment dams and the removal of sediment from mine water dams will occur as necessary as part of the closure and rehabilitation purpose regardless of the suitability of the dams for other purposes.

7.2.8 Domain 8 – Conservation Area

Existing vegetation in this domain at MOP commencement will undergo monitoring and maintenance during the MOP term. During the MOP term a biodiversity offset site 'Vere Offset Site' (refer to Plan 4) will be managed in accordance with the Biodiversity Managment Plan. The annual monitoring/inspections will continue, with results reported in the Annual Review for submission to government agencies and relevant stakeholders.

7.2.9 Domain 9 – Vegetation Re-establishment Area

Existing vegetation in this domain at MOP commencement will undergo monitoring and maintenance during the MOP term.

7.2.10 Domain A – Final Void

There is currently no final void at Bulga Coal, and this will not exist during the MOP term.

7.2.11 Domain B – Rehabilitation/Woodland

Existing rehabilitated areas within this domain will continue to be maintained and monitored as discussed in **Section 7.2.5**.

Proposed rehabilitation within this domain will be undertaken along the extent of the Noise and Visual Bund, the North Blakefield Dump, the Eastern Emplacement Area and the Old Tailings Dam as shown in **Plans 3A – 3D**.

All rehabilitation is undertaken as outlined in **Sections 7.5 – 7.8**.

7.2.12 Domain C – Pasture

Rehabilitation during the MOP term will generally involve progressive rehabilitation of gas drainage infrastructure and subsidence remediation by BUO. Further information will be provided in the BUO MOP.

7.2.13 Domain D – Water Management Area

This domain is associated with the surface water management structures (dams) that will be retained in the final landform following mine closure. This domain is active and subject to on-going operations.

7.3 Summary of Rehabilitation Areas during the MOP Term

The change in the areas of rehabilitation in each domain during the MOP term are summarised in **Table 17**. The areas provided in this table have been calculated for all Bulga Coal activities (i.e. the table includes all domains and disturbance from BOC and BUO including Domain 10 – Subsidence Management Area) and will be included in this MOP and the BUO MOP. This will allow for consistent reporting of Bulga Coal activities against one set of MOP projections within the Annual Review.

Table 17 - Summary of Rehabilitation Proposed during the MOP Term

Primary Domain	Secondary Domain	Code	Rehabilitation Phase	Total Area at MOP start (ha)	Area at end of MOP (ha)	Comment
Infrastructure (1)	Final Void (A)	1A	Active	39.1	23.0	The reduction of infrastructure areas will result from the extension of open cut mining to the south and west.
			Decommissioning	-	-	
			Landform Establishment	-	-	
			Growth Medium Development	-	-	
			Ecosystem and Land Use Establishment	-	-	
			Ecosystem and Land Use Sustainability	-	-	
			Relinquished Lands	-	-	
Domain Total				**39.1**	**23.0**	
Infrastructure (1)	Rehabilitation/Woodland (B)	1B	Active	445.5	466.3	Increase in area will result from the tailings relocation project.
			Decommissioning	-	-	
			Landform Establishment	-	-	
			Growth Medium Development	-	-	
			Ecosystem and Land Use Establishment	-	-	
			Ecosystem and Land Use Sustainability	-	-	
			Relinquished Lands	-	-	
Domain Total				**445.5**	**466.3**	

Primary Domain	Secondary Domain	Code	Rehabilitation Phase	Total Area at MOP start (ha)	Area at end of MOP (ha)	Comment
Infrastructure (1)	Pasture (C)	1C	Active	5.9	5.9	These areas are associated with retained BUO gas drainage infrastructure.
			Decommissioning	-	-	
			Landform Establishment	-	-	
			Growth Medium Development	-	-	
			Ecosystem and Land Use Establishment	-	-	
			Ecosystem and Land Use Sustainability	-	-	
			Relinquished Lands	-	-	
Domain Total				**5.9**	**5.9**	
Emplacement Areas (2)	Final Void (A)	2A	Active	29.1	1.3	-
			Decommissioning	-	-	
			Landform Establishment	-	-	
			Growth Medium Development	-	-	
			Ecosystem and Land Use Establishment	-	-	
			Ecosystem and Land Use Sustainability	-	-	
			Relinquished Lands	-	-	
Domain Total				**29.1**	**1.3**	

Primary Domain	Secondary Domain	Code	Rehabilitation Phase	Total Area at MOP start (ha)	Area at end of MOP (ha)	Comment
Emplacement Areas (2)	Rehabilitation/Woodland (B)	2B	Active	1,087.0	928.8	Decrease to this domain resulting from a decrease of emplacement area footprint during the MOP term.
			Decommissioning	-	-	
			Landform Establishment	-	-	
			Growth Medium Development	-	-	
			Ecosystem and Land Use Establishment	-	-	
			Ecosystem and Land Use Sustainability	-	-	
			Relinquished Lands	-	-	
Domain Total				**1,087.0**	**931.9**	
Active Mining (3)	Final Void (A)	3A	Active	186.9	242.8	The increase to this domain is resulting from the extension of mining to the south and west.
			Decommissioning	-	-	
			Landform Establishment	-	-	
			Growth Medium Development	-	-	
			Ecosystem and Land Use Establishment	-	-	
			Ecosystem and Land Use Sustainability	-	-	
			Relinquished Lands	-	-	
Domain Total				**186.9**	**242.8**	

Primary Domain	Secondary Domain	Code	Rehabilitation Phase	Total Area at MOP start (ha)	Area at end of MOP (ha)	Comment
Active Mining (3)	Rehabilitation/Woodland (B)	3B	Active	227.8	335.9	The increase to this domain is resulting from the extension of mining to the south and west.
			Decommissioning	-	-	
			Landform Establishment	-	-	
			Growth Medium Development	-	-	
			Ecosystem and Land Use Establishment	-	-	
			Ecosystem and Land Use Sustainability	-	-	
			Relinquished Lands	-	-	
Domain Total				**227.8**	**335.9**	
Tailings Emplacement (4)	Final Void (A)	4A	Active	29.3	26.6	The decrease to this domain is resulting from tailings relocation from Bayswater Pit TSF and Deep Pit TSF to the Main Pit TSF.
			Decommissioning	-	-	
			Landform Establishment	-	-	
			Growth Medium Development	-	-	
			Ecosystem and Land Use Establishment	-	-	
			Ecosystem and Land Use Sustainability	-	-	
			Relinquished Lands	-	-	
Domain Total				**29.3**	**26.6**	

Primary Domain	Secondary Domain	Code	Rehabilitation Phase	Total Area at MOP start (ha)	Area at end of MOP (ha)	Comment
Tailings Emplacement (4)	Rehabilitation/Woodland (B)	4B	Active	84.6	108.9	The increase to this domain is resulting from the commencement of tailings relocation from Bayswater Pit TSF and Deep Pit TSF to the Main TSF.
			Decommissioning	-	-	
			Landform Establishment	-	-	
			Growth Medium Development	-	-	
			Ecosystem and Land Use Establishment	-	-	
			Ecosystem and Land Use Sustainability	-	-	
			Relinquished Lands	-	-	
Domain Total				**84.6**	**108.9**	
Rehabilitation/Woodland (5)	Final Void (A)	5A	Active	0.0	0.0	-
			Decommissioning	-	-	
			Landform Establishment	-	-	
			Growth Medium Development	-	-	
			Ecosystem and Land Use Establishment	0.8	-	
			Ecosystem and Land Use Sustainability	-	-	
			Relinquished Lands	-	-	
Domain Total				**0.8**	**0.0**	

Primary Domain	Secondary Domain	Code	Rehabilitation Phase	Total Area at MOP start (ha)	Area at end of MOP (ha)	Comment
Rehabilitation/Woodland (5)	Rehabilitation/Woodland (B)	5B	Active	-	-	The increase within this domain is resulting from rehabilitation associated with the Eastern Emplacement Area. It also reflects the expansion of in-pit emplacement areas north west of the East Pit.
			Decommissioning	-	-	
			Landform Establishment		58.9	
			Growth Medium Development	607.4	152.2	
			Ecosystem and Land Use Establishment	252.0	753.7	
			Ecosystem and Land Use Sustainability	-		
			Relinquished Lands	-	-	
Domain Total				**859.3**	**965**	
Rehabilitation/Woodland (5)	Pasture (C)	5C	Active	-	-	-
			Decommissioning	-	-	
			Landform Establishment	-	-	
			Growth Medium Development	0.9	-	
			Ecosystem and Land Use Establishment	10.8	11.7	
			Ecosystem and Land Use Sustainability	-	-	
			Relinquished Lands	-	-	
Domain Total				**11.7**	**11.7**	

Primary Domain	Secondary Domain	Code	Rehabilitation Phase	Total Area at MOP start (ha)	Area at end of MOP (ha)	Comment
Pasture (6)	Final Void (A)	6A	Active	-	-	-
			Decommissioning	-	-	
			Landform Establishment	-	-	
			Growth Medium Development	-	-	
			Ecosystem and Land Use Establishment	1.0	-	
			Ecosystem and Land Use Sustainability	-	-	
			Relinquished Lands	-	-	
Domain Total				**1.0**	**0.0**	
Pasture (6)	Rehabilitation/Woodland (B)	6B	Active	-	-	-
			Decommissioning	-	-	
			Landform Establishment	74.1	-	
			Growth Medium Development	39.1	74.1	
			Ecosystem and Land Use Establishment	47.5	85.6	
			Ecosystem and Land Use Sustainability	-	-	
			Relinquished Lands	-	-	
Domain Total				**160.7**	**159.7**	

Primary Domain	Secondary Domain	Code	Rehabilitation Phase	Total Area at MOP start (ha)	Area at end of MOP (ha)	Comment
Pasture (6)	Pasture (C)	6C	Active	-	-	This area is associated with rehabilitated gas drainage infrastructure west of Charlton Road.
			Decommissioning	-	-	
			Landform Establishment	-	-	
			Growth Medium Development	0.7	-	
			Ecosystem and Land Use Establishment	6.6	7.3	
			Ecosystem and Land Use Sustainability	-	-	
			Relinquished Lands	-	-	
Domain Total				**7.3**	**7.3**	
Surface Water/Dams (7)	Final Void (A)	7A	Active	8.4	8.4	-
			Decommissioning	-	-	
			Landform Establishment	-	-	
			Growth Medium Development	-	-	
			Ecosystem and Land Use Establishment	-	-	
			Ecosystem and Land Use Sustainability	-	-	
			Relinquished Lands	-	-	
Domain Total				**8.4**	**8.4**	

Primary Domain	Secondary Domain	Code	Rehabilitation Phase	Total Area at MOP start (ha)	Area at end of MOP (ha)	Comment
Surface Water/Dams (7)	Rehabilitation/Woodland (B)	7B	Active	60.7	64.2	-
			Decommissioning	-	-	
			Landform Establishment	-	-	
			Growth Medium Development	-	-	
			Ecosystem and Land Use Establishment	-	-	
			Ecosystem and Land Use Sustainability	-	-	
			Relinquished Lands	-	-	
Domain Total				**60.7**	**64.2**	
Surface Water/Dams (7)	Pasture (C)	7C	Active	4.2	4.2	-
			Decommissioning	-	-	
			Landform Establishment	-	-	
			Growth Medium Development	-	-	
			Ecosystem and Land Use Establishment	-	-	
			Ecosystem and Land Use Sustainability	-	-	
			Relinquished Lands	-	-	
Domain Total				**4.2**	**4.2**	

Primary Domain	Secondary Domain	Code	Rehabilitation Phase	Total Area at MOP start (ha)	Area at end of MOP (ha)	Comment
Surface Water/Dams (7)	Water Management (D)	7D	Active	112.2	113	Areas associated with existing dams that will be retained in the final landform.
			Decommissioning	-	-	
			Landform Establishment	-	-	
			Growth Medium Development	-	-	
			Ecosystem and Land Use Establishment	-	-	
			Ecosystem and Land Use Sustainability	-	-	
			Relinquished Lands	-	-	
Domain Total				**112.2**	**113**	
Conservation Area (8)	Rehabilitation/Woodland (B)	8B	Active	2,058.1	2,058.1	-
			Decommissioning	-	-	
			Landform Establishment	-	-	
			Growth Medium Development	-	-	
			Ecosystem and Land Use Establishment	-	-	
			Ecosystem and Land Use Sustainability	-	-	
			Relinquished Lands	-	-	
Domain Total				**2,058.1**	**2,058.1**	

Primary Domain	Secondary Domain	Code	Rehabilitation Phase	Total Area at MOP start (ha)	Area at end of MOP (ha)	Comment
Vegetation Enhancement (9)	Rehabilitation/Woodland (B)	9B	Active	24.2	24.2	-
			Decommissioning	-	-	
			Landform Establishment	-	-	
			Growth Medium Development	-	-	
			Ecosystem and Land Use Establishment	-	-	
			Ecosystem and Land Use Sustainability	-	-	
			Relinquished Lands	-	-	
Domain Total				**24.2**	**24.2**	
Subsidence Management Area (10)	Rehabilitation/Woodland (B)	10B	Active	721.0	711.5	-
			Decommissioning	-	-	
			Landform Establishment	-	-	
			Growth Medium Development	-	-	
			Ecosystem and Land Use Establishment	-	-	
			Ecosystem and Land Use Sustainability	-	-	
			Relinquished Lands	-	-	
Domain Total				**721.0**	**711.5**	

Primary Domain	Secondary Domain	Code	Rehabilitation Phase	Total Area at MOP start (ha)	Area at end of MOP (ha)	Comment
Subsidence Management Area (10)	Pasture (C)	10C	Active	583.2	583.2	-
			Decommissioning	-	-	
			Landform Establishment	-	-	
			Growth Medium Development	-	-	
			Ecosystem and Land Use Establishment	-	-	
			Ecosystem and Land Use Sustainability	-	-	
			Relinquished Lands	-	-	
Domain Total				**583.2**	**583.2**	
Overall Total				**6,748.1**	**6,850**	

7.4 Relinquishment Phase Achieved during the MOP Term

As mining activities at BOC are planned to continue past the MOP term, no areas are anticipated to meet the required rehabilitation obligations for lease relinquishment.

7.5 Landform Design

The final landform design has been designed for BOC during the preparation of the EIS (Umwelt 2013a), subsequent RAPAR (Umwelt, 2013b), MOD 1 SEE (Umwelt 2016) and MOD 3 SEE (Umwelt 2019). The proposed final landform has been designed in consideration of the surrounding landscape and includes undulating, natural profiles as shown on Plan 4 (refer to **Appendix 1**).

7.6 Topsoil Management

BOC has a topsoil management strategy to maintain the quality of topsoil for subsequent use in rehabilitation. This strategy will be implemented during the MOP term. Material management and monitoring techniques to be adopted in this strategy include:

- Material characterisation of topsoil and subsoil will be undertaken at an appropriate scale across the site, prior to the re-handling of topsoil that has been stored onsite for a period of two years or more. Representative samples will be taken to characterise the nature of the soil material (e.g. sodicity, acid-generating potential etc.) to determine the potential limitations to rehabilitation and sustainable plant growth. The results will be used to determine specific ameliorant techniques that may be applied to the soil material in order to overcome potential limitations and enhance vegetation establishment;
- Topsoil and subsoil stripping activities will be restricted during adverse weather conditions to minimise the potential for dust generation;
- When stripping topsoil and subsoil a water cart will be available to minimise dust emissions during striping activities;
- Topsoil and stripping depths will be identified for each stripping area using inspections / soil sampling prior to the commencement of clearing;
- If topsoil is noticeably dry, it is moistened slightly to help maintain soil structure and to limit excessive dust emissions;
- Vehicle traffic over the area to be stripped is minimised to prevent compaction prior to stripping;
- Depending on soil survey results, sub-soils may also be stripped as these can contain beneficial nutrients and organics, and in most cases would be preferable to overburden as a growing medium;
- Wherever practicable, topsoil will be transferred directly from stripping location to areas that have been reshaped for rehabilitation, eliminating the need for storage and re-handling;
- Where required, machinery used to handle and transport topsoil shall be washed down prior to and at the completion of works to minimise the transfer of weeds;
- Prior to re-spreading, any weed growth will be scalped from the top of the stockpiles to minimise the transport of weeds into rehabilitated areas; and
- Stockpiles will be appropriately identified to minimise the potential for inadvertent use or disturbance.

The following controls are implemented for topsoil stockpiles:

- Topsoil stockpiles are located away from mining areas, heavily trafficked roads and watercourses wherever possible;
- Stockpiles should not be more than 3 m high and should be shaped into windrows to maximise surface exposure and biological activity;
- Stockpiles which will be kept longer than three months are seeded immediately with a cover crop to reduce erosion and weed growth;
- Stockpiles are located on level or gently sloping areas to minimise erosion, wherever possible;
- Clean water diversions are used to divert surface water runoff around stockpiles;
- Where necessary and/or practical, sediment fencing or other appropriate sediment controls are installed around the base of the stockpile to minimise soil loss; and
- Weed growth is monitored regularly and controlled as required. If necessary, topsoil stockpiles are scraped to remove weeds prior to being spread over rehabilitation areas.

7.7 Surface Preparation

Surface preparation activities for rehabilitated areas will commence as soon as practicable following the completion of mining activities. The current surface preparation process at BOC involves the following general steps:

- Representative sampling of the shaped overburden surface to characterise the nature of the spoil material to determine potential limitations to rehabilitation and sustainable plant growth. Results will be used to determine specific ameliorant techniques that may be required;
- Installation of drainage structures and erosion control measures;
- Deep ripping parallel with the contour to provide for an adequate seed bed;
- Rock raking;
- Installation of habitat features (e.g. stag trees, woody debris) to augment the habitat value of the proposed vegetated corridors;
- Installation of appropriate habitat structures (e.g. ponds) where practicable;
- Spreading of topsoil and/or organic matter (if required);
- Application of soil ameliorants where appropriate;
- Re-ripping of prepared surface; and
- Revegetation.

Ripping occurs along the contour generally to a depth of 450 mm. Following ripping the area is rock raked to remove rocks greater than 200 mm. On flatter areas, these rocks are pushed into sporadic piles to create habitat within the rehabilitation areas. Rock piles are not utilised on slopes as they have the potential to concentrate runoff and cause erosion problems. In these cases rocks greater than 200 mm are removed from the rehabilitation area. Rocks less than 200 mm are left on the surface to provide surface protection until vegetation is established and micro-habitats for native fauna. Contour banks are fully raked to remove all surface rocks.

Habitat features are also incorporated into the rehabilitation at BOC. These generally include rock piles (as outlined above), woody debris (sourced from onsite stockpiles) and stag trees.

Following this topsoil is spread over the rehabilitation to a depth of 100 mm. The depth of topsoil depends on the topsoil quality, availability and use of other organic matter. Additionally, testing of the topsoil and overburden may be undertaken to determine any amelioration requirements. This normally includes the application of gypsum to treat the topsoil which is generally of poor quality (low OC, sodic and dispersive).

Following application of the topsoil and required ameliorants, the rehabilitation area is ripped to a depth 450 mm. This allows for the partial mixing of topsoil, ameliorants and overburden, as well as creating a softer, furrowed surface for seeding.

Pre-strip operations ahead of mining will only be required in areas that have not previously been disturbed by mining activities and may include areas which have been previously rehabilitated. Pre-strip operations will also be carried out prior to emplacement of overburden in out-of-pit emplacement areas and the construction of infrastructure. Establishment of the required water management system infrastructure is also a key component of pre-strip operations.

Following the removal of vegetation, topsoil will be stripped and either stored in stockpiles for later use or placed directly on reshaped overburden for rehabilitation purposes.

7.8 Revegetation

The rehabilitation strategy at Bulga Coal involves the establishment of a native ecosystem, through the creation of large patches of rehabilitated woodland which will link to remnants adjoining the project area. Rehabilitated woodland areas will be created to contain flora species assemblage's characteristic of the dominant communities impacted by the mines expansion. In accordance with the commitments made in the EIS, BOC has commenced revegetating areas with the goal of establishing native forest ecosystems, specifically the following vegetation communities:

- Central Hunter Grey-Box – Ironbark Woodland;
- Central Hunter Ironbark – Spotted Gum – Grey Box Forest; and
- Central Hunter Swamp Oak Forest.

In accordance with the requirements of SSD-4960, Bulga Coal will establish a minimum of 2,321 ha of Central Hunter Grey-Box – Ironbark Woodland; 250 ha of Central Hunter Ironbark – Spotted Gum – Grey Box Forest; and 50 ha of Central Hunter Swamp Oak Forest as part of the Bulga Coal revegetation activities during the life of operations.

Indicative seed mixes that will be initially sown with the goal of reaching these communities are provided in **Appendix 6**. These seed mixes are sown with an non-invasive cover crop to provide initial ground cover and protection from erosion.

Revegetation will primarily involve direct seeding of native species along with a suitable cover crop as required to prevent soil loss and add biomass to the profile. A range of other techniques including the planting of tubestock may also be utilised where appropriate over isolated areas associated with steep slopes.

It is recognised that achieving these communities will require follow up care and maintenance work and plantings and the requirement for these works will be assessed on an ongoing basis through the rehabilitation monitoring program (refer to **Section 8.1**).

7.8.1 Seed Collection and Supply

In 2013, BOC commenced a seed collection program in anticipation of the large volumes of seed required for the rehabilitation of the (then proposed) Bulga Optimisation Project. This initially involved the tendering for and selection of a long term rehabilitation seed supplier. The collection program now includes both on-site collection from buffer lands and offset properties, as well as large-scale collection from the broader Hunter Valley. This allows the majority of seed used on rehabilitation areas to be locally sourced, with only smaller amounts of supplementary seed being sourced from external providers (mostly cover crops, grasses and other ground covers).

Seed collected from on-site is also used to propagate tubestock for in-fill planting or to assist with achieving desired communities in rehabilitation areas.

All locally collected seed is tested for germination viability to provide certainty about the quality of the seed prior to use.

8.0 REHABILITATION MONITORING AND RESEARCH

8.1 Rehabilitation Monitoring

Bulga Coal has developed an annual rehabilitation monitoring program to confirm the rehabilitation objectives, performance criteria and closure criteria are being met, and to identify opportunities for improvement. The monitoring programs have been designed to effectively monitor onsite revegetation, surrounding vegetation, species diversity and native fauna habitats. The monitoring program consists of the following surveys:

- Annual rehabilitation walkover inspection;
- Initial establishment monitoring; and
- Long term rehabilitation monitoring program.

8.1.1 Annual Rehabilitation Walkover Inspection

The annual walkover inspection covers all rehabilitation areas onsite and provides a general assessment on rehabilitation health and potential emerging issues that require maintenance (e.g. weeds, erosion, poor growth rates). The walkover inspection does not review rehabilitation areas against the closure criteria, but provides management recommendations to assist the rehabilitation in moving towards the criteria.

8.1.2 Initial Establishment Monitoring

The initial establishment monitoring is a rapid style assessment of young (≤3 years old) rehabilitated areas, principally to determine germination success and landform stability. The *GCAA Rehabilitation Monitoring Procedure* describes the monitoring methodology and the data collection method used for the key final land uses.

8.1.3 Long Term Rehabilitation Monitoring Program

The long term rehabilitation monitoring program utilises the Biodiversity Assessment Methodology, to compare rehabilitation areas with biometric scores from the targeted vegetation communities (refer to **Section 4**). The objective of the long term monitoring program (areas ≥4 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 long term rehabilitation monitoring apply to both rehabilitation and reference monitoring sites. For further details on methodology and timing refer to the *GCAA Rehabilitation Monitoring Procedure.*

Current (2020) reference and rehabilitation monitoring sites are shown on **Figure 4 4**.

8.2 Research and Rehabilitation Trials and Use of Analogue Sites

No rehabilitation trials are currently proposed to be undertaken during the MOP term at Bulga Coal.

316000 317000 318000 319000 320000 321000 322000 323000 324000 325000 326000

6389000 6388000 6387000 6386000 6385000 6384000 6383000 6382000 6381000 6380000 6379000 6378000 6377000 6376000 6375000 6374000

Mt Thorley Warkworth

Northern Dam

Eastern Emplacement Area

ML 1547

Noise and Visual Bund

Main Pit

East Pit

ML1788

CL 224

ML 1717

CHPP

Broke Road

Parsons Creek

Woodlands Hill Pit

Bayswater Pit

Deep Pit Tailings Dam

Cobcroft Road

Wollombi Brook

Noise and Visual Bund

ML 1494

ML 1674

Broke

Broke Gessnock Road

Monkey Place Creek

H:\Projects-SLR\630-SrvNTL\630-NTL\630.30025.00000 Bulga Open Cut 2020 MOP\06 SLR Data\01 CAD\GIS\GIS\SLR630300025_Fg4_RehabMonitoring_02.mxd

LEGEND

- Mining Lease
- Colliery Holding
- Coal Lease
- Singleton Council Licence
- Road
- Railway

Watercourses

- Watercourse
- Minor Watercourse

Rehabilitation Monitoring Points 2020

- Initial Establishment Monitoring
- Long Term Rehabilitiation Monitoring
- Current Ecological Monitoring Sites

0 500 1,000 1,500 2,000 m

Scale: 1:45,000
GDA 1994 MGA Zone 56

14-Aug-2020
630.30025

Sheet Size : A3

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Rehabilitation Monitoring

FIGURE 4

9.0 INTERVENTION AND ADAPTIVE MANAGEMENT (ACROSS BULGA COAL)

9.1 Threats to Rehabilitation

Where rehabilitation performance is not trending to the nominated completion criteria this may indicate that there is a threat to long term rehabilitation success. Threats to rehabilitation may include events such as periods of drought, bushfire events, or pressures from weeds and feral animals.

Sections 3.3 and **3.4** provide examples of key threats to rehabilitation. Where rehabilitation monitoring indicates that there is a significant threat to rehabilitation, BOC will undertake adaptive management in accordance with the TARP (refer **Section 9.2**).

9.2 Trigger Action Response Plan

The following TARP for rehabilitation has been developed to identify required management actions in the event of impacts to rehabilitation, or where rehabilitation outcomes are not achieved in an acceptable timeframe. Where necessary, rehabilitation procedures will be amended accordingly with the aim of continually improving rehabilitation standards. Bulga Coal Management Pty Ltd will notify the RR and other relevant stakeholders of any incident resulting in major impacts to rehabilitation.

The responses specified within the TARP have been based upon the rehabilitation completion criteria developed during the preparation of the EIS (Umwelt 2013a), MOD 3 SEE (Umwelt 2019) and the current rehabilitation monitoring program. Monitoring of the TARP will be undertaken as outlined in the rehabilitation monitoring program (refer to **Section 8.1**). The rehabilitation monitoring program will trigger response actions, as specified in the TARP to ensure that threats to rehabilitation do not become unmanageable.

The TARP is provided as **Table 18** below, and will be reviewed and may be revised as conditions at BOC change or new threats to rehabilitation are identified.

Table 18 - Trigger Action Response Plan

Aspect/ Category	Key Element	Trigger Response	Condition Green	Condition Amber	Condition Red
Landform stability	Slope gradient outer slopes	Trigger	Rehabilitation areas have slopes that are <10˚, or <14° for some areas of the Noise and Visual Bund and outer slopes of in-pit emplacement areas.	Rehabilitation areas (with the exception of some areas of the Noise and Visual Bund) have slopes >10° but <14˚, the Eastern Emplacement Area have slopes of 14˚ and outer slopes of in-pit emplacement areas (toe to crest slope of up to 14°)).	Rehabilitation areas have slopes >15°.
		Response	No response required. Continue monitoring program.	Undertake a review of the revegetation and stability of the area, if it is not designed to be >10° <14˚ or 14˚.	Undertake a review of the landform design, including survey if required. Undertake regrading and revegetation of the area, if required.
	Slope gradient final void slopes	Trigger	The northern and southern internal slopes of the final void have been will be battered (toe to crest) with slopes ranging between 10° and 18°.	Rehabilitation areas have slopes steeper than designed.	Rehabilitation areas have slopes >18°.
		Response	No response required. Continue monitoring program.	Undertake a review of the revegetation and stability of the area. Undertake regrading and revegetation of the area, if required.	Undertake a review of the landform design, including survey if required. Undertake regrading and revegetation of the area, if required.
	Erosion control	Trigger	No gully or tunnel erosion. No rilling present.	Minor gully or tunnel erosion present and/or rilling <300 mm deep.	Significant gully or tunnel erosion present and/or rilling >300 mm deep.
		Response	No response required. Continue monitoring program.	An inspection of the site will be undertaken by a suitably trained person. Investigate opportunities to install water management infrastructure to address erosion. Remediate as appropriate.	Undertake a review of the drainage of the area and provide recommendations to appropriately remediate the erosion. Remediate as soon as practicable.

Aspect/ Category	Key Element	Trigger Response	Condition Green	Condition Amber	Condition Red
	Drainage Condition	Trigger	Drainage condition is in accordance with the design criteria established within this document.	Landforms exhibiting minor drainage issues but does not threaten to cause rehabilitation failure.	Landforms exhibiting significant drainage issues, threatening or causing rehabilitation failure.
		Response	No response required. Continue monitoring program.	An inspection of the site will be undertaken by a suitably trained person. Investigate opportunities to address issues. Remediate as appropriate.	Undertake a review of the drainage design and provide recommendations to appropriately remediate the area. Remediate as soon as practicable.
Water Quality	Monitoring parameters	Trigger	Surface water quality of runoff from rehabilitation areas is within EPL criteria and rehabilitation performance criteria established within this document.	Water quality exceeds EPL or performance criteria but does not indicate a long-term rehabilitation issue.	Water quality exceeds criteria, indicating a long term rehabilitation liability.
		Response	No response required. Continue monitoring program.	Review and investigation of water quality monitoring and management where appropriate. Implement relevant remedial measures where required.	Reporting as per PIRMP and all statutory reporting requirements. Implement relevant responses and undertake immediate review to determine source of issues and implement remediation measures identified as soon as practicable.
Soil/spoil Quality	Monitoring parameters	Trigger	No bare patches of rehabilitation indicating poor soil/spoil quality.	Some small batches of bare ground, or poor vegetation growth indicating a potential issue with soil/spoil quality.	Large areas (>400 m^2) of bare ground, or poor vegetation growth indicating a potential issue with soil/spoil quality.
		Response	No response required. Continue monitoring program.	Conduct investigation and take samples of soil/spoil to determine the need for ameliorants or other management options.	Engage a consultant to assist with recommendations to appropriately remediate soil/spoil quality and depth. Remediate as soon as practicable.

Aspect/ Category	Key Element	Trigger Response	Condition Green	Condition Amber	Condition Red
Vegetation	Surface cover	Trigger	Twelve months following revegetation works, a minimum of 70% total ground cover is present within rehabilitation areas.	Twelve months following revegetation works, a minimum of 60% total ground cover is present within rehabilitation areas.	Twelve months following revegetation works, a minimum of 30% total ground cover is present within rehabilitation areas.
		Response	No response required. Continue monitoring program.	Review procedures where required to increase vegetation cover.	An inspection of the site will be undertaken by a suitably trained person. Investigate use of appropriate management options to remediate. Remediate as appropriate.
	Weed presence	Trigger	Twelve months following revegetation, no significant weed infestations present.	Twelve months following revegetation, >25% but <50% cover of undesirable species present.	Twelve months following revegetation, >50% cover of undesirable species present.
		Response	No response required. Continue monitoring program.	Review monitoring report to identify the nature of the weeds present and recommendations from monitoring report. Engage a weed management contractor to remove noxious and problematic weeds if required.	Engage a weed management contractor to remove noxious and problematic weeds from the site as soon as practicable. Investigate management measures to assist native plant establishment including use of ameliorants and implement as appropriate.
	Species composition	Trigger	Two years following revegetation, species composition comprises native tree and shrub species consistent with analogue site.	Five years following revegetation, native tree and shrub species composition comprises <75% consistent with analogue site.	Five years following revegetation, native tree and shrub species composition comprises <50% consistent with analogue site.
		Response	No response required. Continue monitoring program.	Review native seed mix and amend accordingly. Consider remedial actions such as tube stock planting or re-seeding to achieve required species composition.	An inspection of the site will be undertaken by a suitably trained person. Investigate remedial options to achieve required species composition

Aspect/ Category	Key Element	Trigger Response	Condition Green	Condition Amber	Condition Red
Tailings	Consolidation	Trigger	Tailings emplacement volumes/consolidation within 10% of predictions.	Tailings emplacement volumes/consolidation greater than 10% more or less than predictions.	Tailings emplacement volumes/consolidation greater than 20% more or less than predictions.
		Response	No response required. Continue monitoring program.	Review management and longer term implications for capping and final landform.	Review management and longer term implications for capping and final landform and modify landform design including identification of required material.

9.3 Continual Improvement and Adaptive Management

Bulga Coal manages environment and community aspects, impacts and performance in accordance with the *Bulga Coal Environmental Management Strategy*. This document provides an overview of the EMS implementation, which ensures that the operations at Bulga Coal are undertaken in accordance with relevant Glencore policies and standards and all relevant licences and approvals.

The *Bulga Coal Environmental Management Strategy* has been developed generally in accordance with the ISO 14001 environmental management framework. The ISO 14001 framework requires the following:

- Commitment and policy;
- Planning;
- Implementation;
- Measurement and evaluation; and
- Review and improvement.

10.0 REPORTING

The Annual Review, which is submitted to relevant government agencies and made publically available on the Bulga Coal website (www.bulgacoal.com.au), reports on the following information relating to rehabilitation:

- An overview of rehabilitation undertaken each year;
- Results of annual rehabilitation inspections and monitoring;
- Outcomes of the annual ecological monitoring; and
- Progress against the projected rehabilitation in the approved BOC and BUO MOPs.

An Annual Rehabilitation Plan is also developed each year based on the mining plan, results from the annual rehabilitation inspections and rehabilitation monitoring reports. This report is provided to Glencore for internal planning and provisioning purposes.

11.0 PLANS

The BOC is classified as a Level 1 Mine, and therefore the following maps have been prepared:

- **Plans 1B – 1C** show the location and pre-mining natural and physical environment of BOC;
- **Plan 2** shows the mine domains and mining features at commencement of the MOP term;
- **Plans 3A** – **3D** are a series of Plans which show the annual sequence of mining and rehabilitation activities over the MOP term;
- **Plan 4** shows the proposed post-mining land use and landform in 2044 (five years following the cessation of mining operations); and
- **Plans 5A** and **5B** show vertical and longitudinal cross sections.

These Plans are contained in **Appendix 1**.

12.0 REVIEW AND IMPLEMENTATION OF THE MOP

12.1 Review of the MOP

This section provides the Protocol for periodic review of this MOP. Reviews are conducted to assess the effectiveness of the procedures against the objectives of the MOP. The MOP may be reviewed, and if necessary revised, following the submission of an:

- Annual Review;
- Incident report;
- Audit;
- Updated or additional Management Plans prepared; or
- Any modification to the conditions of the Development Consent.

This MOP may also be revised due to:

- Deficiencies being identified;
- Recommendations resulting from the monitoring and review program;
- Changing environmental requirements due to (for example) changed legislation or regulatory requirements;
- Where a risk assessment identifies the requirement to alter the MOP; and
- Change in the activities or operations.

Any major amendments to the MOP that affect its application will be undertaken in consultation with the appropriate regulatory authorities and stakeholders.

12.2 Implementation

Table 19 defines the personnel who are responsible for the monitoring, review and implementation of this MOP.

Table 19 - Responsibilities for Implementation of this MOP

Title	Responsibility
Operations Manager	• Implement the procedures referenced in this MOP; • Undertake training in relevant Management Plans and procedures as required; • Provide resources required to support and implement these procedures; • Provide adequate resources for the completion of rehabilitation activities; • Construct landforms in accordance with this MOP; • Develop dumping strategies to allow for progressive rehabilitation of mined land; and • Approve this document and any subsequent reviews/amendments.

Title	Responsibility
Technical Services Manager	• Implement the procedures referenced in this MOP; • Undertake training in relevant Management Plans and procedures as required; • Provide resources required to implement these procedures; • Develop mine plans to allow for progressive rehabilitation of mined land; and • Liaise with the Environment and Community Department to ensure that regulatory commitments relating to rehabilitation are considered during mine planning processes.
Environment and Community Manager	• Prepare the relevant Management Plans; • Implement, monitor and review the programs and procedures linked to this MOP; • Consult with regulatory authorities as required; • Undertake monitoring as required; • Undertake maintenance as required; • Provide measures for continual improvement to this MOP and procedures; • Ensure all personnel undertaking works in relation to this MOP are trained and competent; • Report the progress of any rehabilitation and monitoring of biodiversity in the Annual Review; • Undertake site based actions to implement this MOP in cooperation with the Operations Manager; • Coordinate the development of Annual Rehabilitation Plans to guide rehabilitation activities; • Coordinate the completion of rehabilitation activities in accordance with this document; • Coordinate the development of the site rehabilitation objectives and closure criteria in consultation with key stakeholders; • Coordinate the rehabilitation monitoring program and an annual review of monitoring results to provide a continual improvement process for rehabilitation; and • Coordinate biodiversity and land management baseline studies, participate in risk assessments, contribute to the development of management strategies in consultation with affected parties and co-ordinate their implementation as part of the site EMS.
Site Commercial Manager	• Ensure that there are adequate provisions available for mine closure by implementing and updating an accrual system over the life of mine.

13.0 REFERENCES

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Appendix 1 - MOP Plans

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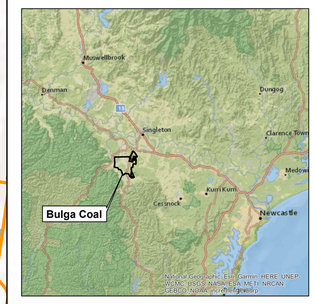
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JERRYS PLAINS
WARKWORTH
SINGLETON
GLENDON BROOK
WHITTINGHAM
MOUNT THORLEY
SINGLETON ARMY BASE
BULGA
BELFORD NATIONAL PARK
BELFORD
BRANXTON
GRETA
ML 1547
ML1547
ML 1788
CL224
EL8315
EL5277
Charlton Road
ML 1494
ML 1674
AUTH 447
AUTH 450
EL8375
BROKE
EL5461
BROKE - CESSNOCK ROAD
SINGLETON LOCAL GOVERNMENT AREA
CESSNOCK LOCAL GOVERNMENT AREA
ROTHBURY
PUTTY STATE FOREST
YENGO NATIONAL PARK
DARKEY CREEK
WERAKATA NATIONAL PARK
POKOLBIN STATE FOREST
POKOLBIN
CESSNOCK STATE FOREST
CESSNOCK
HOWES VALLEY
MACDONALD RIVER
PAYNES CROSSING
CONGEWAI CREEK
BELLBIRD
WERAKATA NATIONAL PARK
KITCHENER
WERAKATA STATE CONSERVATION AREA
MILLFIELD
CORRABARE STATE FOREST
PAXTON
ELLALONG
YENGO NATIONAL PARK
HUNTER RIVER
WOLLOMBI BROOK
PARSONS CREEK
GLENDON BROOK

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Legend

- Mining Lease
- Coal Lease
- Commonwealth Licence Agreement
- Colliery Holding
- Exploration Licence
- Authorisation
- Road
- Railway
- Watercourse
- Built-up Areas
- State Forest
- National Park
- Local Government Area Boundary



I, ..., Registered Mine Surveyor, certify that to the best of my knowledge and belief, this plan conforms to the accuracy & standards required by NSW Department of Planning, Industry and Environment - Resources Regulator.

Registered Mine Surveyor ..... Date .....

I, ..., Holder of Mine Managers Practising Certificate, certify that to the best of my knowledge and belief, that this plan is a true indication of the proposed development.

Mine Manager ..... Date .....

Bulga Open Cut
Mining Operations Plan
Project Locality: Statewide Context
Plan 1A

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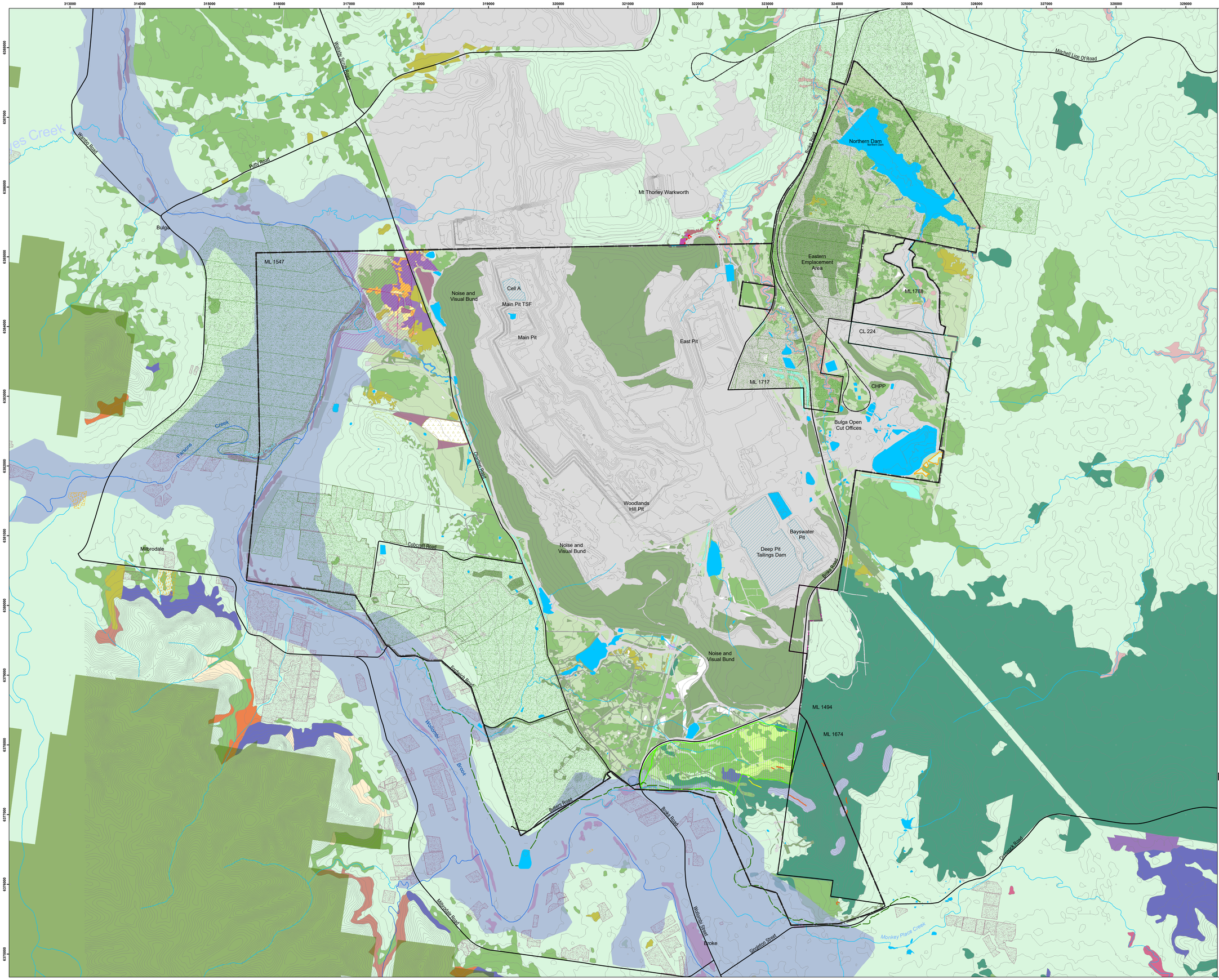
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Legend

- Mining Lease
- Coal Lease
- Commonwealth Licence Agreement
- Colliery Holding
- Road
- Railway
- Contours 10m
- Watercourse
- Minor Watercourse
- Tailings Dams
- Wet Soak
- Flood Prone Land
- Limit of Alluvium

Land Use

- National Park Boundaries
- Grazing
- Olive Grove
- Orchard
- Vineyards

Cliff Lines and Rock Pinnacles

- Cliff Lines
- Rock Pinnacles
- Forest Red Gum Woodland Offset Area

Cultural Heritage Sites

- Artefact Scatter Site
- Isolated Artefact Site
- Open Site
- Potential Archaeological Deposit
- Site Complex
- European Heritage Site

Vegetation Communities

- Existing Mine Rehabilitation Areas
- Bulga Wattle Woodland
- Central Hunter Bulloak Forest Regeneration
- Central Hunter Grey Box - Ironbark Derived Native Grassland
- Central Hunter Grey Box - Ironbark Woodland EEC
- Central Hunter Ironbark - Spotted Gum - Grey Box Forest EEC
- Central Hunter Paperbark Soaks Woodland
- Central Hunter Swamp Oak Forest
- Central Hunter Box - Ironbark Woodland EEC
- Hunter Floodplain Red Gum Woodland Complex
- Hunter Valley River Oak Forest EEC
- Hunter Valley Weeping Myall Woodland EEC
- Lower Hunter Dry Rainforest
- Riparian Derived Native Grassland
- Southern Hunter Escarpment Spotted Gum Woodland
- Southern Hunter Footslopes Sheltered Forest
- Upper Hunter Coastal Myall Exposed Forest
- Upper Hunter Narrabeen Gully Ironwood Dry Rainforest
- Warkworth Sands Derived Native Grassland
- Warkworth Sands Disturbed Grassland
- Warkworth Sands Woodland EEC
- Wollombi Alluvial Red Gum - Apple Forest
- Rehabilitated Bulloak Forest
- Exotic Grassland
- Planted areas
- Derived Native Grassland
- Disturbed Land
- Vegetation Communities Unmapped by Bulga Coal
- Artefact Scatter Area
- Open Site
- Site Complex
- Conservation Area
- Offset Area - 'The Vere'

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Registered Mine Surveyor ..... Date .....

I, ..., Holder of Mine Managers Practising Certificate, certify that to the best of my knowledge and belief, that this plan is a true indication of the proposed development.

Mine Manager ..... Date .....

Bulga Open Cut
Mining Operations Plan
Pre-mining Environment - Natural Environment
Plan 1B

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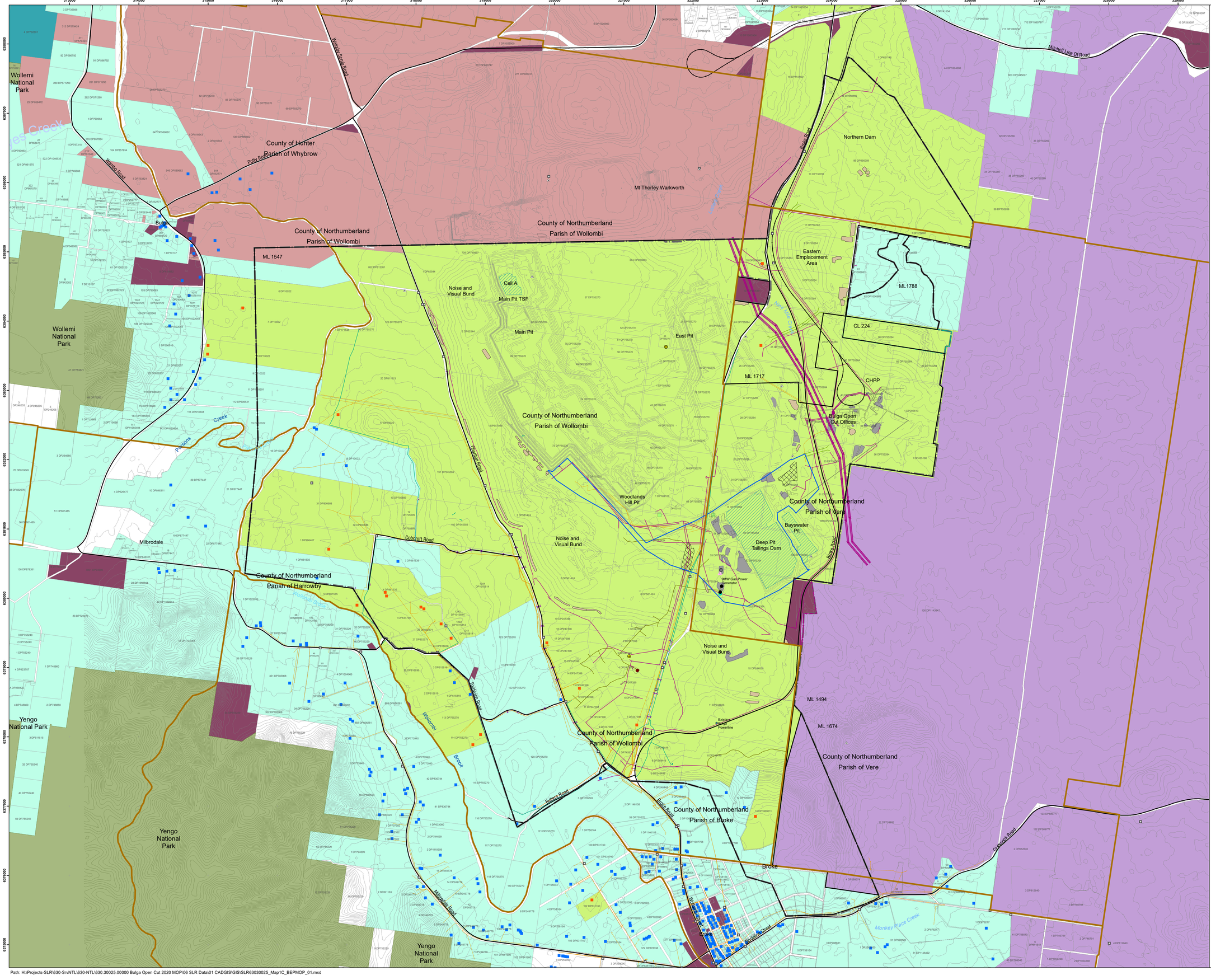
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Legend

- Mining Lease
- Coal Lease
- Commonwealth Licence Agreement
- Colliery Holding
- Contours 10m
- Buildings
- South Pit Extension Area
- In-pit Stockpiles
- Railway
- Powerlines
- Cadastre
- Parish Boundary
- Detailed Infrastructure
- Tailings Dams
- National Park
- Laydown Areas
- Topsoil Stockpiles

Survey Marks

- Site Survey Marks
- Permanent Survey Mark; State Survey Mark
- Trigonometrical Station

Infrastructure

- 9MW Power Station
- Pit Top Facilites
- Meteorological Station
- Pre-drainage Energen Flares
- Energen Flares
- Ventilation Fans
- Vocsidisers
- Bulga Joint Venture Residence
- Private Residence
- Powerlines
- Road
- Bridges
- Telecommunications
- Piping and Instrumentation Design
- Underground Pipelines
- Culverts

Land Ownership

- Land Owned by Bulga Joint Venture
- Land Owned by Coal and Allied
- Private Land
- Crown/LGA
- Commonwealth Land (Singleton Army Training Area)
- Mining - Other

I, ..., Registered Mine Surveyor, certify that to the best of my knowledge and belief, this plan conforms to the accuracy & standards required by NSW Department of Planning, Industry and Environment - Resources Regulator.

Registered Mine Surveyor ..... Date .....

I, ..., Holder of Mine Managers Practising Certificate, certify that to the best of my knowledge and belief, that this plan is a true indication of the proposed development.

Mine Manager ..... Date .....

Bulga Open Cut
Mining Operations Plan
Pre-mining Environment; Built Environment
Plan 1C

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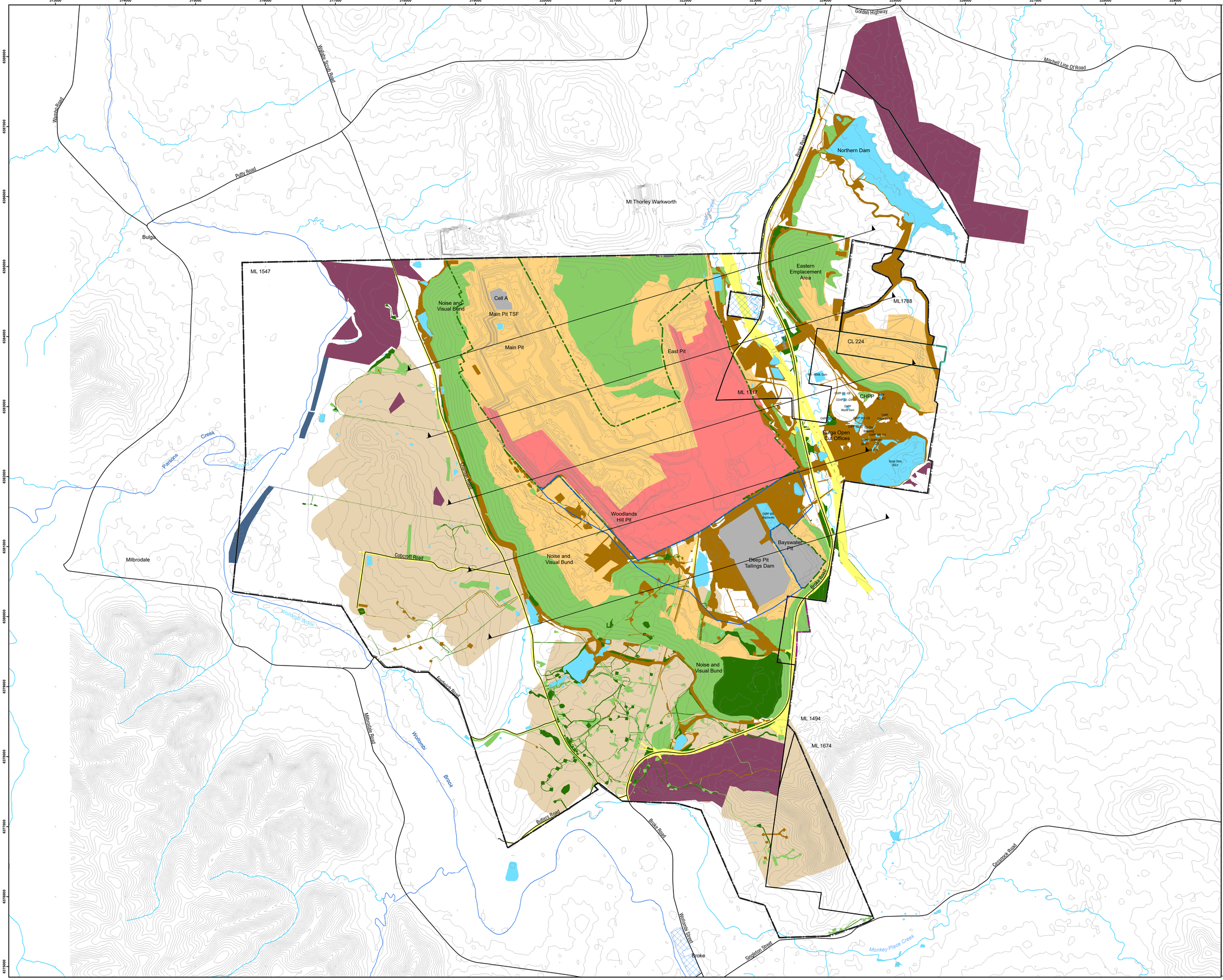
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Legend

- Mining Lease
- Coal Lease
- Commonwealth Licence Agreement
- Colliery Holding
- Approved Mine Workings Outline – Open Cut
- South Pit Extension Area
- Road
- Contours 10m
- Cross Sections
- Watercourse
- Minor Watercourse

Land Ownership

- Crown Land
- Public Infrastructure

Primary Domains

- Domain 1 - Infrastructure
- Domain 2 - Emplacement Areas
- Domain 3 - Active Mining
- Domain 4 - Tailings Emplacement
- Domain 5 - Rehabilitation Woodland
- Domain 6 - Rehabilitation Pasture
- Domain 7 - Surface Water / Dams
- Domain 8 - Conservation Area
- Domain 9 - Vegetation Re-establishment Area
- Domain 10 - Subsidence Management

I, ..., Registered Mine Surveyor, certify that to the best of my knowledge and belief, this plan conforms to the accuracy & standards required by NSW Department of Planning, Industry and Environment - Resources Regulator.

Registered Mine Surveyor Date

....

I, ..., Holder of Mine Managers Practising Certificate, certify that to the best of my knowledge and belief, that this plan is a true indication of the proposed development.

Mine Manager Date

....

Bulga Open Cut
Mining Operations Plan
Mine Domains at Commencement of MOP
Plan 2

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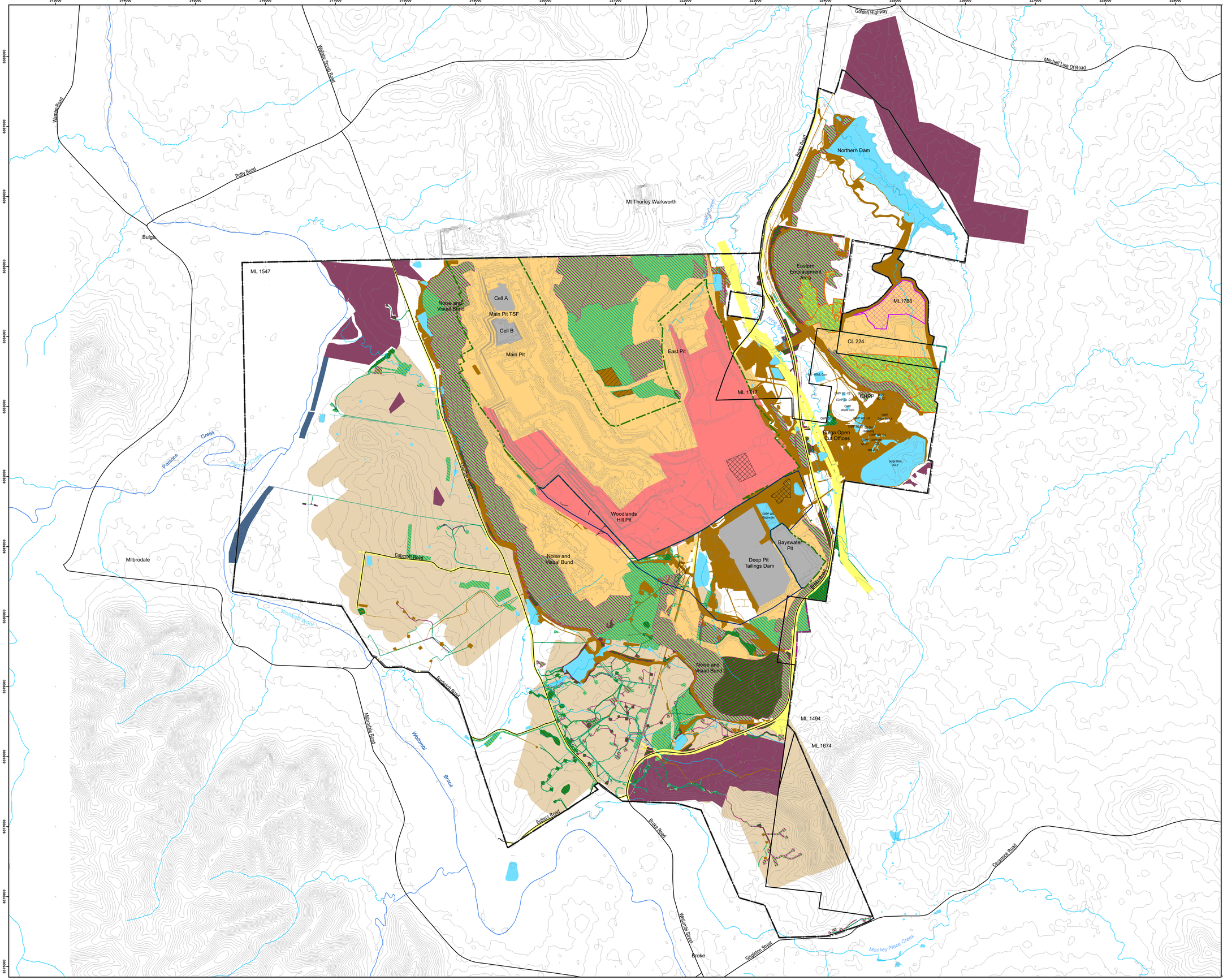
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Legend

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- Coal Lease
- Commonwealth Licence Agreement
- Colliery Holding
- Approved Mine Workings Outline – Open Cut
- South Pit Extension Area
- In-pit Stockpiles
- Road
- Contours 10m
- Watercourse
- Minor Watercourse
- Public Infrastructure

2020 Activity

- 2020 - Rehabilitation
- 2020 - Disturbance
- 2020 - Disturbance of Rehabilitation

Primary Domains

- Domain 1 - Infrastructure
- Domain 2 - Emplacement Areas
- Domain 3 - Active Mining
- Domain 4 - Tailings Emplacement
- Domain 5 - Rehabilitation Woodland
- Domain 6 - Rehabilitation Pasture
- Domain 7 - Surface Water / Dams
- Domain 8 - Conservation Area
- Domain 9 - Vegetation Re-establishment Area
- Domain 10 - Subsidence Management

Rehabilitation Phase

- Phase 2 - Landform Establishment
- Phase 3 - Growth Medium Development
- Phase 4 - Ecosystem and Land Use Establishment

I, ..., Registered Mine Surveyor, certify that to the best of my knowledge and belief, this plan conforms to the accuracy & standards required by NSW Department of Planning, Industry and Environment - Resources Regulator.

Registered Mine Surveyor ..... Date .....

I, ..., Holder of Mine Managers Practising Certificate, certify that to the best of my knowledge and belief, that this plan is a true indication of the proposed development.

Mine Manager ..... Date .....

Bulga Open Cut
Mining Operations Plan
Mining and Rehabilitation - July - Dec 2020
Plan 3A

GLENCORE

N

Date: 17-Aug-2020 Sheet size: A0

Drawn by: LH Approved: AW

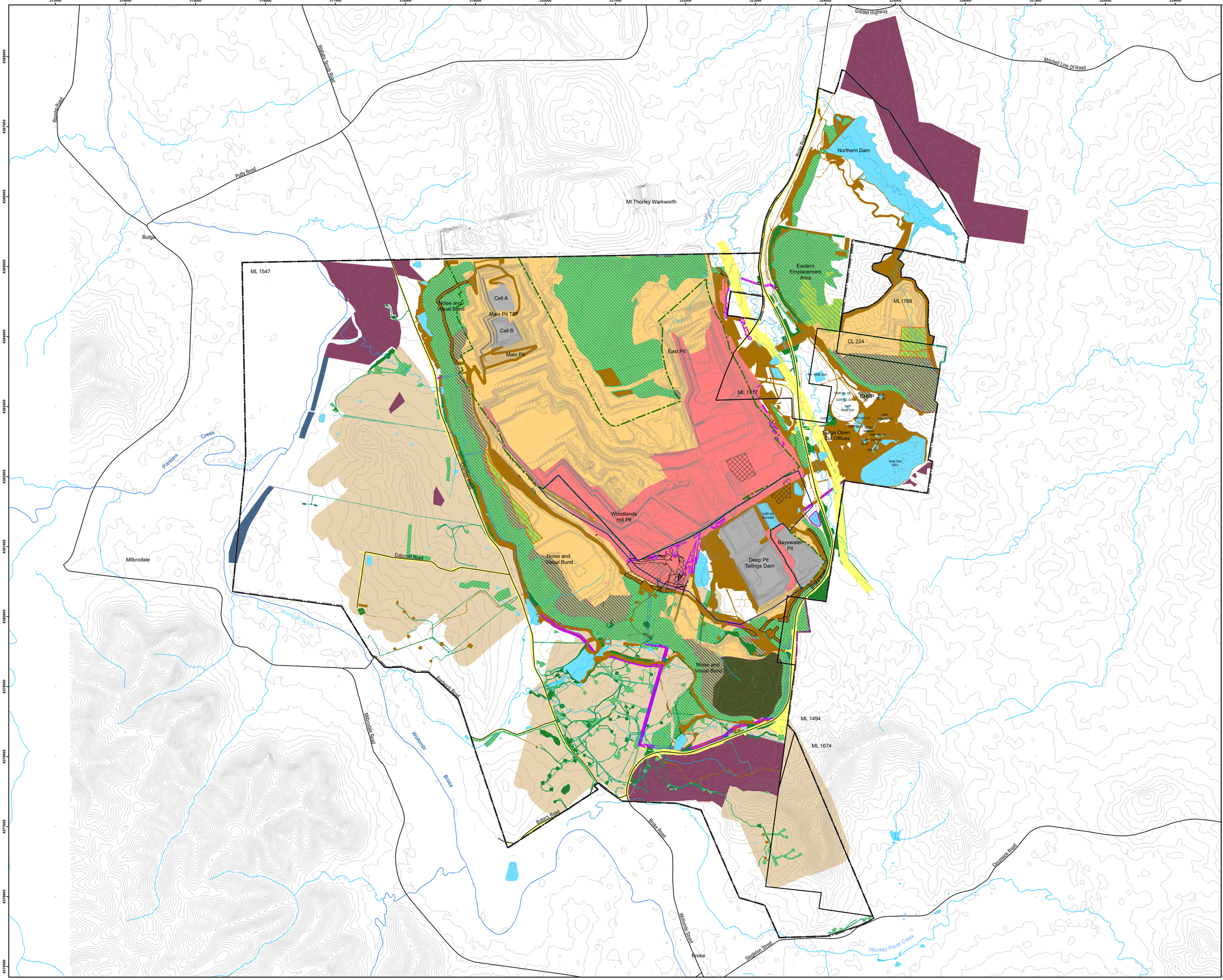
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Kilometers

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Legend

- Mining Lease
- Coal Lease
- Commonwealth Licence Agreement
- Colliery Holding
- Approved Mine Workings Outline – Open Cut
- South Pit Extension Area
- In-pit Stockpiles
- Road
- Contours 10m
- Watercourse
- Minor Watercourse
- Public Infrastructure

2021 Activity

- 2021 - Rehabilitation
- 2021 - Disturbance
- 2021 - Disturbance of Rehabilitation
- 2021 - Clearing

Primary Domains

- Domain 1 - Infrastructure
- Domain 2 - Emplacement Areas
- Domain 3 - Active Mining
- Domain 4 - Tailings Emplacement
- Domain 5 - Rehabilitation Woodland
- Domain 6 - Rehabilitation Pasture
- Domain 7 - Surface Water / Dams
- Domain 8 - Conservation Area
- Domain 9 - Vegetation Re-establishment Area
- Domain 10 - Subsidence Management

Phase

- Phase 2 - Landform Establishment
- Phase 3 - Growth Medium Development
- Phase 4 - Ecosystem and Land Use Establishment

I, ..., Registered Mine Surveyor, certify that to the best of my knowledge and belief, this plan conforms to the accuracy & standards required by NSW Department of Planning, Industry and Environment - Resources Regulator.

Registered Mine Surveyor Date

....

I, ..., Holder of Mine Managers Practising Certificate, certify that to the best of my knowledge and belief, that this plan is a true indication of the proposed development.

Mine Manager Date

....

Bulga Open Cut
Mining Operations Plan
Mining and Rehabilitation - Jan - Dec 2021
Plan 3B

GLENCORE

N

Date:	17-Aug-2020	Sheet size:	A0
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Scale:	1:17,500		

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Kilometers

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Golden Highway
Mitchell Line Of Road
Wollar South Road
Wampo Road
Putty Road
Bulga
Mt Thorley Warkworth
Lower Wollar Creek
Bylong River
Northern Dam
Eastern Emplacement Area
ML 1547
Noise and Visual Bund
Main Pit TSF
Main Pit
East Pit
ML 1788
CL 224
ML 1717
CHPP
Bulga Open Cut Offices
Parsons Creek
Parsons Creek
Saddlers Creek
Woodlands Hill Pit
Noise and Visual Bund
Deep Pit Tailings Dam
Bayswater Pit
Milbrodale
Cobcroft Road
Wollombi Brook
Noise and Visual Bund
Putty Road
Milbrodale Road
Wollombi Brook
Bulga Road
ML 1494
ML 1674
Broke Road
Wollombi Brook
Broke
Singleton Street
Monkey Place Creek
Cessnock Road

Legend

- Mining Lease
- Coal Lease
- Commonwealth Licence Agreement
- Colliery Holding
- Approved Mine Workings Outline – Open Cut
- South Pit Extension Area
- In-pit Stockpiles
- Road
- Contours 10m
- Watercourse
- Minor Watercourse
- Public Infrastructure

2022 Activity

- 2022 - Rehabilitation
- 2022 - Disturbance
- 2022 - Disturbance of Rehabilitation

Primary Domains

- Domain 1 - Infrastructure
- Domain 2 - Emplacement Areas
- Domain 3 - Active Mining
- Domain 4 - Tailings Emplacement
- Domain 5 - Rehabilitation Woodland
- Domain 6 - Rehabilitation Pasture
- Domain 7 - Surface Water / Dams
- Domain 8 - Conservation Area
- Domain 9 - Vegetation Re-establishment Area
- Domain 10 - Subsidence Management

Phase

- Phase 2 - Landform Establishment
- Phase 3 - Growth Medium Development
- Phase 4 - Ecosystem and Land Use Establishment

I, ..., Registered Mine Surveyor, certify that to the best of my knowledge and belief, this plan conforms to the accuracy & standards required by NSW Department of Planning, Industry and Environment - Resources Regulator.

Registered Mine Surveyor ..... Date .....

I, ..., Holder of Mine Managers Practising Certificate, certify that to the best of my knowledge and belief, that this plan is a true indication of the proposed development.

Mine Manager ..... Date .....

Bulga Open Cut
Mining Operations Plan
Mining and Rehabilitation - Jan - Dec 2022
Plan 3C

GLENCORE

N

Date: 17-Aug-2020 Sheet size: A0

Drawn by: LH Approved: AW

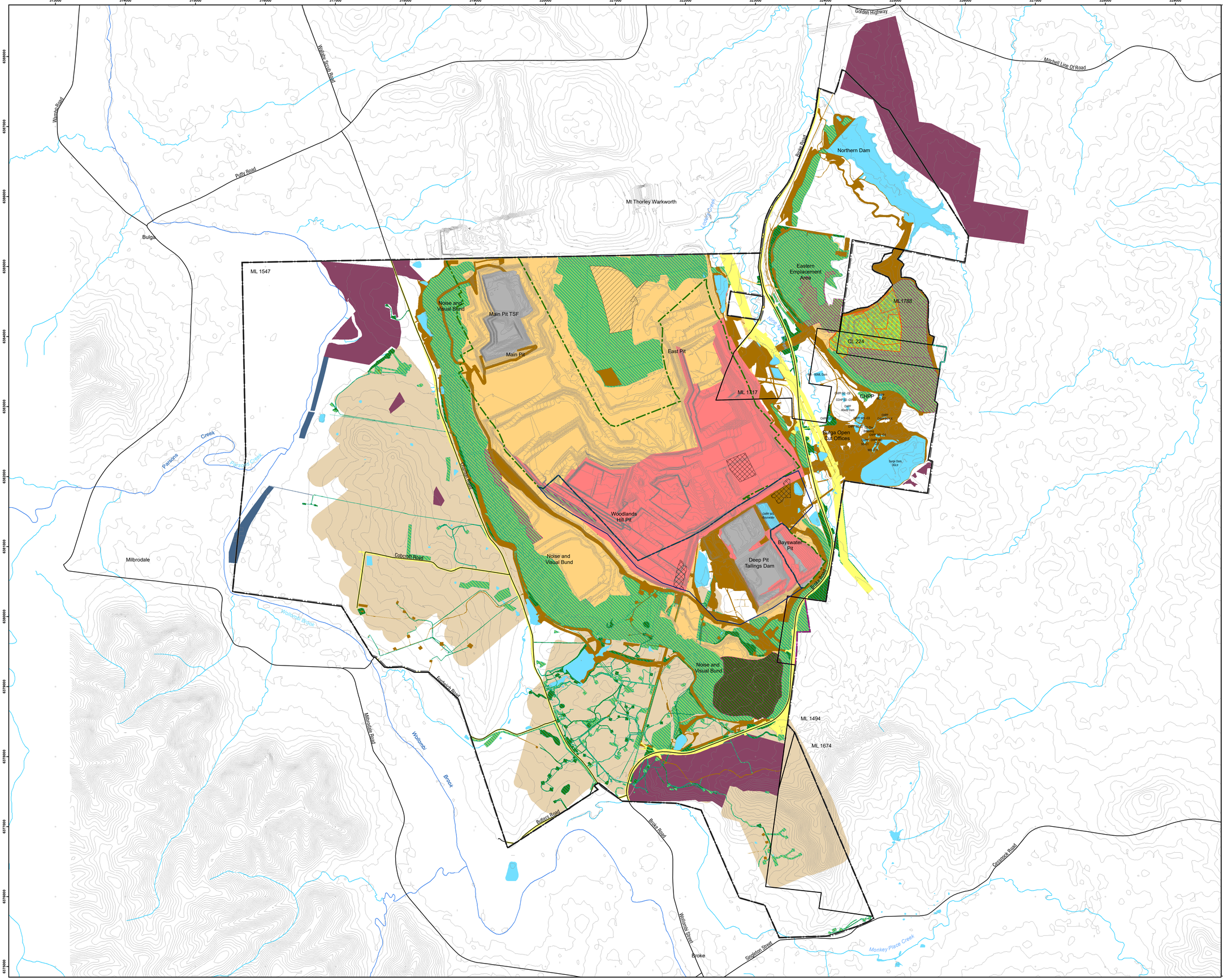
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Kilometers

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Legend

- Mining Lease
- Coal Lease
- Commonwealth Licence Agreement
- Colliery Holding
- Approved Mine Workings Outline – Open Cut
- South Pit Extension Area
- In-pit Stockpiles
- Road
- Contours 10m
- Watercourse
- Minor Watercourse
- Public Infrastructure

2023 Activity

- 2023 - Rehabilitation
- 2023 - Disturbance of Rehabilitation

Primary Domains

- Domain 1 - Infrastructure
- Domain 2 - Emplacement Areas
- Domain 3 - Active Mining
- Domain 4 - Tailings Emplacement
- Domain 5 - Rehabilitation Woodland
- Domain 6 - Rehabilitation Pasture
- Domain 7 - Surface Water / Dams
- Domain 8 - Conservation Area
- Domain 9 - Vegetation Re-establishment Area
- Domain 10 - Subsidence Management

Phase

- Phase 2 - Landform Establishment
- Phase 3 - Growth Medium Development
- Phase 4 - Ecosystem and Land Use Establishment

I, ..., Registered Mine Surveyor, certify that to the best of my knowledge and belief, this plan conforms to the accuracy & standards required by NSW Department of Planning, Industry and Environment - Resources Regulator.

Registered Mine Surveyor ..... Date .....

I, ..., Holder of Mine Managers Practising Certificate, certify that to the best of my knowledge and belief, that this plan is a true indication of the proposed development.

Mine Manager ..... Date .....

Bulga Open Cut
Mining Operations Plan
Mining and Rehabilitation - Jan - June 2023
Plan 3D

GLENCORE

N


Date:	17-Aug-2020	Sheet size:	A0
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I, ..., Registered Mine Surveyor, certify that to the best of my knowledge and belief, this plan conforms to the accuracy & standards required by NSW Department of Planning, Industry and Environment - Resources Regulator.

Registered Mine Surveyor .... Date ....

I, ..., Holder of Mine Managers Practising Certificate, certify that to the best of my knowledge and belief, that this plan is a true indication of the proposed development.

Mine Manager .... Date ....

Bulga Open Cut Mining Operations Plan Final Rehabilitation and Post Mining Land Use Plan 4 - Year 2039

GLENCORE

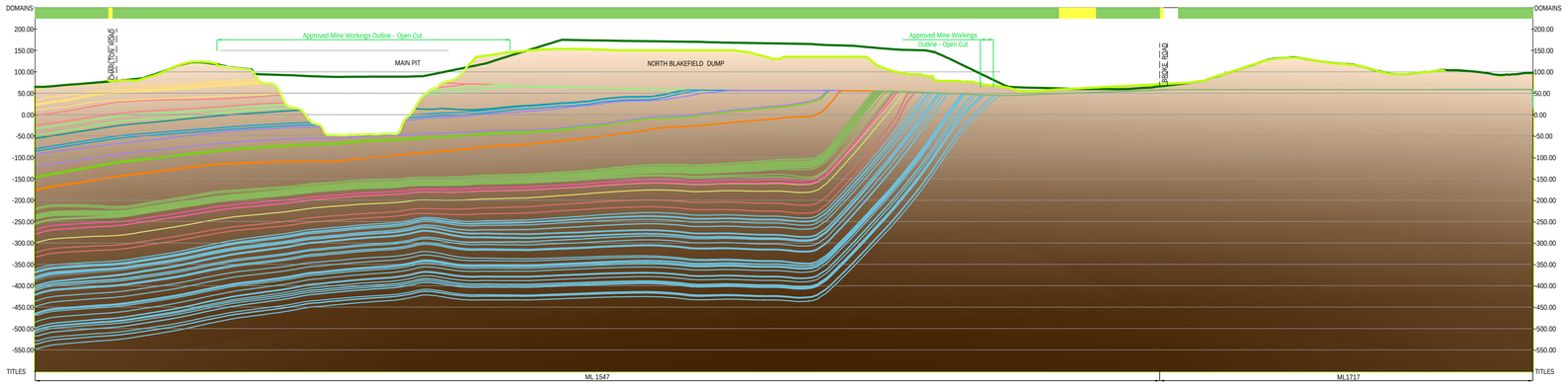
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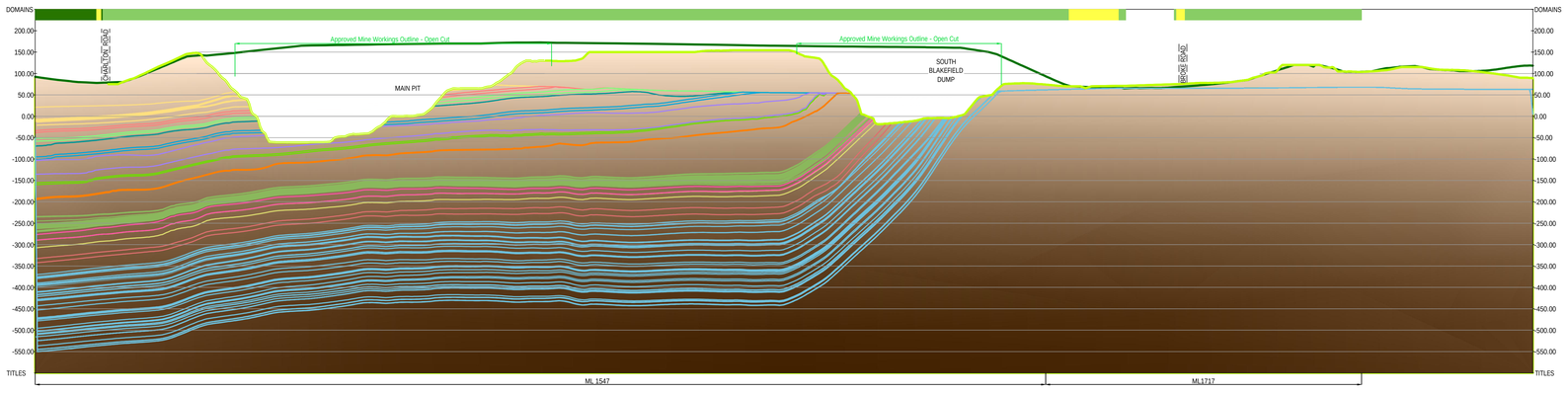
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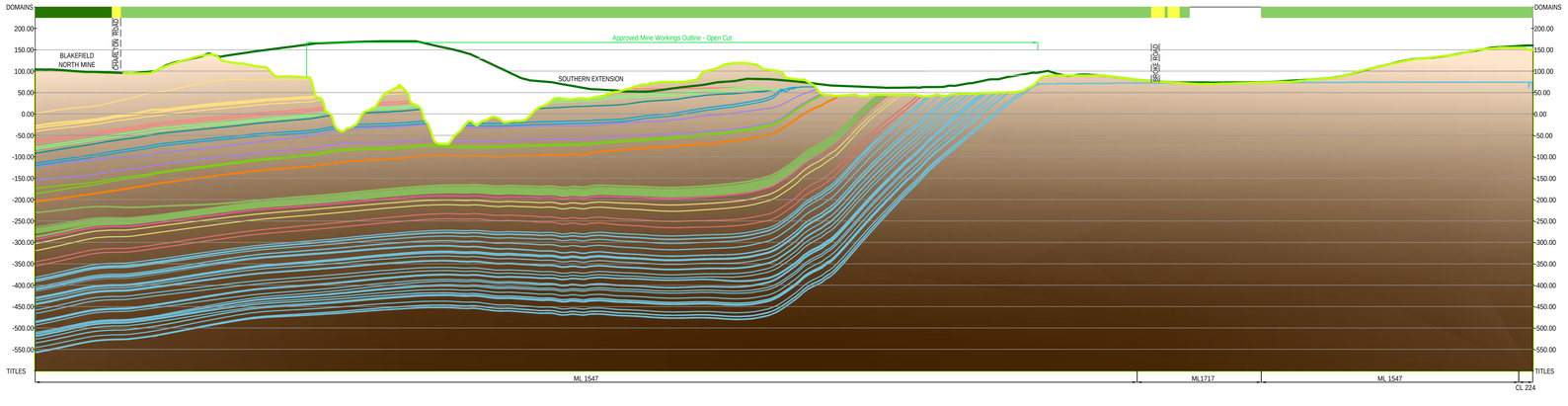
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Section A-A'



Section B-B'



Section C-C'

Legend

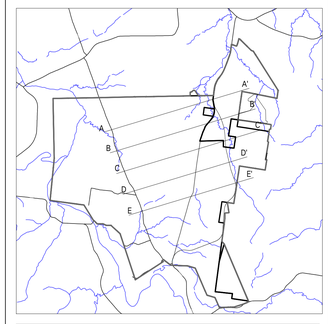
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- Proposed Final Landform (2039)
- Public Infrastructure

Coal Seams

- Whybrow Seam
- Redbank Creek Seam
- Wambo Seam
- Whynot Seam
- Blakefield Seam
- Glen Munro Seam
- Woodlands Hill Seam
- Mt Arthur Seam
- Piercefield Seam
- Vaux Seam
- Broonie Seam
- Bayswater Seam
- Foybrook Seam

Primary Domains

- Domain A - Final Void
- Domain B - Rehabilitation / Woodland
- Domain C - Pasture



I, ..., Registered Mine Surveyor, certify that to the best of my knowledge and belief, this plan conforms to the accuracy & standards required by NSW Department of Planning, Industry and Environment - Resources Regulator.

Registered Mine Surveyor ..... Date .....

I, ..., Holder of Mine Managers Practising Certificate, certify that to the best of my knowledge and belief, that this plan is a true indication of the proposed development.

Mine Manager ..... Date .....

Bulga open Cut
Mining Operations Plan
Cross Sections
Plan 5A

GLENCORE

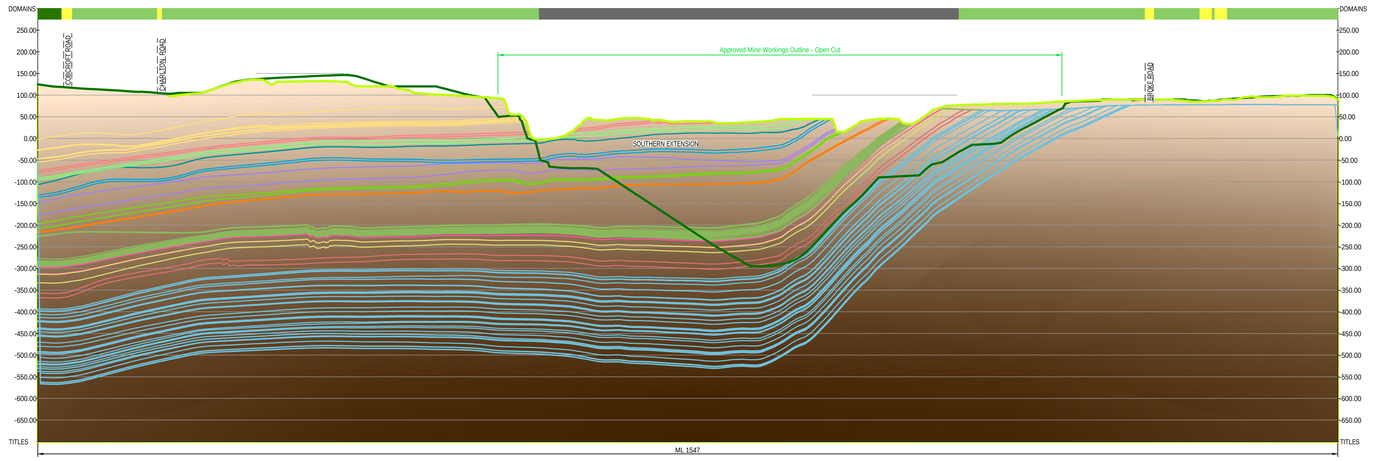
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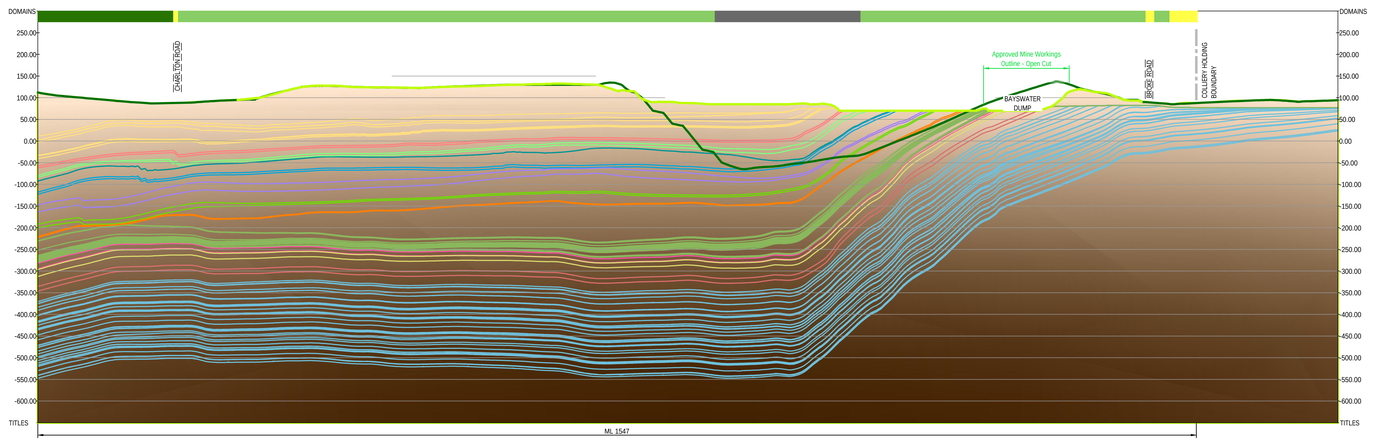
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Section D-D'



Section E-E'

Legend

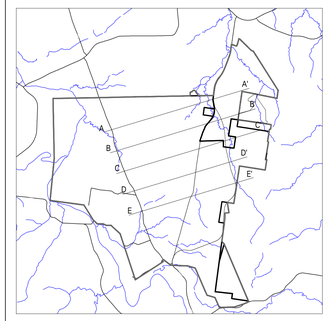
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- Proposed Final Landform (2039)
- Public Infrastructure

Coal Seams

- Whybrow Seam
- Redbank Creek Seam
- Wambo Seam
- Whynot Seam
- Blakefield Seam
- Glen Munro Seam
- Woodlands Hill Seam
- Mt Arthur Seam
- Piercefield Seam
- Vaux Seam
- Broonie Seam
- Bayswater Seam
- Foybrook Seam

Primary Domains

- Domain A - Final Void
- Domain B - Rehabilitation / Woodland
- Domain C - Pasture



I, ..., Registered Mine Surveyor, certify that to the best of my knowledge and belief, this plan conforms to the accuracy & standards required by NSW Department of Planning, Industry and Environment - Resources Regulator.

Registered Mine Surveyor Date

....

I, ..., Holder of Mine Managers Practising Certificate, certify that to the best of my knowledge and belief, that this plan is a true indication of the proposed development.

Mine Manager Date

....

Bulga Open Cut
Mining Operations Plan
Cross Sections
Plan 5B

GLENCORE

N

Date: 17/08/2020 Sheet size: A0

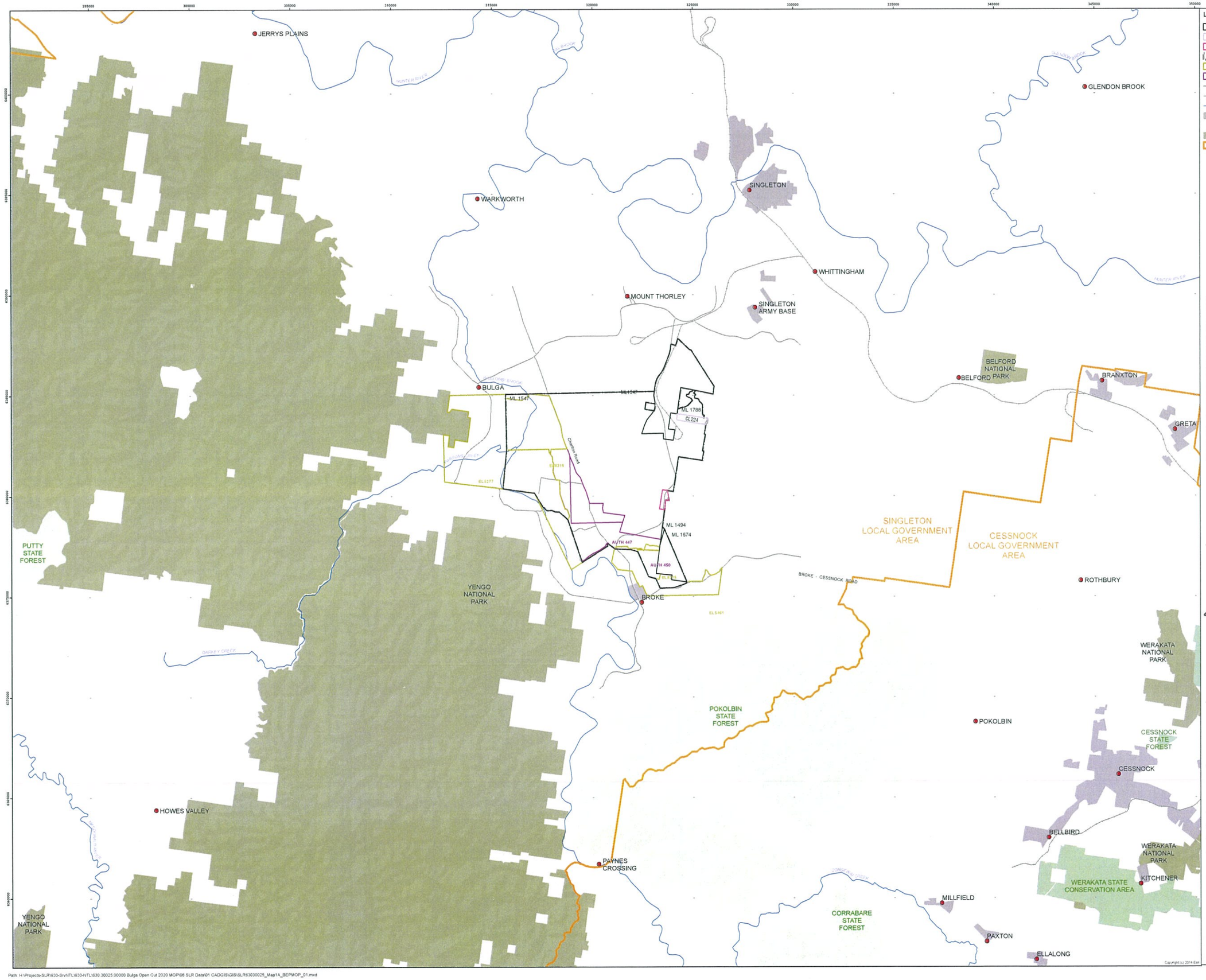
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I, N WILLIAMS, Registered Mine Surveyor, certify that to the best of my knowledge and belief, this plan conforms to the accuracy & standards required by NSW Department of Planning, Industry and Environment - Resources Regulator.

Registered Mine Surveyor ..... Date 17/9/20

I, C.GERARD, Holder of Mine Managers Practising Certificate, certify that to the best of my knowledge and belief, that this plan is a true indication of the proposed development.

Mine Manager ..... Date 17/8/2020

Bulga Open Cut
Mining Operations Plan
Project Locality: Statewide Context
Plan 1A

GLENCORE

N

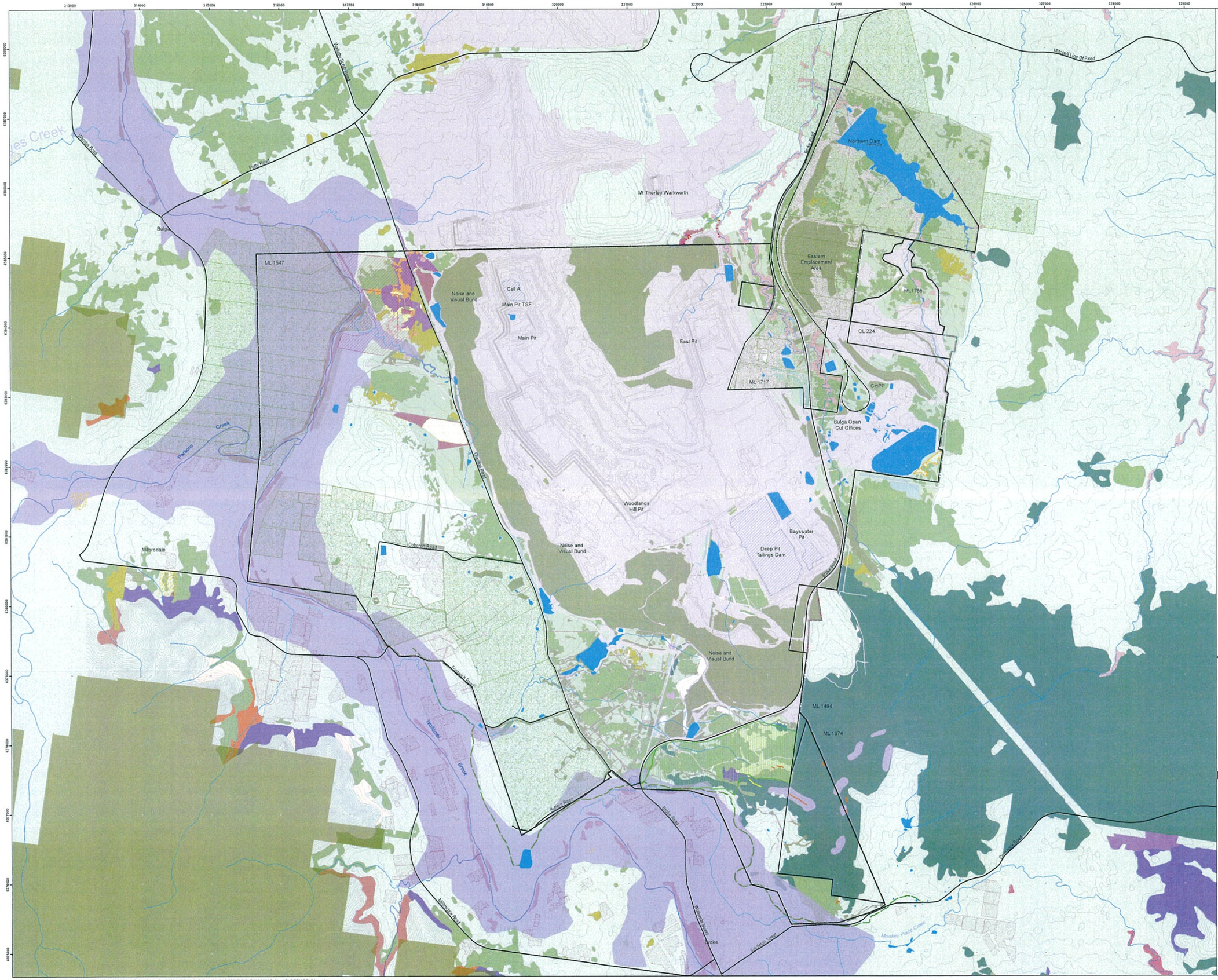
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Legend

- Mining Lease
- Coal Lease
- Commonwealth Licence Agreement
- Colliery Holding
- Road
- Railway
- Contours 10m
- Watercourse
- Minor Watercourse
- Tailings Dams
- Wet Soak
- Flood Prone Land
- Limit of Alluvium

Land Use

- National Park Boundaries
- Grazing
- Olive Grove
- Orchard
- Vineyards

Cliff Lines and Rock Pinnacles

- Cliff Lines
- Rock Pinnacles
- Forest Red Gum Woodland Offset Area

Cultural Heritage Sites

- Artefact Scatter Site
- Isolated Artefact Site
- Open Site
- Potential Archaeological Deposit
- Site Complex
- European Heritage Site

Vegetation Communities

- Existing Mine Rehabilitation Areas
- Bulga Wattle Woodland
- Central Hunter Bulloak Forest Regeneration
- Central Hunter Grey Box - Ironbark Derived Native Grassland
- Central Hunter Grey Box - Ironbark Woodland EEC
- Central Hunter Ironbark - Spotted Gum - Grey Box Forest EEC
- Central Hunter Paperbark Soaks Woodland
- Central Hunter Swamp Oak Forest
- Central Hunter Box - Ironbark Woodland EEC
- Hunter Floodplain Red Gum Woodland Complex
- Hunter Valley River Oak Forest EEC
- Hunter Valley Weeping Myall Woodland EEC
- Lower Hunter Dry Rainforest
- Riparian Derived Native Grassland
- Southern Hunter Escarpment Spotted Gum Woodland
- Southern Hunter Footslopes Sheltered Forest
- Upper Hunter Coastal Myall Exposed Forest
- Upper Hunter Narrabeen Gully Ironwood Dry Rainforest
- Warkworth Sands Derived Native Grassland
- Warkworth Sands Disturbed Grassland
- Warkworth Sands Woodland EEC
- Wollombi Alluvial Red Gum - Apple Forest
- Rehabilitated Bulloak Forest
- Exotic Grassland
- Planted areas
- Derived Native Grassland
- Disturbed Land
- Vegetation Communities Unmapped by Bulga Coal
- Artefact Scatter Area
- Open Site
- Site Complex
- Conservation Area
- Offset Area - 'The Vere'

I N WILLIAMS, Registered Mine Surveyor, certify that to the best of my knowledge and belief, this plan conforms to the accuracy & standards required by NSW Department of Planning, Industry and Environment - Resources Regulator.

Registered Mine Surveyor ..... Date 17/8/20

I, C.GENZAO, Holder of Mine Managers Practising Certificate, certify that to the best of my knowledge and belief, that this plan is a true indication of the proposed development.

Mine Manager ..... Date 17/8/2020

Bulga Open Cut
Mining Operations Plan
Pre-mining Environment - Natural Environment
Plan 1B

GLENCORE

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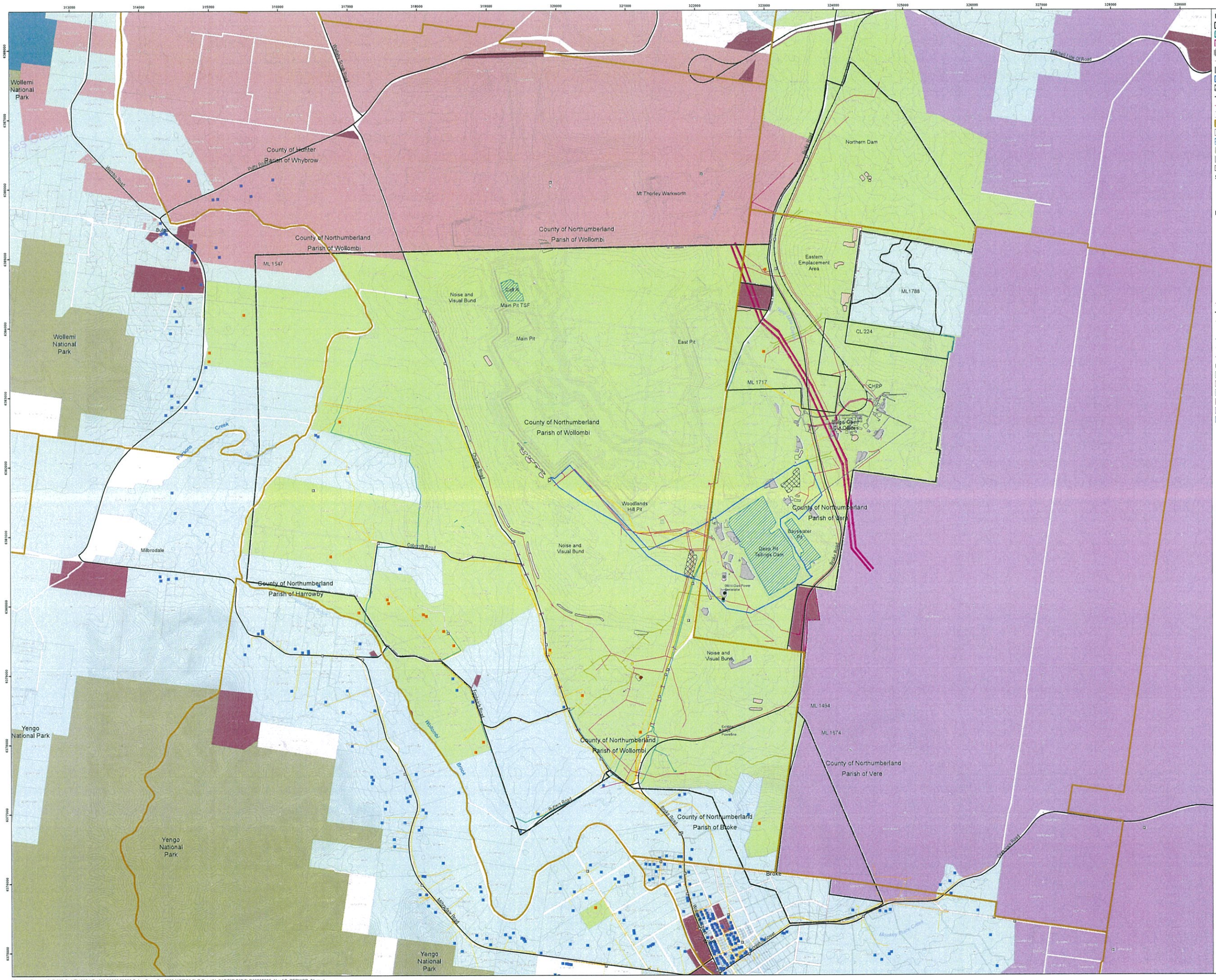
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Legend

- Mining Lease
- Coal Lease
- Commonwealth Licence Agreement
- Colliery Holding
- Contours 10m
- Buildings
- South Pit Extension Area
- In-pit Stockpiles
- Railway
- Powerlines
- Cadastre
- Parish Boundary
- Detailed Infrastructure
- Tailings Dams
- National Park
- Laydown Areas
- Topsoil Stockpiles

Survey Marks

- Site Survey Marks
- Permament Survey Mark: State Survey Mark
- Trigonometrical Station

Infrastructure

- 9MW Power Station
- Pit Top Facilites
- Meteorological Station
- Pre-drainage Energen Flares
- Energen Flares
- Ventilation Fans
- Vocsidisers
- Bulga Joint Venture Residence
- Private Residence
- Powerlines
- Road
- Bridges
- Telecommunications
- Piping and Instrumentation Design
- Underground Pipelines
- Culverts

Land Ownership

- Land Owned by Bulga Joint Venture
- Land Owned by Coal and Allied
- Private Land
- Crown/LGA
- Commonwealth Land (Singleton Army Training Area)
- Mining - Other

I, N WILLIAMS, Registered Mine Surveyor, certify that to the best of my knowledge and belief, this plan conforms to the accuracy & standards required by NSW Department of Planning, Industry and Environment - Resources Regulator.

Registered Mine Surveyor ..... Date 17/8/20

I, L.BEDARD, Holder of Mine Managers Practising Certificate, certify that to the best of my knowledge and belief, that this plan is a true indication of the proposed development.

Mine Manager ..... Date 17/8/2020

Bulga Open Cut
Mining Operations Plan
Pre-mining Environment; Built Environment
Plan 1C

GLENCORE

N

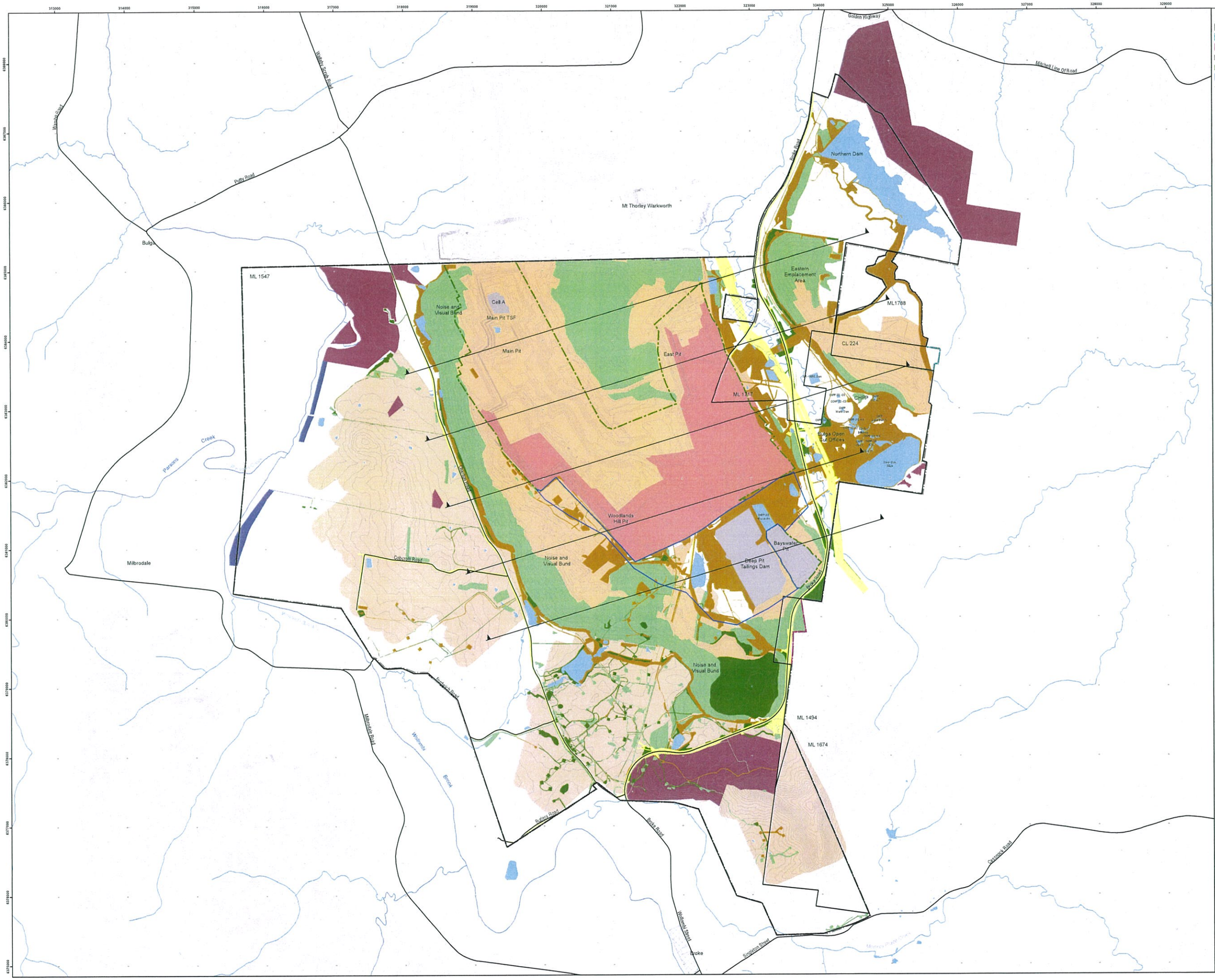
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I, N WILLIAMS, Registered Mine Surveyor, certify that to the best of my knowledge and belief, this plan conforms to the accuracy & standards required by NSW Department of Planning, Industry and Environment - Resources Regulator.

Registered Mine Surveyor ..... Date 17/8/20

I, L FERRARO, Holder of Mine Managers Practising Certificate, certify that to the best of my knowledge and belief, that this plan is a true indication of the proposed development.

Mine Manager ..... Date 17/8/2020

Bulga Open Cut
Mining Operations Plan
Mine Domains at Commencement of MOP
Plan 2

GLENCORE

N

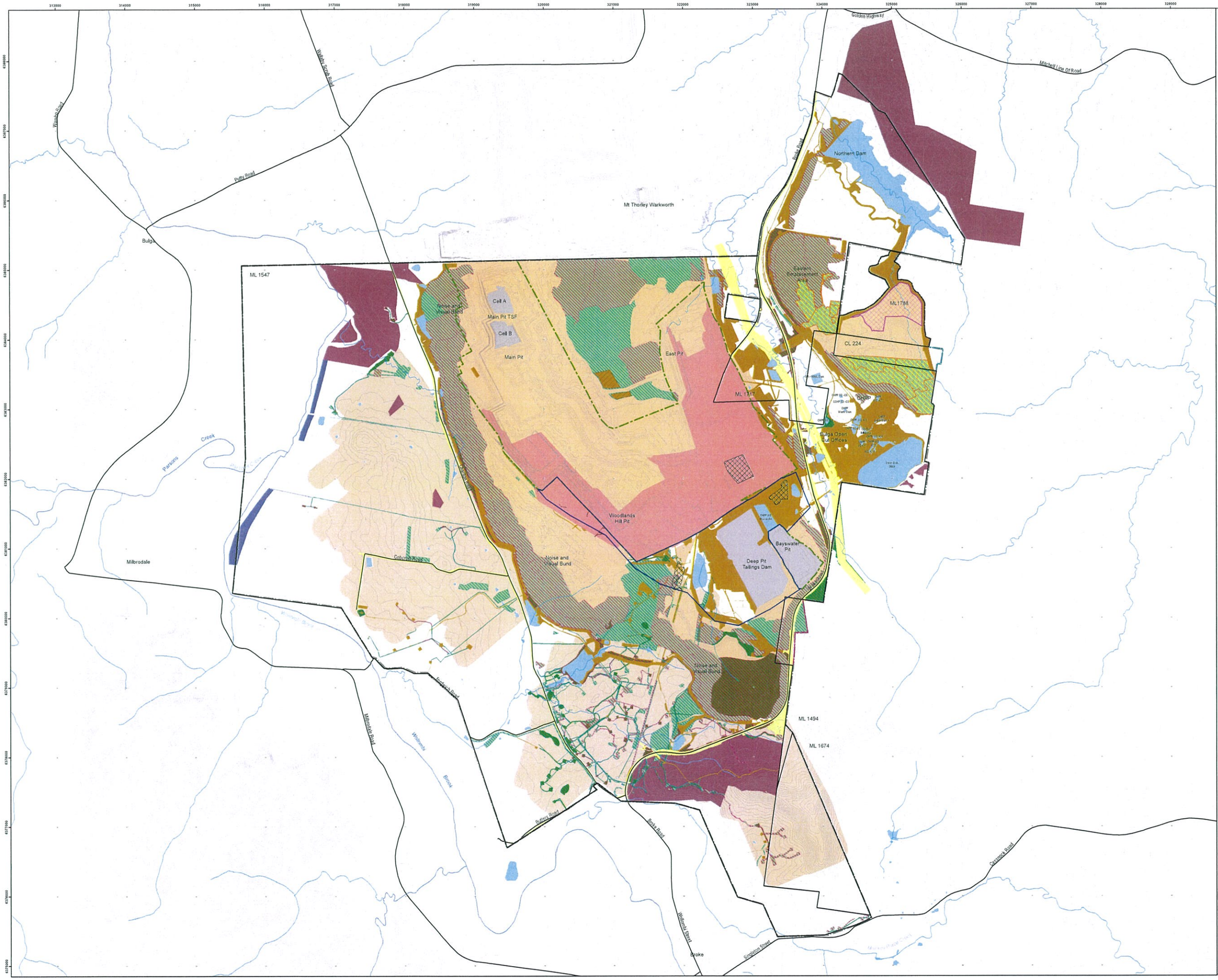
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Kilometers

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Legend

- Mining Lease
- Coal Lease
- Commonwealth Licence Agreement
- Colliery Holding
- Approved Mine Workings Outline – Open Cut
- South Pit Extension Area
- In-pit Stockpiles
- Road
- Contours 10m
- Watercourse
- Minor Watercourse
- Public Infrastructure

2020 Activity

- 2020 - Rehabilitation
- 2020 - Disturbance
- 2020 - Disturbance of Rehabilitation

Primary Domains

- Domain 1 - Infrastructure
- Domain 2 - Emplacement Areas
- Domain 3 - Active Mining
- Domain 4 - Tailings Emplacement
- Domain 5 - Rehabilitation Woodland
- Domain 6 - Rehabilitation Pasture
- Domain 7 - Surface Water / Dams
- Domain 8 - Conservation Area
- Domain 9 - Vegetation Re-establishment Area
- Domain 10 - Subsidence Management

Rehabilitation Phase

- Phase 2 - Landform Establishment
- Phase 3 - Growth Medium Development
- Phase 4 - Ecosystem and Land Use Establishment

I, N WILLIAMS Registered Mine Surveyor, certify that to the best of my knowledge and belief, this plan conforms to the accuracy & standards required by NSW Department of Planning, Industry and Environment - Resources Regulator.

Registered Mine Surveyor ..... Date 17/8/20

I, C GODDARD ..... Holder of Mine Managers Practising Certificate, certify that to the best of my knowledge and belief, that this plan is a true indication of the proposed development.

Mine Manager ..... Date 17/8/2020

Bulga Open Cut
Mining Operations Plan
Mining and Rehabilitation - July - Dec 2020
Plan 3A

GLENCORE

N

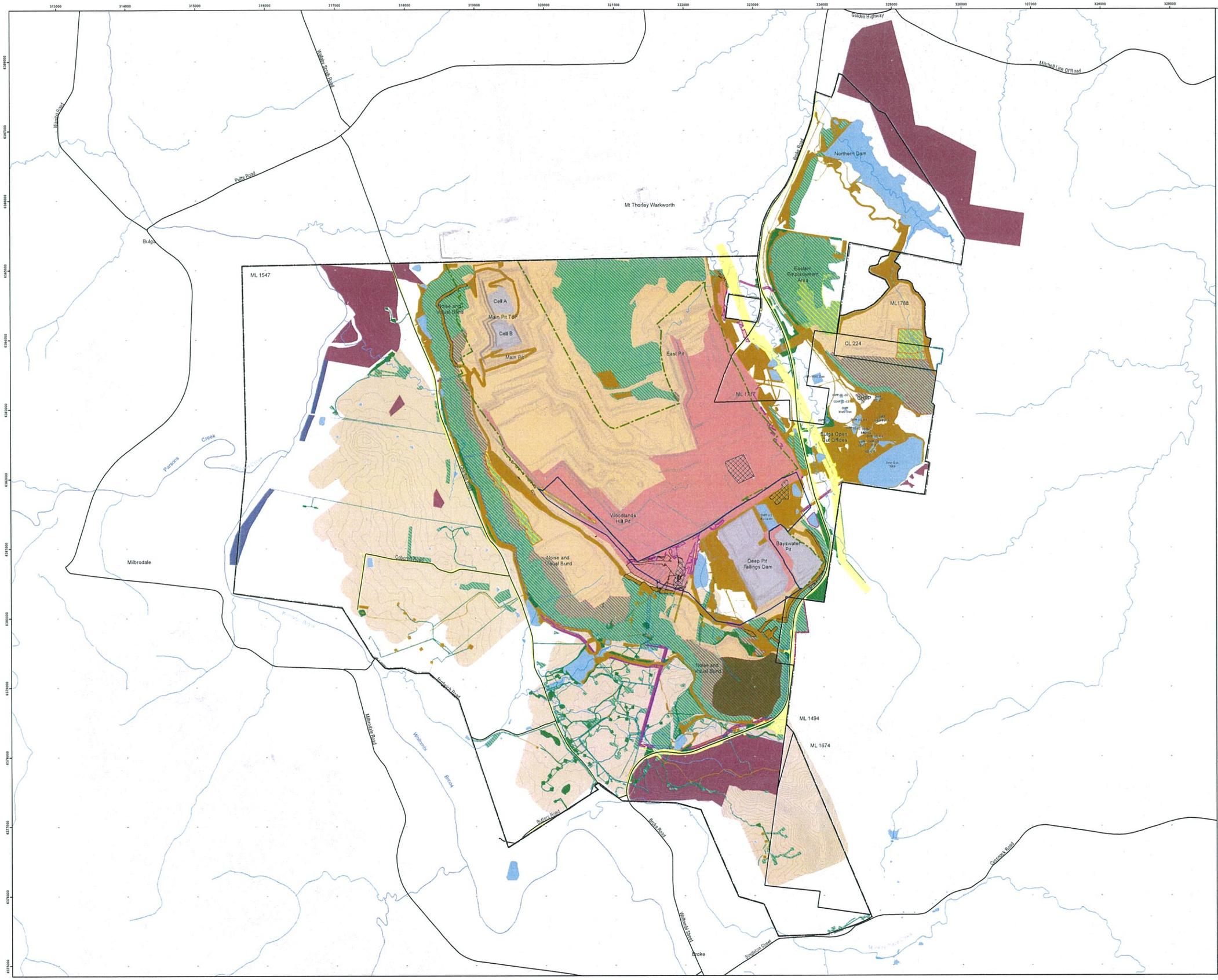
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Legend

- Mining Lease
- Coal Lease
- Commonwealth Licence Agreement
- Colliery Holding
- Approved Mine Workings Outline – Open Cut
- South Pit Extension Area
- In-pit Stockpiles
- Road
- Contours 10m
- Watercourse
- Minor Watercourse
- Public Infrastructure

2021 Activity

- 2021 - Rehabilitation
- 2021 - Disturbance
- 2021 - Disturbance of Rehabilitation
- 2021 - Clearing

Primary Domains

- Domain 1 - Infrastructure
- Domain 2 - Emplacement Areas
- Domain 3 - Active Mining
- Domain 4 - Tailings Emplacement
- Domain 5 - Rehabilitation Woodland
- Domain 6 - Rehabilitation Pasture
- Domain 7 - Surface Water / Dams
- Domain 8 - Conservation Area
- Domain 9 - Vegetation Re-establishment Area
- Domain 10 - Subsidence Management

Phase

- Phase 2 - Landform Establishment
- Phase 3 - Growth Medium Development
- Phase 4 - Ecosystem and Land Use Establishment

I, N WILLIAMS, Registered Mine Surveyor, certify that to the best of my knowledge and belief, this plan conforms to the accuracy & standards required by NSW Department of Planning, Industry and Environment - Resources Regulator.

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Mine Manager ..... Date 17/8/2020

Bulga Open Cut
Mining Operations Plan
Mining and Rehabilitation - Jan - Dec 2021
Plan 3B

GLENCORE

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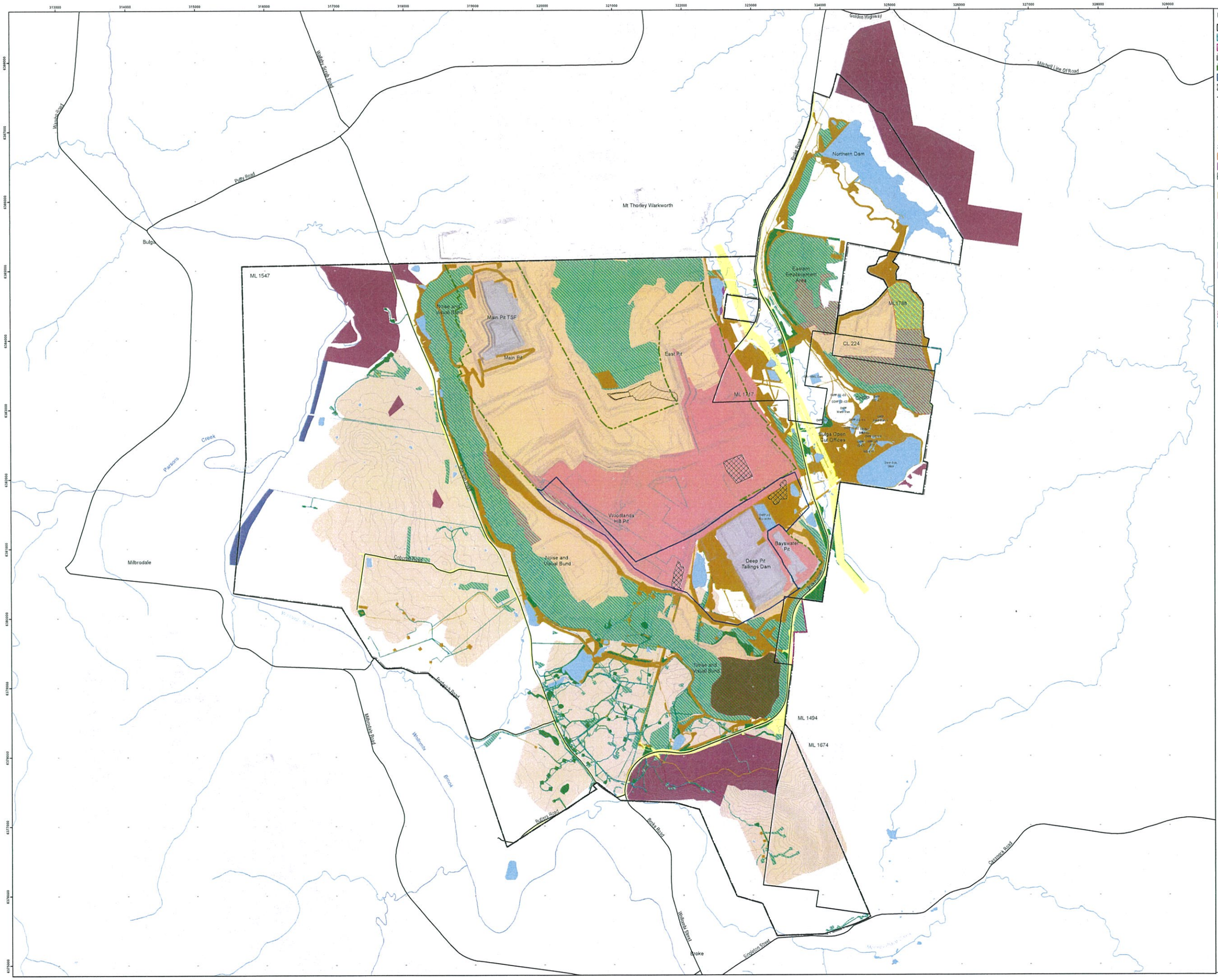
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Registered Mine Surveyor ..... Date 17/8/20

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Mine Manager ..... Date 17/8/2020

Bulga Open Cut
Mining Operations Plan
Mining and Rehabilitation - Jan - Dec 2022
Plan 3C

GLENCORE

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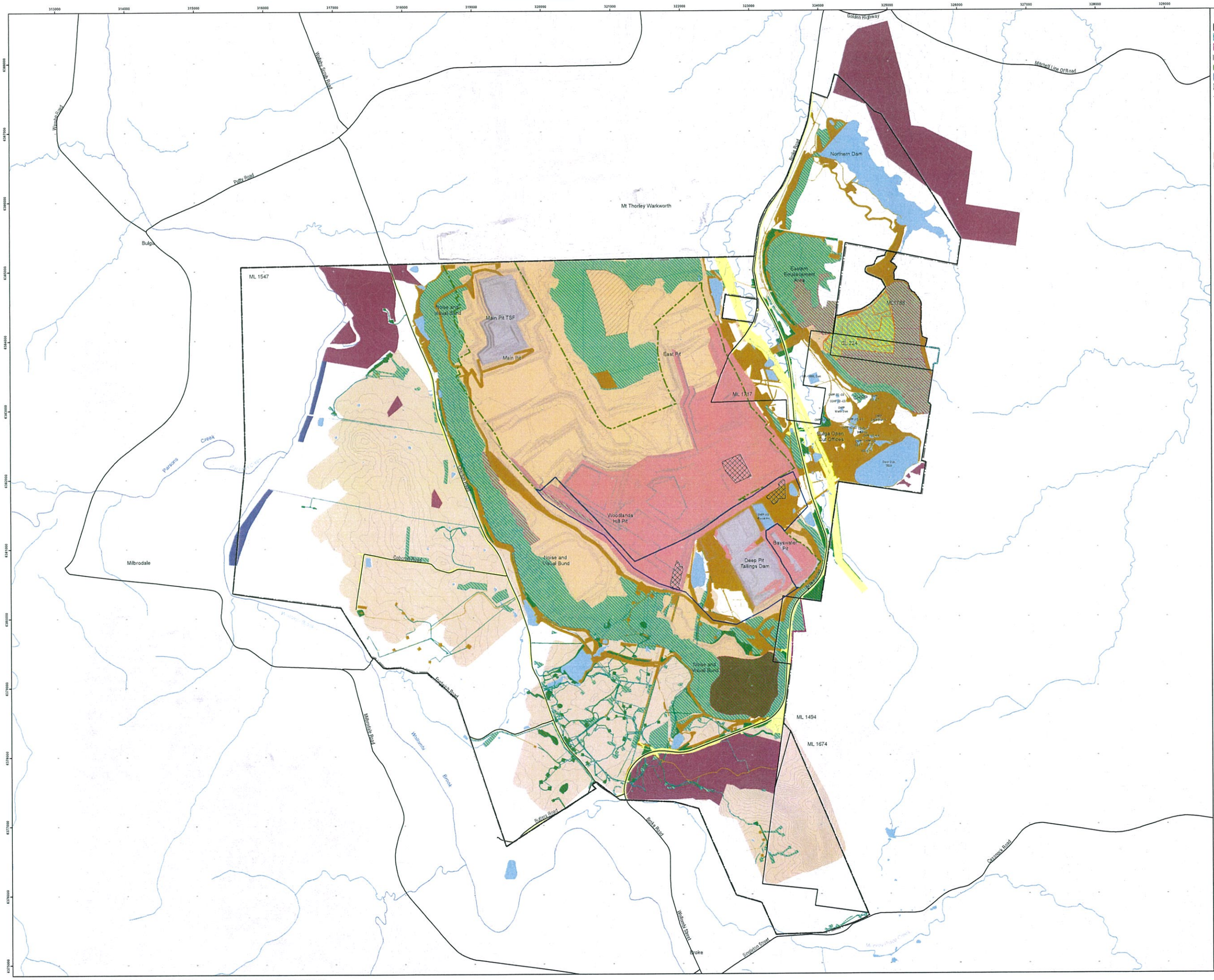
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Legend

- Mining Lease
- Coal Lease
- Commonwealth Licence Agreement
- Colliery Holding
- Approved Mine Workings Outline – Open Cut
- South Pit Extension Area
- In-pit Stockpiles
- Road
- Contours 10m
- Watercourse
- Minor Watercourse
- Public Infrastructure

2023 Activity

- 2023 - Rehabilitation
- 2023 - Disturbance of Rehabilitation

Primary Domains

- Domain 1 - Infrastructure
- Domain 2 - Emplacement Areas
- Domain 3 - Active Mining
- Domain 4 - Tailings Emplacement
- Domain 5 - Rehabilitation Woodland
- Domain 6 - Rehabilitation Pasture
- Domain 7 - Surface Water / Dams
- Domain 8 - Conservation Area
- Domain 9 - Vegetation Re-establishment Area
- Domain 10 - Subsidence Management

Phase

- Phase 2 - Landform Establishment
- Phase 3 - Growth Medium Development
- Phase 4 - Ecosystem and Land Use Establishment

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Mine Manager ..... Date 17/8/2020

Bulga Open Cut
Mining Operations Plan
Mining and Rehabilitation - Jan - June 2023
Plan 3D

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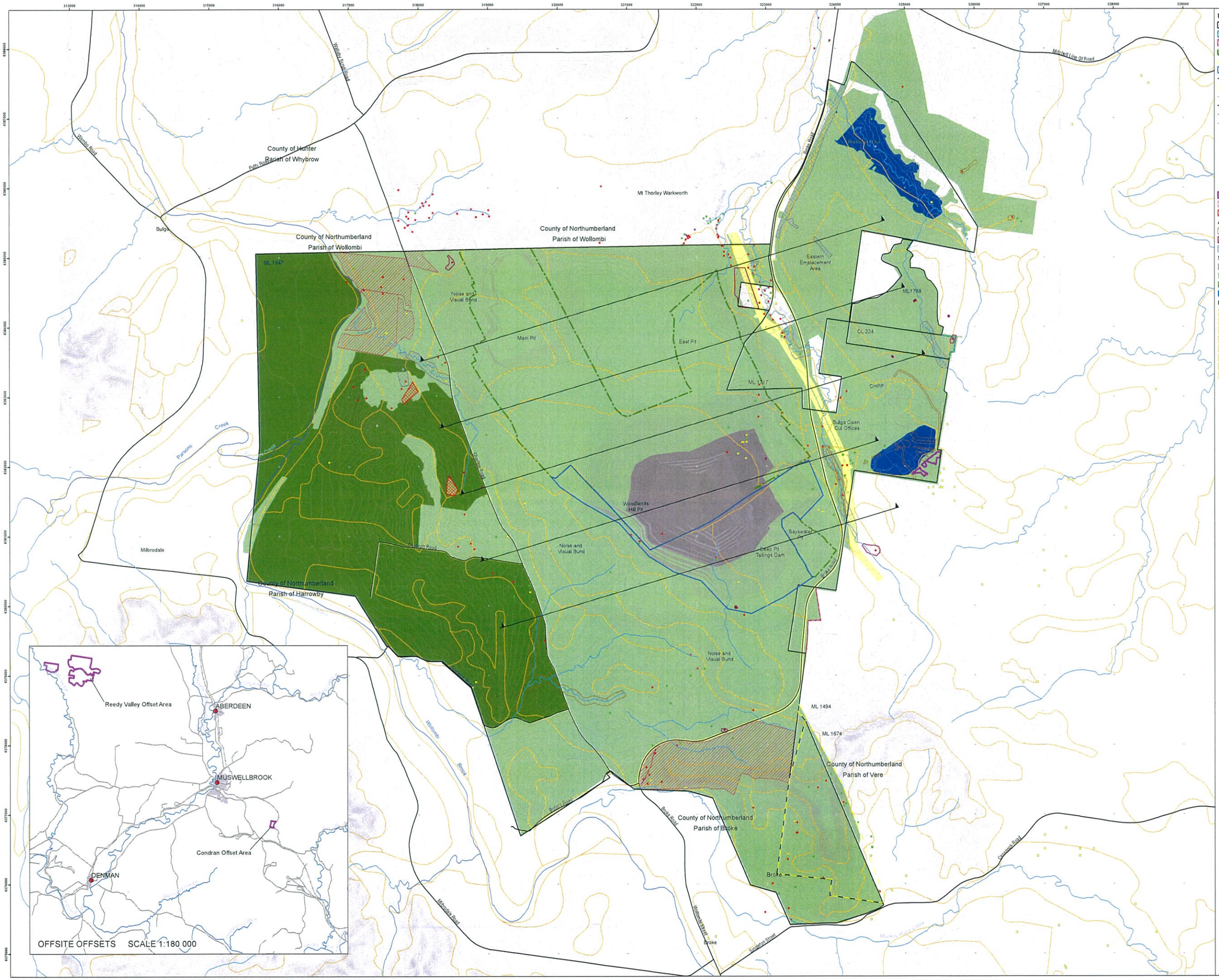
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Legend

- Mining Lease
- Coal Lease
- Commonwealth Licence Agreement
- Approved Mine Workings Outline – Open Cut
- Commonwealth SMP Area
- South Pit Extension Area
- Cross_Sections
- Public Infrastructure
- Final Landform Contours
- Road
- Watercourse
- Minor Watercourse
- Artefact Scatter Site
- Isolated Artefact Site
- Potential Archaeological Deposit
- Unconfirmed Artefact Site
- Open Site
- Site Complex
- European Heritage Site
- Offset and Conservation Areas
- Conservation Area
- Weeping Myall Management Area

Aboriginal Heritage Regions

- Artefact Scatter Area
- Open Site
- Site Complex

Secondary Domains

- Domain A - Final Void
- Domain B - Rehabilitation / Woodland
- Domain C - Pasture
- Domain D - Water Management Area

Post Closure Land Capability

- 1 - Suitable for Regular Cultivation
- 2 - Suitable for Regular Cultivation
- 4 - Suitable for Grazing with Occasional Cultivation
- 5 - Suitable for Grazing with Occasional Cultivation
- 6 - Suitable for Grazing with No Cultivation
- 7 - Suitable for Low Intensity Grazing
- 8 - Land Not Suitable for Grazing
- Urban

I, [illegible], Registered Mine Surveyor, certify that to the best of my knowledge and belief, this plan conforms to the accuracy & standards required by NSW Department of Planning, Industry and Environment - Resources Regulator.

Registered Mine Surveyor: [signature] Date: 17/8/20

I, [illegible], Holder of Mine Managers Practising Certificate, certify that to the best of my knowledge and belief, that this plan is a true indication of the proposed development.

Mine Manager: [signature] Date: 17/8/2020

Bulga Open Cut Mining Operations Plan Final Rehabilitation and Post Mining Land Use Plan 4 - Year 2039

GLENCORE

N

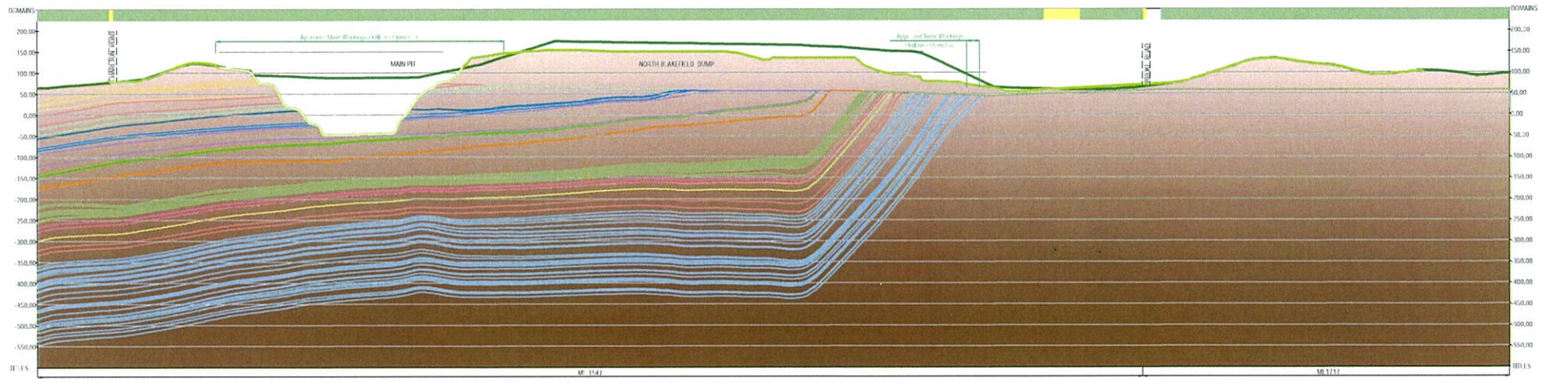
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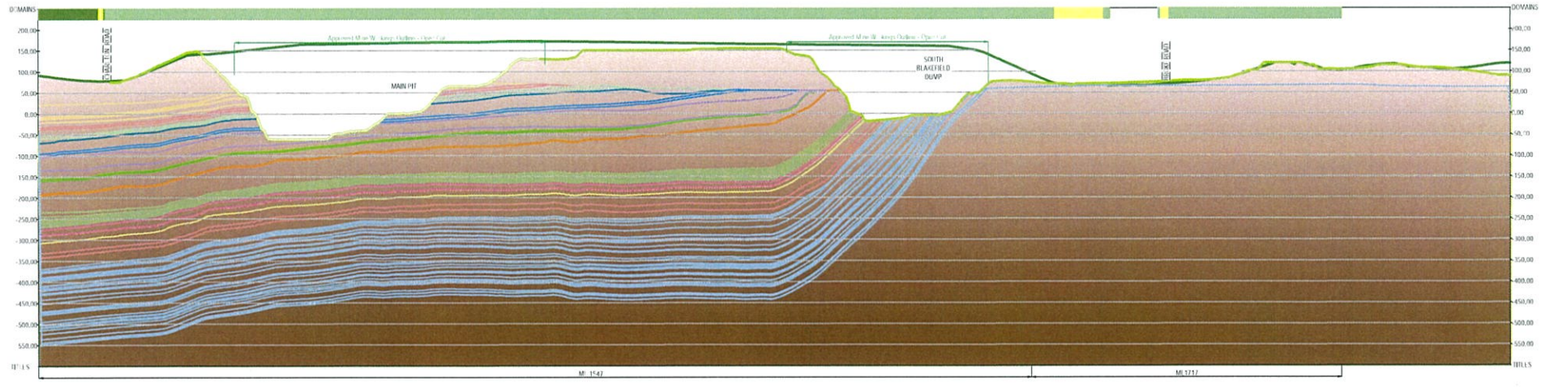
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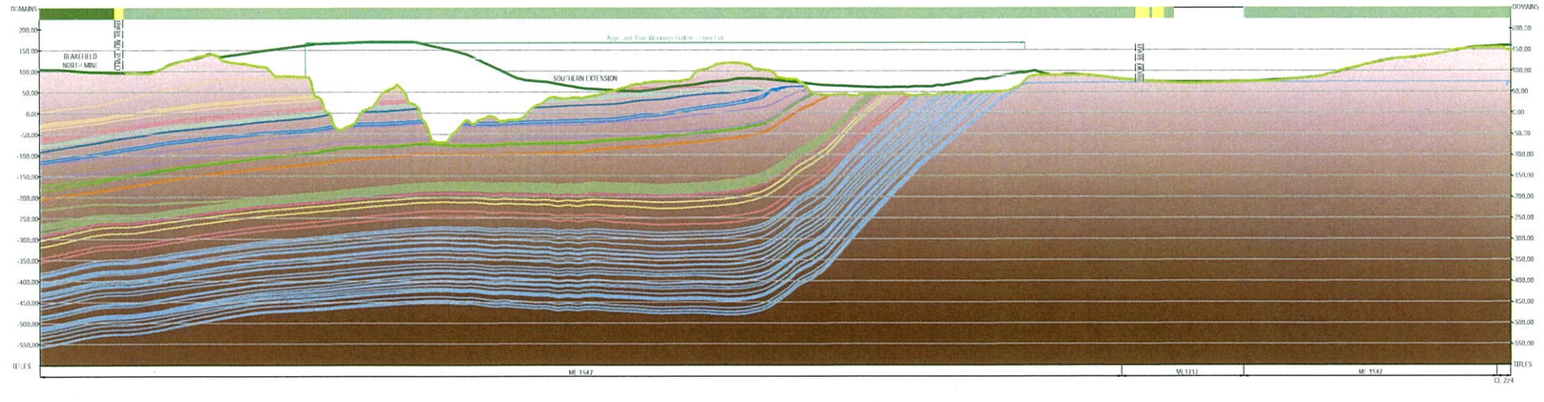
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Section A-A'



Section B-B'



Section C-C'

Legend

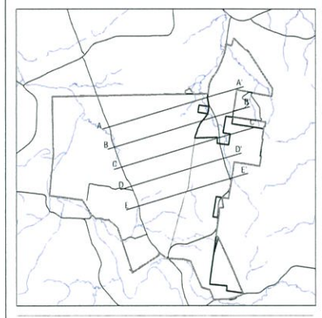
- Existing Surface (2020)
- Proposed Final Landform (2039)
- Public Infrastructure

Coal Seams

- Whybrow Seam
- Redbank Creek Seam
- Wambo Seam
- Whynot Seam
- Blakefield Seam
- Glen Munro Seam
- Woodlands Hill Seam
- Mt Arthur Seam
- Piercefield Seam
- Vaux Seam
- Broonie Seam
- Bayswater Seam
- Foybrook Seam

Primary Domains

- Domain A - Final Void
- Domain B - Rehabilitation / Woodland
- Domain C - Pasture



I, N WILLIAMS, Registered Mine Surveyor, certify that to the best of my knowledge and belief, this plan conforms to the accuracy & standards required by NSW Department of Planning, Industry and Environment - Resources Regulator.

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Mine Manager ..... Date 17/8/2020

Bulga open Cut
Mining Operations Plan
Cross Sections
Plan 5A

GLENCORE

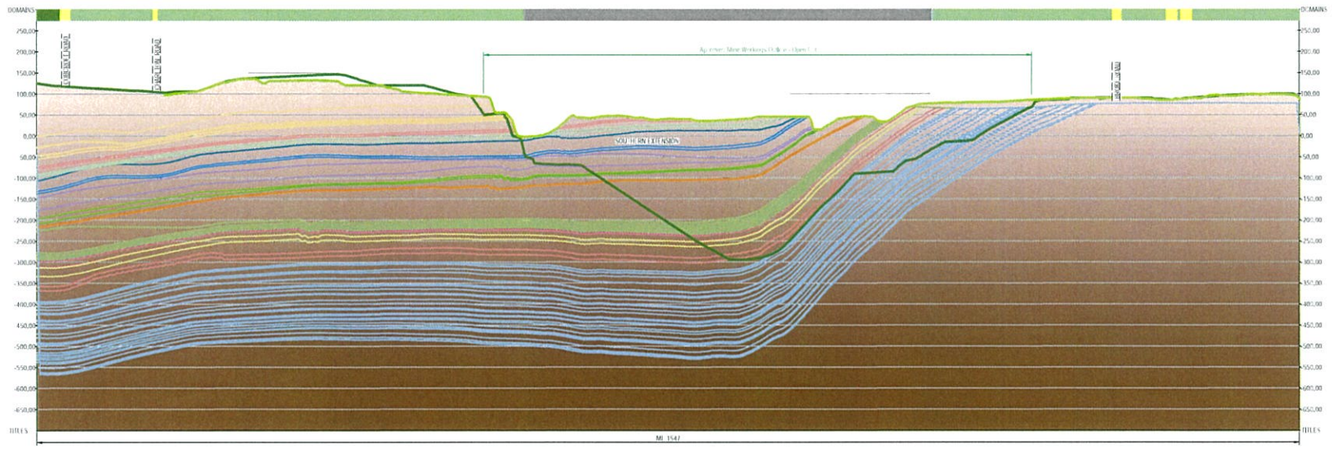
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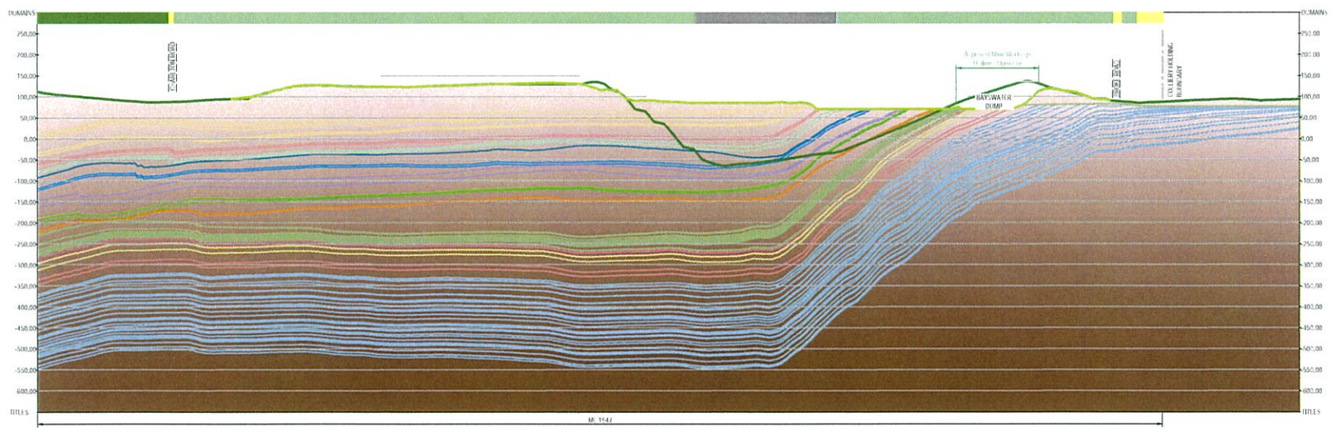
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Kilometers

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Section D-D'



Section E-E'

Legend

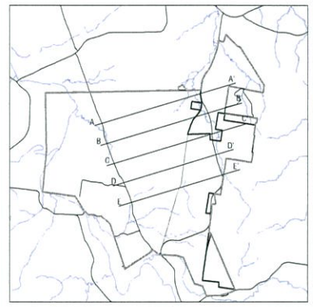
- Existing Surface (2020)
- Proposed Final Landform (2039)
- Public Infrastructure

Coal Seams

- Whybrow Seam
- Redbank Creek Seam
- Wambo Seam
- Whynot Seam
- Blakefield Seam
- Glen Munro Seam
- Woodlands Hill Seam
- Mt Arthur Seam
- Piercefield Seam
- Vaux Seam
- Broonie Seam
- Bayswater Seam
- Foybrook Seam

Primary Domains

- Domain A - Final Void
- Domain B - Rehabilitation / Woodland
- Domain C - Pasture



I, N WILLIAMS, Registered Mine Surveyor, certify that to the best of my knowledge and belief, this plan conforms to the accuracy & standards required by NSW Department of Planning, Industry and Environment - Resources Regulator.

Registered Mine Surveyor ..... Date 17/8/20

I, C. GERARD, Holder of Mine Managers Practising Certificate, certify that to the best of my knowledge and belief, that this plan is a true indication of the proposed development.

Mine Manager ..... Date 17/8/2020

Bulga Open Cut
Mining Operations Plan
Cross Sections
Plan 5B

GLENCORE

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Scale:	Vertical 1:10,000	Horizontal	1:5,000

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Kilometers

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Appendix 2 – Schedule of Land Ownership

Bulga Coal Schedule of Lands

Lot/DP	Owner
35//755264	Mining - Bulga
4//755264	Mining - Bulga
111//755264	Mining - Bulga
109//755264	Mining - Bulga
61//755264	Mining - Bulga
43//755264	Mining - Bulga
25//755264	Mining - Bulga
3//755264	Mining - Bulga
34//755264	Mining - Bulga
80//755264	Mining - Bulga
22//755264	Mining - Bulga
103//755264	Mining - Bulga
30//755264	Mining - Bulga
27//755264	Mining - Bulga
86//755264	Mining - Bulga
113//755264	Mining - Bulga
98//755264	Mining - Bulga
52//755264	Mining - Bulga
105//755264	Mining - Bulga
28//755264	Mining - Bulga
26//755264	Mining - Bulga
53//755264	Mining - Bulga
101//1033019	Mining - Bulga
83//755264	Mining - Bulga
33//755264	Mining - Bulga
1//784032	Mining - Bulga
85//755264	Mining - Bulga
54//755264	Mining - Bulga
81//755264	Mining - Bulga
5//248448	Mining - Bulga
6//561424	Mining - Bulga
2//102103	Mining - Bulga
85//856359	Mining - Bulga
1//102103	Mining - Bulga
8//248448	Mining - Bulga
4//615819	Private
6//248448	Mining - Bulga
3//561424	Mining - Bulga
4//561424	Mining - Bulga
1//745971	Mining - Bulga
1//133168	Mining - Bulga
6//755264	Mining - Bulga
31//755264	Mining - Bulga
36//755264	Mining - Bulga
23//755264	Mining - Bulga
5//755264	Mining - Bulga

Lot/DP	Owner
1//657988	Mining - Bulga
82//755264	Mining - Bulga
44//755264	Mining - Bulga
29//755264	Mining - Bulga
125//755264	Mining - Bulga
24//755264	Mining - Bulga
51//755264	Mining - Bulga
5//561424	Mining - Bulga
56//755264	Mining - Bulga
4//248448	Private
2//133168	Mining - Bulga
18//10022	Private
7//10022	Mining - Bulga
8//10022	Mining - Bulga
852//612261	Mining - Bulga
2//62544	Mining - Bulga
17//10022	Mining - Bulga
7//248448	Mining - Bulga
82//1006883	Private
1241//1015814	Mining - Bulga
6//10022	Mining - Bulga
112//606531	Private
1243//1015814	Mining - Bulga
1242//1015814	Mining - Bulga
21//877447	Private
81//1006883	Private
274//260663	Mining - Bulga
1//563668	Mining - Bulga
3//861535	Private
2//133135	Mining - Bulga
4//1007798	Private
11//247398	Mining - Bulga
18//247398	Mining - Bulga
5//247398	Mining - Bulga
15//247398	Mining - Bulga
9//247398	Mining - Bulga
1//62544	Mining - Bulga
1//133135	Mining - Bulga
5//861535	Mining - Bulga
1//136366	Private
16//247398	Mining - Bulga
30//800688	Mining - Bulga
7//247398	Mining - Bulga
4//861535	Mining - Bulga
709//749857	Mining - Bulga
8//247398	Mining - Bulga

Lot/DP	Owner
3//133168	Mining - Bulga
14//247398	Mining - Bulga
31//800688	Mining - Bulga
17//247398	Mining - Bulga
1//247398	Mining - Bulga
45//755270	Mining - Bulga
50//755270	Mining - Bulga
1//966407	Mining - Bulga
3//133135	Mining - Bulga
68//755270	Mining - Bulga
3//247398	Mining - Bulga
127//856361	Crown
73//755270	Mining - Bulga
19//247398	Mining - Bulga
6//247398	Mining - Bulga
62//755270	Mining - Bulga
39//755270	Mining - Bulga
76//755270	Mining - Bulga
49//755270	Mining - Bulga
48//755270	Mining - Bulga
75//755270	Mining - Bulga
121//755270	Private
43//755270	Mining - Bulga
79//755270	Mining - Bulga
1//445449	Mining - Bulga
1//47305	Mining - Bulga
1//861535	Private
20//263943	Mining - Bulga
10//244826	Mining - Bulga
60//755270	Mining - Bulga
125//755270	Mining - Bulga
37//755270	Mining - Bulga
A//174788	Mining - Bulga
74//755270	Mining - Bulga
69//755270	Mining - Bulga
78//755270	Mining - Bulga
46//755270	Mining - Bulga
13//247398	Mining - Bulga
2//861535	Private
7//704474	Mining - Bulga
77//755270	Mining - Bulga
40//755270	Mining - Bulga
10//247398	Mining - Bulga
1//822165	Private
2//247398	Mining - Bulga
52//755270	Mining - Bulga
B//174788	Mining - Bulga
1//729923	Mining - Bulga
13//705699	Mining - Bulga

Lot/DP	Owner
4//247398	Mining - Bulga
1//564480	Mining - Bulga
12//247398	Mining - Bulga
10//730762	Mining - Bulga
12//705699	Mining - Bulga
24//816636	Mining - Bulga
44//755270	Mining - Bulga
72//755270	Mining - Bulga
6//704474	Mining - Bulga
38//755270	Mining - Bulga
51//755270	Mining - Bulga
5/33/758164	Private
3/51/758164	Private
21//811613	Mining - Bulga
7/21/758164	Private
11//244826	Mining - Bulga
1//723292	Mining - Bulga
41//755270	Mining - Bulga
2//986831	Private
3/33/758164	Private
6/21/758164	Private
192//545559	Mining - Bulga
8/33/758164	Private
11//730762	Mining - Bulga
2/51/758164	Private
7/33/758164	Private
1//986831	Private
11//705699	Mining - Bulga
1//435160	Mining - Bulga
4/33/758164	Private
4/51/758164	Private
1/51/758164	Private
6/33/758164	Private
2/33/758164	Private
1/33/758164	Private
2//205613	Mining - Bulga
8/21/758164	Private
4//599574	Defence
1//45581	Mining - Bulga
1//821150	Mining - Bulga
1//662301	Mining - Bulga
32//703892	Defence
2//1143947	Defence
1//634708	Mining - Bulga
126//729952	Mining - Bulga
3//205613	Mining - Bulga
3/50/758164	Private
1244//1015814	Mining - Bulga
26//852571	Mining - Bulga

Lot/DP	Owner
20//811613	Mining - Bulga
15//10022	Private
120//755270	Private
27//852571	Mining - Bulga
12//1069011	Private
1//205613	Mining - Bulga
1//171648	Mining - Bulga
3//1105582	Private
191//545559	Mining - Bulga
11//1118291	Private
5//1114603	Private
1//829741	Mining - Bulga
16//10022	Private
11//1069011	Private
13//1069011	Mining - Bulga
5//10022	Mining - Coal and Allied
4//10022	Mining - Coal and Allied

Lot/DP	Owner
9//10022	Private
5//587986	Mining - Coal and Allied
851//612261	Mining - Coal and Allied
57//755270	Mining - Coal and Allied
21//263943	Mining - Coal and Allied
271//260663	Mining - Coal and Allied
84//856359	Mining - Bulga
2//621145	Mining - Bulga
1//1145329	Mining - Bulga
1//376892	Mining - Bulga
15//1141621	Mining - Bulga
1//621145	Mining - Bulga
85//856359	Mining - Bulga
84//856359	Mining - Bulga
1//621145	Mining - Bulga
2//621145	Mining - Bulga
1//621145	Mining - Bulga

Appendix 3 – MOP Risk Assesment

Environmental Risk Assessment: Bulga - May 2020

Key Element	Issue	Caused By	Consequence	Current Controls *(are in place)*	Expected Risk Consequence	Risk Likelihood	Current Risk Rating	Proposed Additional Controls/Actions	Task Owner	Due Date	% Complete
Approvals	Exploration drilling undertaken without appropriate approvals in place resulting in regulatory non-compliance	Failure to obtain exploration activity approval from RR	Complaints. Prosecution and fines.	1. Drilling procedures 2. Current approvals 3. Trained and competent supervisors	2	E	L				
Approvals	Non-compliance with external regulatory condition in regards to general construction (building modification and small projects). For example not having a construction certificate.	LTA planning Lack of clarity regarding infrastructure approved in the DA	Complaints. Prosecution and fines.	1. Bulga Coal Complex Management Plan and procedures (HS and EC) are utilised for construction activities. 2. Specific EC controls developed and implemented as required and captured within GDP. 3. GCAA standards 4. External relevant standards 5. EC input into relevant site procedures (E.g. excavation permits). 6. Construction activities of varying size and scale could be undertaken and these are managed through existing site management plans and GDP process as required. 7. Significant construction projects also subjected to specific risk assessments etc. 8. Construction certificate being obtained.	1	C	L				
Final Void	Stability of overburden internal slopes of final void	1. Erosion and geotechnical instability 2. Steep slopes 3. Rehabitation failure	Inability to reach closure and relinquishment of the lease. Additional costs for rework. Safety concerns.	1. Slope Stability Management Plan which stipulates maximum dump lift heights 2. Geotechnical engineering input into design 3. Slope stability assessment 4. rehabilitation methodology	3	D	M	Final void landform and drainage design	Tas Willis	30-12-2020	
Final Landform Design (excluding final void)	Landform instability.	LTA design. Poor landform/rehabilitation construction. Poor vegetation establishment. Erosive/dispersive material.	Inability to reach closure and relinquishment of the lease.	1. Rehabilitation Landform design. 2. Rehabilitation monitoring 3. Quality control 4. As built survey 5. MOP 6. RCE 7. Existing performance 8. Rehabiitation methodology	3	C	M				
Slopes and Slope Management	Failure to achieve the rehabilitation outcome prescribed in the MOP.	LTA control of landform design and construction Erosion of softwall treatment Steep long internal final void slopes	Inability to reach closure and relinquishment of the lease. Reworking areas.	1. Design of final landform and associated drainage 2. Progressive rehab 4. Survey inspections and drone pickups 5. Fit for purpose equipment/working within parameters 6. Construction as per design	3	D	M				

Geotechnical	Failure of highwall around final void (excluding softwall)	Geotechnical failure.	Inability to reach closure and relinquishment of the lease. Additional costs for rework. Safety concerns.	1. Slope Stability Management Plan which stipulates maximum dump lift heights 2. Geotechnical engineering input into design 3. Slope stability assessment 4. Geotechnical Reference Report	3	D	M				
Geotechnical	Softwall instability	Erosion and geotechnical instability	Inability to reach closure and relinquishment of the lease. Additional costs for rework. Safety concerns.	1. Slope Stability Management Plan which stipulates maximum dump lift heights 2. Geotechnical engineering input into design 3. Slope stability assessment 4. Geotechnical Reference Report	3	C	M				
Geology and Geochemistry	Failure to achieve the rehabilitation outcome prescribed in the MOP due to geochemical composition of materials.	LTA knowledge of material and its geochemistry. Inappropriate placement of materials.	Inability to reach closure and relinquishment of the lease.	1. Geochemical analysis of materials. Geochemical Assessment did not identify any significant issues. 2. Operating history suggests no significant issues. 3. Coarse rejects managed in accordance with site procedures. 4. Existing management plans in place (e.g. water management plan) in which surface and groundwater water quality is analysed. 5. Groundwater sampling for heavy metal content . 6. Previous performance 7. Dumping procedure	2	D	L				
Material prone to Spontaneous Combustion	Spontaneous combustion of exposed coal seams in highwall.	Poor management of materials with propensity for spontaneous combustion.	Cost of managing spontaneous combustion outbreak.	1. Spontaneous Combustion Management Plan (document has objective, action and responsibility for Preventative measures).	3	D	M				
Material prone to Spontaneous Combustion	Spontaneous combustion in exposed / intersected UG workings.	Poor management of materials with propensity for spontaneous combustion Poor planning	Cost of managing spontaneous combustion outbreak.	1. Spontaneous Combustion Management Plan (document has objective, action and responsibility for Preventative measures). 2. Underground Interaction Principal Hazard Managment Plan 3. Grouting of UG workings and UG workings are sealed. 4. Monitoring and verification of grout seals (highwall).	3	D	M				
Material prone to Spontaneous Combustion	Spontaneous combustion impedes rehabilitation.	Poor management of materials with propensity for spontaneous combustion.	Inability to complete rehabilitation. Impact on established rehabilitation. Cost of managing spontaneous combustion outbreak.	1. Spontaneous Combustion Management Plan (document has objective, action and responsibility for Preventative measures). 2. Geotech validation of suitable material. 3. Dump Design Procedure	2	D	L				

Tailings	Inadequate volume of suitable materials for capping tailings dams and therefore not achieving final landform.	Availability of quality/usable resources. Greater than predicted tailings pile consolidation.	Increased costs to source materials. Rehabilitation bond is not returned. Inability to reach closure and relinquishment of the lease.	1. Tailings pile consolidation modelling, Materials balance 2. Tailings dredging trial 3. Engineering design for tailings dam capping 4. Provisions in RCE 5. Capping material stockpiled adjacent to tailings emplacement facility 6. Tailings consolidation monitoring	2	D	L				
Tailings	Failure to achieve the rehabilitation outcome prescribed in the MOP.	Settlement of tailings dams.	Settlement of rehabilitated landform resulting in ponding on tailings capped surfaces / erosion / rehabilitation failure.	1. Tailings pile consolidation modelling, Materials balance 2. Tailings dredging trial 3. Engineering design for tailings dam capping 4. Provisions in RCE 5. Capping material stockpiled adjacent to tailings emplacement facility.	2	D	L				
Tailings	Tailings crust does not consolidate sufficiently to allow capping to progress as planned.	Poor water management with respect to recovering water from the tailings surface. LTA management of rise during tailings deposition. LTA understanding of material properties.	Inability to reach closure and relinquishment of the lease. Delayed capping.	1. Tailings depositional strategy including flocculation. 2. Effective tailings bleed decant 3. Integrated water management system 4. Previous performance	2	D	L				
Tailings	Insufficient water for tailings dredging operations.	Site water deficit.	Unable to meet mine plan.	1. Site water balance model 2. Adequate water storages 3. Supplementary HR supply 4. Integrated water management system	2	C	M				
Overflow ROM stockpile	Limited ROM stockpile capacity.	ROM production exceeds CHPP demand and stockpile capacity.	In pit ROM stockpile. Potential spon com and dust issues. Compliance issue.	1. Production coal flow scheduling 2. In pit ROM stockpiles 3. Spon Com Management Plan	2	B	M				

Blasting	Damage to infrastructure, heritage, graveyard, powerlines and infrastructure from vibration	LTA blast management	Complaints. Prosecution and fines.	1. Blasting Management Plan (vibration criteria set and monitored) 2. Historic Heritage Management Plan 3. Utilisation of specific products 5. Scale distance model utilised to predict vibration. 6. Structural assessments of heritage locations 7. Blast design 7. EMD 8. Environmental Monitoring 9. Community education 10. Blast Notifications	2	D	L				
Blasting	Blast vibration and overpressure impacts resulting in non-compliance or complaints	LTA blast management	Complaints. Prosecution and fines.	1. Blasting Management Plan (vibration criteria set and monitored) 2. Blast design procedure 3. Utilisation of specific products 5. Scale distance model utilised to predict vibration. 7. EMD 8. Environmental Monitoring 9. Community education 10. Blast Notifications	2	D	L				
Blasting	Blast impacts associated with final landform resulting in non-compliance with consents.	Blasting of subsided ground causing blasting excedences.	Complaints. Prosecution and fines.	1. Blast Management Plan 2. Drill and blast design procedures/training 3. Monitoring Program and data validation 4. Internal approval forms and checklists 5. Underground Interaction Principal Hazard Management Plan	2	C	M				
Air Quality	Air quality impacts during rehabilitation works resulting in non- compliance or complaints.	Dust created from earthworks during rehabilitation. Exposed areas. Delays in being able to commence rehabilitation. Rehabilitation failure. Drought.	Complaints. Prosecution and fines.	1. Air Quality Management Plan which states proactive and reactive air quality controls 2. Site specific Air quality TARPs 3. Air quality & rehabilitation monitoring 4. EEA AQ Framework Management Document (Technical Review Committee)	2	C	M				
Air Quality	Air quality impacts (dust and/or fume) from blasting events on subsided ground and weaker tertiary areas resulting in non-compliance or complaints	LTA blast management	Complaints. Prosecution and fines.	1. Blasting Management Plan 3. Blasting permission assessment tool 4. Blast Notifications 6. Utilisation of specific products (Fortis Clear) 7. Minimised sleep time. 8. Environmental Monitoring	2	C	M	Previous actions from BBRA to develop a blasting strategy for subsided ground. Confirm has been completed and include in current controls (Tom Hubert and Mitch Draper).	Blaise Walters	30-08-2020	
Air Quality	Air quality impacts during mining operations using equipment without appropriate controls resulting in non-compliance or complaints	Using equipment without appropriate controls	Complaints. Prosecution and fines.	1. Drilling procedures 2. Air Quality Management Plan 3. Regular maintenance of equipment 4. Trained and competent operators 5. OCE supervision 6. Drilling in pit (where possible) decreases potential for dust from drilling activities 7. Dust Curtains 8. Dust suppression through water injection 9. Water carts that drive on drill patterns to water down drill cuttings (for in pit drilling)	2	C	M	Review existing procedures to accommodate drilling without dust curtains down to manage methane generation.	Blaise Walters	30-08-2020	

Air Quality	Air quality impacts from dumping/hauling and general mine activity resulting in non-compliance or complaints	Failure to adhere with dust TARP	Complaints. Prosecution and fines.	1. Air Quality Management Plan - including TARP 2. Dumping procedures 3.Trained and competent personnel 4. Mine Planning considers restraints 5. Dispatch control 6. Water carts 7. Progressive rehabilitation of disturbed areas 8.Met forecasting system and real time monitoring	2	B	M				
Air Quality	Release of goaf gas emissions from BUO resulting in fire	LTA goaf subsidence crack repairs and gas management	Complaints. Prosecution and fines.	1. Subsidence management procedures 2. Subsidence monitoring plan identities high risk areas 3. Goaf gas drainage infrastructure 4. Subsidence inspections	2	D	L				
Air Quality	CHPP (including ROM Pad) operations generate unacceptable dust emissions resulting in community complaints/impacts on community amenity.	Failure to adhere with dust TARP	Complaints. Prosecution and fines.	1. Air Quality Management Plan 2. Sprays on ROM bin 3. ROM bin hood. 4. Water cart operation	2	C	M				
Air Quality/spon com	Operations generate unacceptable spontaneous combustion that results in smoke leaving mine owned land and impacts on sensitive receptors.	LTA spon com management	Complaints. Prosecution and fines.	1. Spon Comb Management Plan established 2. Action plan in place for mining into underground workings - currently being developed by Mining Department 3. CHPP inspections 4. Sprays on ROM bin	2	C	M				

Groundwater	Groundwater pollution.	Contamination due to leakage from tailings facility to groundwater aquifer. PAF leachate. Hydrocarbon spills.	Impacts to groundwater quality. Non compliance. EPA action (PIN/prosecution/clean up order).	1. Water MP in which surface and groundwater water quality is analysed. 2. Groundwater monitoring results and triggers in EMD 3. Fuel/chemical storage systems 4. Bioremediation process 5. NDTs on storage tanks 6. geotechnical inspections and monitoring	3	D	M				
Groundwater	Excessive groundwater leakage from Wollombi Brook to Bulga Underground Operations (BUO)	Higher than simulated leakage to the underground workings.	Impacts to sensitive receptors and water quality deterioration. Non compliance. EPA action (PIN/prosecution/clean up order).	1. Annual groundwater studies 2. Water licences for Wollombi Brook 3. Water Management Plan 4. Groundwater model has been re run 5. Monitoring and past performance	2	D	L				
Noise	Mining operations resulting in non-compliance with consents or complaints.	Mining and/or rehabilitation operations. LTA controls.	Complaints. Prosecution and fines.	1. Noise Management Plan 2. Noise TARP 3. Dumping procedures 4. Met forecasting system and real time monitoring 5. Noise impacts modelled in EA and as part of operational planning for NVB and BEP dumping. 6. Trained and competent personnel 7. Mine Planning considers restraints 8. Dispatch control 9. LOM plan allows for noise delays 10. Attenuated equipment 11. Noise monitoring undertaken (attended)	2	C	M				
Surface Water	Discharge of dirty water outside of dirty water catchment.	Leaking/spilt hydrocarbon. LTA water management on site. Leaking of tailings or return water line.	Impact to water quality. Non- compliance with consents.	1. Water Management Plan (Surface and Groundwater Response Plan TARP status) 2. Water Monitoring Program 3. Engineering design for final landform 4. Clean water diversions 5. Sediment dams 6. Differential flow monitoring 7. Inspections 8. Site and GCAA protocols	3	C	M	1. Upgrade ROM B dam in terms of capacity.	Serang Hanwante	30-08-2020	
Surface water	Tailings relocation infrastructure discharges into clean water catchment (i.e. pipeline blowout).	LTA inspection / maintenance regime leads to blowout Tailings pipeline blockage	Offsite pollution incident. EPA action (PIN/ prosecution/cleanup). Reputational impact. Cleanup costs.	1. Differential flow monitoring 2. Inspections 3. Operation design (FoS) 4. Pipeline in downstream catchment	3	D	M				

Surface water	Seepage from the Northern dam wall discharge into clean water catchment	LTA inspection / maintenance regime	Uncontrolled release of mine water going outside the contained catchment (offsite).	1. Inspections 2. Permanent recovery system has been installed.	3	D	M				
Visual	Public screening does not meet regulatory expectations	LTA design/ construction	Impacts nearby sensitive receptors. Complaints	Visual Impact Management Plan	2	D	L				
Visual and lighting	Visual/lighting impacts resulting in non-compliance with consents or complaints.	Lighting plant visible during bulk earthworks. Exposed areas visible and identifiable change to the landscape. Non-compliant fixed lighting	Complaints	1. Aust std for lighting 2. Lighting impacts reduced during closure (daytime ops) 3. Current visual/lighting procedures 4. Noise and Visual Bund 5. Transportable lighting Procedure	1	B	M				
Visual and lighting	Tailings pipeline visible to receptors.	Construction of the tailings pipeline in exposed locations	Complaints	1. Visual screen (earth bund)	1	D	L				
Waste	Creation of contaminated site	Inappropriate waste disposal in general across site	Regulatory action and costs/delays to business.	1. Waste Management Plan 2.Total Waste Management Contract established for Bulga Complex. 3. Development Consent has been obtained. 4. Monthly Inspections 5. Training and awareness 6. Waste segregation areas for BUO and BOC 7. Bioremediation Area	1	D	L				
Waste	Inappropriate disposal of tyres	Not burying tyres at depth or in accordance with site procedures	Costs upon mine closure and rehabilitation.	1. Procedure developed for the disposal of tyres on site. 2. Amount stored is tracked on site. 3. locations of burial are surveyed and recorded. 4. legal advice obtained to confirm practice is legally approved - no limit for the amount of tyres which can be stored and buried on site. 5. Areas for tyre disposal are demarcated on site.	1	D	L				

Material prone to Generating Acid Mine Drainage	Failure to achieve the rehabilitation outcome prescribed in the MOP due to AMD. Potential for pollution of waters.	LTA knowledge of material that may result in AMD.	Inability to reach closure and relinquishment of the lease. Requirement to treat water long term. Impact on environment.	1. Identification and classification of PAF materials 2. Water Quality Monitoring 3.Geochemical Assessment 4. Material has high buffering capacity 5. Operating history suggests no significant issues 6. Coarse rejects and tailings managed in accordance with site procedures 7. Dump Design Procedure	2	D	L				
Land Contamination	Land contamination	Spillage of hydrocarbons from mobile equipment/servicing/refuelling. Inappropriate hydrocarbon storage/handling	Costs to remediate Fines, prosecution	1. Operating procedures for equipment. 2. Fuel cart and appropriate operating procedures. 3. Maintenance procedures - improved maintenance program for digger fleet. 4. Trained and competent personnel 5. Regular maintenance of equipment. 6. Hydrocarbon management plan 7. Phase 2 contamination assessment conducted.	1	C	L				
Contaminated Lands	Contaminated land (existing or occurring on the site at closure).	Fuel use at the site. Long site history. Spills, leaks etc. LTA management of hydrocarbons. Placement of MWOO (retrospectively banned by EPA).	Impact on environment. Constraint for future land use. Possible remedial work.	1. Fuel storage systems 2. Incident reporting system & PIRMP 3. Spill kits and spill response procedure 4. Contaminated Sites Register 5. Bioremediation area 6. Hydrocarbon Management Plan 7. Dumping over MWOO applied areas 8. Remediation of known contaminated sites 9. Phase 2 contamination assessment conducted.	2	D	L				
Greenhouse gases, methane drainage / venting	Methane Emissions.	OC intersecting UG workings or gas wells.	H&S Hazard. GHG Emissions (financial cost).	1. UG seals 2. Sealing of SIS wells prior to mining	1	B	M				
Erosion and Sediment Control	Erosion within rehabilitation areas/creek diversions/active mining areas causing uncontrolled discharge offsite of sediment laden water.	LTA progressive rehab during operations. LTA water management system and/or design. LTA final landform design and/or construction. Large rainfall events. LTA maintenance of the water management structures.	Impact on rehabilitation. Pollution event offsite. Decrease in water quality. Additional rework required. Failed rehab. Reputation damage. Section 240 Notice.	1. Water Management Plan 2. Erosion and Sediment Control Plan 3. Visual inspections 4. Water quality monitoring 5. Annual creek stability monitoring 6. Diversions & dams designed and constructed to engineering standard (Blue Book) 7. Rehabilitation monitoring 8. Maintenance of ESC Structures 9 Quarterly ESC & Rehab Audits 10. GDPs and ESCPs 11. LIDAR Surveys.	2	C	M				
Mine Subsidence	Failure to achieve the rehabilitation outcome prescribed in the MOP	Mine subsidence (UG) of overburden emplacement area.	Interactions with UG mine (cracking/deformations to landform following mining). Additional costs. Repair of water management structures/erosion.	1. Mine design considers UG interactions 2. Information sharing (both GCAA operations) 3. Protocol for inspection and repair 4. Monitoring.	2	D	L				

Hazardous materials	Hazardous materials and dangerous goods remaining on the site at closure.	Failure to identify HAZMAT at closure.	Breach of licence. Health and safety hazard. Financial cost to remedy.	1. Chemalert system 2. Procurement/stock management 3. Waste management plan 4. Use of licenced waste disposal contractor and facility 5. Asbestos assessments 6. Hazardous Substances Register 7. Radiation licence & dangerous goods licence	2	D	L				
Land Contamination	Spillage of hydrocarbons from the Main Workshop/Area Station and hydrocarbon storage facilities which makes its way into dirty water management system	Failure of oily water separators	Pollution incident and potential fine and/or prosecution	1. Hydrocarbon mgt Plan and refuelling procedures. 2. Phase 2 contamination assessment conducted. 3. Inspections and maintenance undertaken by maintenance personnel. 4. Demolished and remediated at mine closure. 5. Bunding 6. Oil Water Separator	2	D	L				
Rehabilitation Methodology	Failed/poor rehabilitation.	LTA methodology/ maintenance/ environmental conditions.	Additional financial cost to rework. Reputation damage.	1. RCE (including annual updates) 2. Progressive rehabilitation 3. Ongoing rehab monitoring 4. CAA HSEC PCL 0007 11.16 Rehabilitation Management. 5. MOP/Rehab Strategy 6. Existing rehabilitation performance	2	D	L				
Land Management	Habitat destroyed/Ecological impact - Protected species from clearing land both on and offsite	LTA GDP process and planning	Inability to reach closure and relinquish lease in a timely manner. Impacts to habitat/species.	1.GDP and Work authorisations 2. MOP 3. Biodiversity Management Plan 4. DA Approved for Clearing 5. EPBC approval conditions 6. Fencing and signage 7. Majority of works undertaken within Project Approval disturbance footprint. 8. GIS - maintained and implemented. 9. Permits, training and competency process 10. GDP Training undertaken for relevant mining supervisors and contract personnel. 11. Fencing undertaken and being completed for offset areas.	2	D	L				
Land Management	Weeds and Pests	Weeds and Pests are not managed to regulatory expectations	Adjacent property owners are impacted. Complaints.	1. Land acquired 2. Biodiversity Offset Management Plan 3. Conservation agreements (with LRS for registration) 4. Extensive studies undertaken as part of EIS 5. Biodiversity Offset requirements identified and managed. 6. Biodiversity offsets are fenced	1	C	L				
Land Management	Failure to achieve biodiversity offset obligations	Inappropriate management of biodiversity offsets	Additional costs to restore and regulatory intervention.	1. Land acquired 2. Biodiversity Offset Management Plan 3. Conservation agreements (with LRS for registration) 4. Extensive studies undertaken as part of EIS 5. Biodiversity Offset requirements identified and managed. 6. Biodiversity offsets are fenced	1	D	L	Update Offset Management Plan to invlude the Vere Offset Area	Tasman Willis	20-12-2020	

Land Management	Degraded buffer lands	Poor buffer land management practices	Reduction in capital values of properties and impacts on community perceptions.	1. Biodiversity Management Plan 2. Offset Management Plan 3. Property inspections 4. 6 monthly land management inspections	1	C	L				
ROM contamination	ROM contamination.	OC mining of UG workings including roof bolts and materials.	Damage to CHPP infrastructure (Conveyor belts, crushers). Contamination of clean coal.	1. Separation of contaminated coal in pit.	1	A	M				
Soil Type(s) and Suitability	LTA topsoil quality/quantity for rehabilitation to be undertaken in accordance with approved MOP.	Time required to stockpile soil, weed infested topsoil, poor management, site conditions, LTA additional stripping opportunities available. Poor recovery of topsoil.	Inability to reach closure and relinquishment of the lease. Cost of sourcing ameliorants and alternates.	1. Topsoil balance and surveyed stockpile locations 2. Soil management activities outlined in MOP 3. Weed management activities. 4. Inspections (6 monthly) 5. Topsoil quality assessments (GDP process) - Topsoil testing and stripping plan, direct implacement 6. Ameliorants (e.g. biosolids).	2	D	L				
Weed and Pest Management	Weed infestations and/or damage to rehab by pest species.	LTA weed management/inspections. Lack of resources/budget. LTA pest management/fencing. LTA management of buffer lands. LTA management of topsoil (Weed infested).	Poor quality rehabilitation. Rehabilitation bond not returned. Environmental impacts. Impacts to neighbouring landholders.	1. Existing MOP and TARPs 2. Biodiversity Management Plan 3. Commitment to undertake rehab monitoring/weed/pest inspections 4. Ongoing weed/pest management program 5. CAA HSEC PCL 0007 11.16 Rehabilitation Management. 6. CAA HSEC PCL 0028 11.18 Biodiversity Management.	2	D	L				
Bushfire	Damage to rehab or offset areas from bushfire	Bushfire from external (regional fire/ lighting) or internal source (e.g. LTA fuel management, fire caused by site activities/equipment failure).	Loss of established rehabilitation. Additional costs for rework of rehab. Exposed areas (erosion, sediment, dust). Damage to offset areas.	1. Bushfire Management Plan/Poster 2. Bushfire emergency response procedure 3. Fire fighting equipment/ procedures 4. Hot work permit process 5. Lightning warning system 6. Firetrail maintenance 7. Grazing of bufferlands	2	D	L				
Mine Closure	Mine closure financial provision is inadequate to close the operation to the regulatory and community expectations.	LTA mine closure planning	Financial liability for closure.	1. Conceptual Mine Closure Plan 2. Glencore three yearly RCE review end of LOM 3. Progressive rehabilitation undertaken.	3	D	M				
Public Safety	Public access to the site during closure/rehab operations.	LTA fencing/gates/signage.	Personal injury. Impact to rehab (vandalism). Safety concerns.	1. Controlled access during rehab/closure 2. Signs	2	D	L				

Flora and Fauna	Failure to achieve the rehabilitation commitments prescribed in the MOP.	Erosion, weed and pests. LTA land management. LTA planning. Lack of available seed. Shaped land not available to meet rehab schedule.	Inability to reach closure and relinquish lease in a timely manner. Impacts to habitat/species.	1. Biodiversity Management Plan 2. Rehabilitation Strategy 3. MOP 4. Inspections 5. Weed and pest management procedures 6. Endemic species used in rehabilitation 7. Rehabilitation Monitoring Program 8. Research and development on rehabilitation outcomes 9. CAA HSEC PCL 0007 11.16 Rehabilitation Management. 10. CAA HSEC PCL 0028 11.18 Biodiversity Management.	2	D	L				
Cultural heritage	Aboriginal / European Heritage - area destroyed across site during clearing	LTA GDP process and planning Failure to identify heritage item in survey	Prosecution. Loss of culturally/historically significant site. Loss of reputation with stakeholders.	1. GDP 2. Work authorisation system 3.Training and awareness of workforce 4. Aboriginal Heritage Management Plan - updated in 2019 5. Consultation with Aboriginal community 6. EIS mitigation commitments 7. Section 90 approvals 8. Native title claimant agreements 9. DA/EIS 10. GIS 11. Due diligence surveys 12. GDP process 13. Historic Heritage Management Plan	2	C	M				
Cultural heritage	Unknown cultural heritage sites impacted.	Failure to identify heritage item in survey	Prosecution. Loss of culturally/historically significant site. Loss of reputation with stakeholders.	1. GDP 2. Work authorisation system 3.Training and awareness of workforce 4. Aboriginal Heritage Management Plan - updated in 2019 5. Consultation with Aboriginal community 6. EIS mitigation commitments 7. Section 90 approvals 8. Native title claimant agreements 9. DA/EIS 10. GIS 11. Due diligence surveys 12. Historic Heritage Management Plan	2	C	M				
Cultural heritage	Known cultural heritage sites impacted without approval.	LTA GDP process and planning GIS layer not up to date	Prosecution. Loss of culturally/historically significant site. Loss of reputation with stakeholders.	1. GDP 2. Work authorisation system 3.Training and awareness of workforce 4. Aboriginal Heritage Management Plan - updated in 2019 5. Consultation with Aboriginal community 6. EIS mitigation commitments 7. Section 90 approvals 8. Native title claimant agreements 9. DA/EIS 10. GIS 11. Due diligence surveys 12. quarterly inspections	2	C	M				

Heritage (Aboriginal and European)	Disturbance of known/unknown Aboriginal/European sites during rehabilitation.	Unintended interaction with heritage site due to lack of awareness/fencing/signage/training.	Prosecution. Loss of culturally/historically significant site. Loss of reputation with stakeholders.	1. ACHMP and HHMP 2. Ground Disturbance permit 3. Training/awareness 4. Heritage surveys 5. Geographical Information System/ AHIMS/ Site cards 6. Fencing and signage	2	D	L				
Community	Not satisfied with final landuse outcomes.	Changed expectations Lack of understanding.	Dissatisfied community.	1. Stakeholder Engagement Plan 2. Social Impact Management Plan	3	D	M				

MEETING SIGN-IN SHEET

Project:	GLN08-001 Bulga Risk Assessment Workshop	**Meeting Date:**	28/05/2020
Facilitator:	Chris Cooper	**Place/Room:**	Bulga Open Cut – Room TBD
Scribe	Lauren Byrne	**Notes**	

Name	Title	Company	Phone	E-Mail	Years of relevant industry experience
Chris Cooper	FACILITATOR – Principal Consultant	IEMA	0417464111	chris.cooper@iema.com.au	12+
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Luke Hanson	Tech Services Mgr	BOC	0490577165	Luke.hanson@glencore.com.au	19yrs
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Name	Title	Company	Phone	E-Mail	Years of relevant industry experience
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CONSEQUENCE [potential foreseeable outcome of the event]

	Health & Safety	Environment	Financial Impact	Image & Reputation / Community	Legal & Compliance
5 Catastrophic	• Multiple fatalities • Multiple cases of permanent total disability / health effects	• Environmental damage or effect (permanent; >10 years) • Requires major remediation	• >$600M investment return • >$100M operating profit • >$20M property damage	• Negative media coverage at international level • Loss of multiple major customers or large proportion of sales contracts • Loss of community support • Significant negative impact on the share price	• Major litigation / prosecution at Glencore corporate level • Nationalisation / loss of licence to operate
4 Major	• Fatality or permanent incapacity / health effects	• Long-term (2 to 10 years) impact • Requires significant remediation	• $60-600M investment return • $20-100M operating profit • $2-20M property damage	• Negative media coverage at national level • Scrutiny from government and NGOs • Complaints from multiple "final" customers • Loss of major customer • Loss of community support • Negative impact on share price	• Major litigation / prosecution at Division level
3 Moderate	• Lost time / disabling injury / occupational health effects / multiple medical treatments	• Medium-term (<2 years) impact • Requires moderate remediation	• $6-60M investment return • $2-20M operating profit • $200K-2M property damage	• Negative media coverage at local / regional level over more than one day • Complaint from a "final" customer • Off-spec product • Community complaint resulting in social issue	• Major litigation / prosecution at Operation level
2 Minor	• Medical Treatment Injury (MTI) / occupational health effects • Restricted Work Injury (RWI)	• Short-term impact • Requires minor remediation	• $600K-6M investment return • $200K-2M operating profit • $10-200K property damage	• Complaint received from stakeholder or community • Negative local media coverage	• Regulation breaches resulting in fine or litigation
1 Negligible	• First Aid Injury (FAI) / illness	• No lasting environmental damage or effect • Requires minor or no remediation	• <$600K investment return • <$200K operating profit • <$10K property damage	• Negligible media coverage	• Regulation breaches without fine or litigation

LIKELIHOOD [of the event occurring with that consequence]

Basis of Rating	E - Rare	D - Unlikely	C - Possible	B - Likely	A – Almost Certain
LIFETIME OR PROJECT OR TRIAL OR FIXED TIME PERIOD OR NEW PROCESS / PLANT / R&D	Unlikely to occur during a lifetime OR Very unlikely to occur OR No known occurrences in broader worldwide industry	Could occur about once during a lifetime OR More likely NOT to occur than to occur OR Has occurred at least once in broader worldwide industry	Could occur more than once during a lifetime OR As likely to occur as not to occur OR Has occurred at least once in the mining / commodities trading industries	May occur about once per year OR More likely to occur than not occur OR Has occurred at least once within Glencore	May occur several times per year OR Expected to occur OR Has occurred several times within Glencore
5 Catastrophic	15 (M)	19 (H)	22 (H)	24 (H)	25 (H)
4 Major	10 (M)	14 (M)	18 (H)	21 (H)	23 (H)
3 Moderate	6 (L)	9 (M)	13 (M)	17 (H)	20 (H)
2 Minor	3 (L)	5 (L)	8 (M)	12 (M)	16 (M)
1 Negligible	1 (L)	2 (L)	4 (L)	7 (M)	11 (M)

Consequence Category	Consequence Type	Ownership	Action
Cat. 5	Catastrophic Hazard	Divisional / Functional / Operational / Asset Leadership	• Quantitative or semi-quantitative risk assessment required. • Capital expenditure will be justified to achieve ALARP ('As Low As Reasonably Practicable'). • Catastrophic Hazard Management Plans (CHMP) must be implemented where practical, Crisis Management Plans (CMP) tested and Catastrophic Event Recovery Plans (CERP) developed.
Cat. 4 (Health & Safety consequence)	Fatal Hazard	Divisional / Functional / Operational / Asset Leadership	• Glencore SafeWork Fatal Hazard Protocols or appropriate management plans must be applied. • Capital expenditure will be justified to achieve ALARP.
Risk Rank	**Risk Rating**	**Ownership**	**Action**
17 to 25	High Risk	Divisional / Functional / Operational / Asset Leadership	• Install additional HARD and SOFT controls to achieve ALARP. • Capital expenditure will be justified to achieve ALARP.
7 to 16	Medium Risk	Operational / Asset Leadership	• install additional HARD and SOFT controls if necessary to achieve ALARP. • Capital expenditure may be justified.
1 to 6	Low Risk	Operational / Asset Leadership	• Install additional controls if necessary to achieve ALARP. • Capital expenditure is not usually justified.

Table 3-3 - Risk Control Effectiveness (RCE)

RCE	Guide
Poor or no existing controls	• Significant control gaps or no credible control; • Either controls do not treat root causes, are non-existent or, if they exist, they are ineffective; • Management has no confidence that any degree of control is being achieved due to poor control design; • Very limited or no operational effectiveness.
Require improvement	• Most controls are designed correctly and are in place and effective; • Controls may only treat some of the root causes of the risk, and/or are not currently effective and/or there may be an over-reliance on "reactive" controls; • Management has doubts about operational effectiveness and reliability; • More work is required to improve operating effectiveness.
Satisfactory	• Controls are well designed and appropriate for the risk; • Controls are largely "preventative" and address the root causes; • Management believes that they are effective and reliable at all times; • Nothing more to be done except review and monitor the existing controls.

Figure 3-4 – Hierarchy of control

Table 3-4 - Priority for risk treatment authority for continued toleration of risk (applicable for risk assessment level 3 and 4)

Current risk rank	Action	Timing for authority	Authority for continued toleration of current level of risk
23 to 25	The activity must be stopped immediately until action to reduce the level of risk to less than 23 is undertaken or authority to continue is received.	Immediately to within 24 hours.	CE/COO Notification to CE prior to granting of authority to continue
17 to 22	The activity must be stopped immediately until action to reduce the level of risk to less than 17 is under taken or authority to continue is received.	The activity must be stopped immediately until action to reduce the level of risk to less than 17 is under taken or authority to continue is received.	Directors/COO Notification to COO prior to granting of authority to continue
10 to 16	Take action to reduce the level of risk to less than 10 or authority to continue is received.	Within 1 month.	General Managers / Operations Managers / Project Managers
7 to 9	Take action to reduce the level of risk to less than 7 or authority to continue is received.	Within 1 month.	Superintendents/ Managers / Project Team
1 to 6	Tolerable risk unless circumstances change	Ongoing control as part of a management system.	N/A

Appendix 4 – Tailings Report

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Project Memo

Client:	Glencore	**Date:**	17 June 2020
Attention:	Vicky Cheng	**From:**	Sam Paterson
Project No:	GLE007	**Revision No:**	0
Project Name:	Bulga Tailings Assessment		
Subject:	Update of Main Pit TSF consolidation modelling – long term planning		

1 Introduction

As part of the ongoing tailings deposition modelling for the Bulga Extension Project (BEP), SRK Consulting (Australasia) Pty Ltd (SRK) has been engaged by Glencore Coal (Glencore) to update the consolidation models for the Main Pit TSF using site data to develop benchmarked parameters for deposition consolidation modelling.

The BEP requires the relocation of tailings currently stored in Deep Pit to Main Pit to allow mining to in Deep Pit recommence. The tailings to be stored in Main Pit will also include tailings produced from the ROM coal processing during the life of the mine (as well as the tailings being removed by dredging from Deep Pit).

To date the BEP Main Pit TSF study has comprised a number of phases of modelling and the preceding reports provide a background to the modelling detailed in this memorandum and should be referenced accordingly when reading this document.

2 Scope of Analyses

The requested study scope was detailed in an email from Vicky Cheng of Glencore dated 10 June 2020, as follows:

- 8% open pit and underground ROM - one (1) consolidation model to be undertaken to model the deposition into the Main Pit TSF, with the addition of underground tailings to the deposition (8% RoM for both open cut and underground tailings). Consolidation modelling to be run until 150 years after deposition into the Main Pit TSF ceases.
- 10% open pit and underground ROM - one (1) consolidation model to be undertaken to model the deposition into the Main Pit TSF, with the addition of underground tailings to the deposition (10% RoM for both open cut and underground tailings). Consolidation modelling to be run until 150 years after deposition into the Main Pit TSF ceases.

Based on the results of the analysis of the two cases above a further case was included to study the potential for achieving additional storage as follows:

- 11% open pit and underground ROM - one (1) consolidation model to be undertaken to model the deposition into the Main Pit TSF, with the addition of underground tailings to the deposition (11% RoM for both open cut and underground tailings). Consolidation modelling to be run until 150 years after deposition into the Main Pit TSF ceases.

2.1 Tailings Parameters

In accordance with the scope outlined above the consolidation modelling was undertaken for the following tailings schedules:

Table 2-1 Consolidation Models

Parameter	Main Pit TSF – 8% RoM	Main Pit TSF – 10%RoM	Main Pit TSF – 11%RoM
Average Specific Gravity:	1.9 t/m^3		
Solids Content	60% w/w (both CHPP and BEP Tailings)		
Average X% RoM Feed - Open Cut Tailings	10% of ROM from 29/01/2019 to 31/12/2019	10% of ROM from 29/01/2019 to 31/12/2039	10% of ROM from 29/01/2019 to 31/12/2019
	8% of ROM from 01/01/2020 to 31/12/2039		11% of ROM from 01/01/2020 to 31/12/2039
Average X% RoM Feed – Underground Tailings	8% of ROM from 01/01/2021 to 31/12/2039	10% of ROM from 01/01/2021 to 31/12/2039	11% of ROM from 01/01/2021 to 31/12/2039
BEP Tailings Production Rate	26Mt over 5 years (2022-2026)	26Mt over 5 years (2022-2026)	26Mt over 5 years (2022-2026)

3 Consolidation Analysis

The consolidation analysis was undertaken using propriety software SVFlux/ SVSolid which can be used to analyse time and stress-dependent one-dimensional consolidation of soils. The consolidation analysis is dependent on the definition of the relationship between permeability (k), void ratio (e), and in situ effective vertical stress (σ'_v). Using previously established parameter for flocculated tailings as detailed in Table 3-1.

Table 3-1: Tailings material properties used in models

Material Properties	Main Pit
Solids concentration (w/w)	60%
Specific Gravity	1.90
Voids Ratio (e)	1.27
Slurry Density (t/m^3)	0.838
Void ratio (e) to effective stress (σ') relationship $e = A (\sigma' + Z)^B$	
A	1.5
B	-0.2
Z	0.1
Permeability (k) to void ratio (e) relationship $k = C e^D$	
C (1E-8 m/s)	1.4
D	3.3

3.1 Rate of Tailings Production

The consolidation of the tailings deposit was then analysed using the tailings production schedule provided by Glencore[1]. As detailed above, the Main Pit tailings schedule incorporates inputs from the ROM and the Deep Pit dredging operations and is detailed in Table 3-2, Table 3-3 and Table 3-4 for the 8%ROM, 10%ROM and 11% ROM cases respectively**Error! Reference source not found.**.

Table 3-2: Main Pit Tailings Schedule – 8% RoM model

Year	Open Cut – Total RoM	Open Cut – 8% RoM	Underground – Total RoM	Underground – 8% RoM	Deep Pit Tailings	Tailings Deposited
	Mt	Mt	Mt	Mt	Mt	Mt
2019	12.20	1.22	-	-	-	1.22
2020	12.20	0.98	-	-	-	0.98
2021	10.50	0.84	8.58	0.69	-	1.53
2022	9.70	0.78	7.17	0.57	5.20	6.55
2023	9.80	0.78	4.64	0.37	5.20	6.35
2024	10.50	0.84	4.58	0.37	5.20	6.42
2025	11.00	0.88	4.62	0.37	5.20	6.45
2026	12.00	0.96	4.58	0.37	5.20	6.53
2027	12.20	0.98	5.23	0.42	-	1.40
2028	11.90	0.95	3.30	0.26	-	1.21
2029	12.00	0.96	3.28	0.26	-	1.22
2030	11.80	0.94	2.51	0.20	-	1.14
2031	11.00	0.88	2.51	0.20	-	1.08
2032	9.60	0.77	2.51	0.20	-	0.97
2033	8.20	0.66	3.37	0.27	-	0.93
2034	8.30	0.66	3.21	0.26	-	0.92
2035	8.90	0.71	3.24	0.26	-	0.97
2036	10.00	0.8	3.16	0.25	-	1.05
2037	9.60	0.77	2.83	0.23	-	1.00
2038	8.00	0.64	2.51	0.20	-	0.84
2039	3.60	0.29	1.26	0.10	-	0.39
Total	**213.0**	**17.3**	**73.1**	**5.9**	**26.0**	**49.2**

[1] Glencore. February, 2020. *BEP Production Schedule for TSF Assessment 20 02 2020.*

Table 3-3: Main Pit Tailings Schedule – 10% RoM model

Year	Open Cut – Total RoM	Open Cut – 10% RoM	Underground – Total RoM	Underground – 10% RoM	Deep Pit Tailings	Tailings Deposited
	Mt	Mt	Mt	Mt	Mt	Mt
2019	12.20	1.22	-	-	-	1.22
2020	12.20	1.22	-	-	-	1.22
2021	10.50	1.05	8.58	0.86	-	1.91
2022	9.70	0.97	7.17	0.72	5.20	6.89
2023	9.80	0.98	4.64	0.46	5.20	6.64
2024	10.50	1.05	4.58	0.46	5.20	6.71
2025	11.00	1.10	4.62	0.46	5.20	6.76
2026	12.00	1.20	4.58	0.46	5.20	6.86
2027	12.20	1.22	5.23	0.52	-	1.74
2028	11.90	1.19	3.30	0.33	-	1.52
2029	12.00	1.20	3.28	0.33	-	1.53
2030	11.80	1.18	2.51	0.25	-	1.43
2031	11.00	1.10	2.51	0.25	-	1.35
2032	9.60	0.96	2.51	0.25	-	1.21
2033	8.20	0.82	3.37	0.34	-	1.16
2034	8.30	0.83	3.21	0.32	-	1.15
2035	8.90	0.89	3.24	0.32	-	1.21
2036	10.00	1.00	3.16	0.32	-	1.32
2037	9.60	0.96	2.83	0.28	-	1.24
2038	8.00	0.80	2.51	0.25	-	1.05
2039	3.60	0.36	1.26	0.13	-	0.49
Total	**213.0**	**21.3**	**73.1**	**7.3**	**26.0**	**54.6**

Table 3-4: Main Pit Tailings Schedule – 11% RoM model

Year	Open Cut – Total RoM	Open Cut – 11% RoM	Underground – Total RoM	Underground – 11% RoM	Deep Pit Tailings	Tailings Deposited
	Mt	Mt	Mt	Mt	Mt	Mt
2019	12.20	1.22	-	-	-	1.22
2020	12.20	1.34	-	-	-	1.34
2021	10.50	1.16	8.58	0.94	-	2.10
2022	9.70	1.07	7.17	0.79	5.20	7.06
2023	9.80	1.08	4.64	0.51	5.20	6.79
2024	10.50	1.16	4.58	0.50	5.20	6.88
2025	11.00	1.21	4.62	0.51	5.20	6.92
2026	12.00	1.32	4.58	0.50	5.20	7.02
2027	12.20	1.34	5.23	0.58	-	1.92
2028	11.90	1.31	3.30	0.36	-	1.67
2029	12.00	1.32	3.28	0.36	-	1.68
2030	11.80	1.3	2.51	0.28	-	1.58
2031	11.00	1.21	2.51	0.28	-	1.49
2032	9.60	1.06	2.51	0.28	-	1.34
2033	8.20	0.9	3.37	0.37	-	1.27
2034	8.30	0.91	3.21	0.35	-	1.26
2035	8.90	0.98	3.24	0.36	-	1.34
2036	10.00	1.1	3.16	0.35	-	1.45
2037	9.60	1.06	2.83	0.31	-	1.37
2038	8.00	0.88	2.51	0.28	-	1.16
2039	3.60	0.4	1.26	0.14	-	0.54
Total	**213.0**	**23.3**	**73.1**	**8.0**	**26.0**	**57.4**

4 Main Pit Model Results

Utilising the parameters and tailings deposition schedules detailed, modelling of the life of mine tailings deposition into the Main Pit TSF was undertaken, including a 150-year post-deposition consolidation analysis. A simplified deposition model was used (without stepped deposition into Cell A and B) due to the primary focus of this modelling on the final ground surface level.

The results for the 8%, 10% and 11% ROM cases are shown in Figure 4-1, Figure 4-2, and Figure 4-3 respectively. Table 4-1 contains the details of all models, displaying the surface level at yearly intervals.

As can be seen for all models the maximum tailings deposition level does not exceed the limiting storage elevation of 85 m RL, with the 8% model reaching 74 m RL, the 10% model reaching 81 m RL, and the 11% model reaching 85 m RL. Final tailings surface elevations (after 150 years of consolidation) of 57 m, 63 m and 66 m have been derived for 8%, 10% and 11% models respectively which equate to, approximately 17.1 m (8% model), 18.0 m (10% model) and 18.3 m (11% model) of settlement.

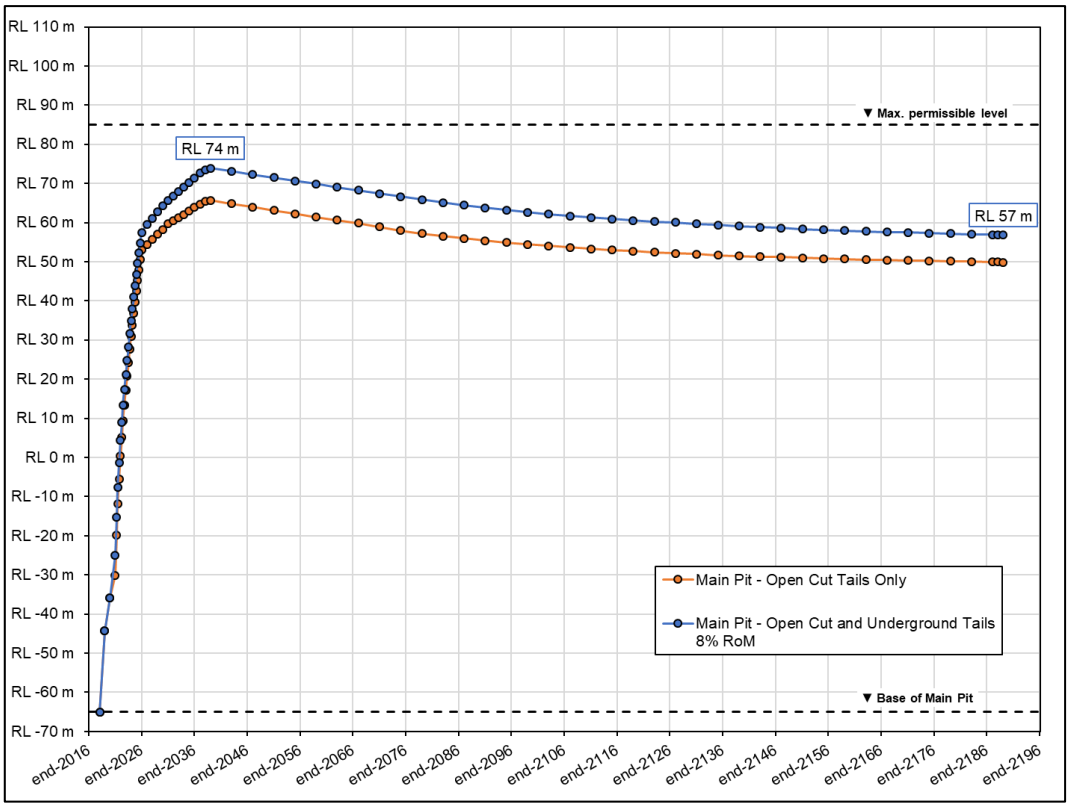


Figure 4-1: Main Pit 8% RoM Model consolidation analysis

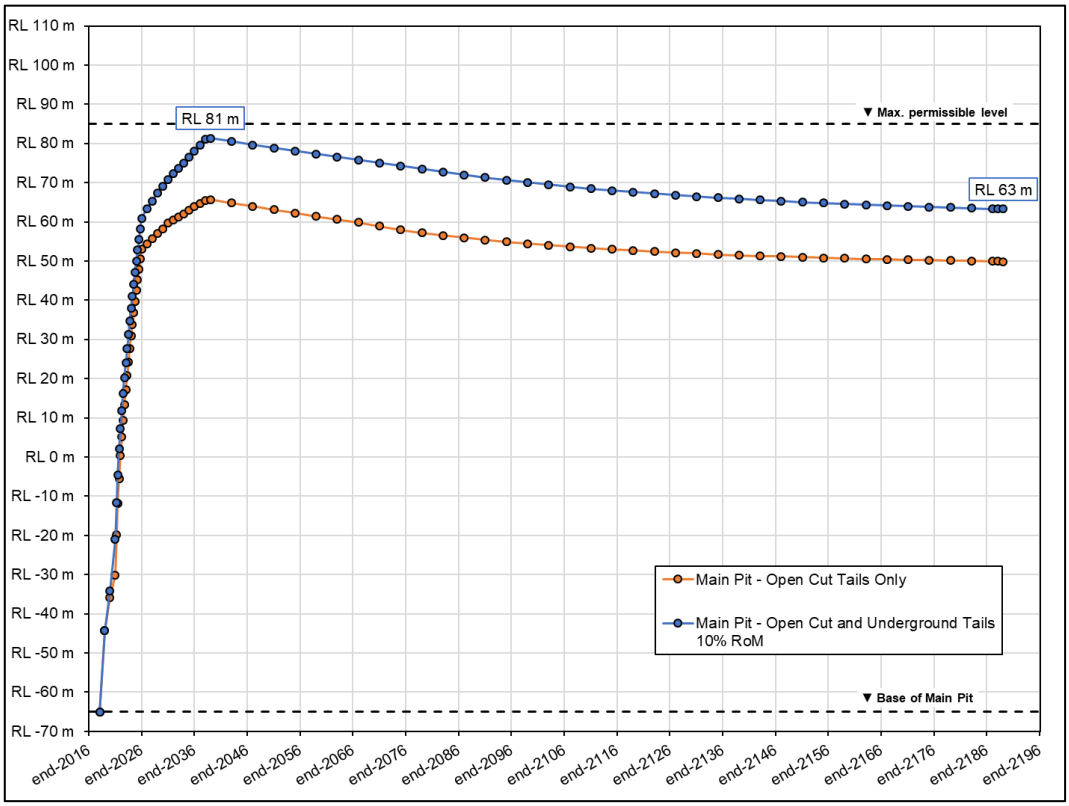


Figure 4-2: Main Pit 10% RoM model consolidation analysis

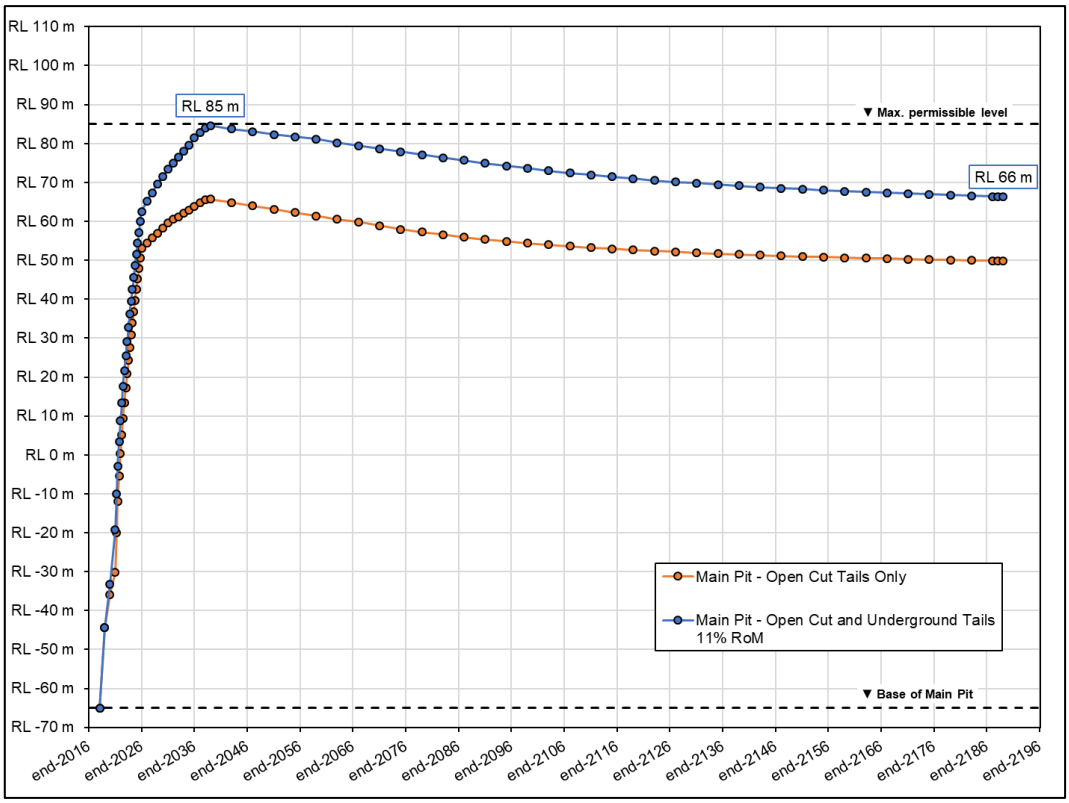


Figure 4-3: Main Pit 11% RoM model consolidation analysis

Table 4-1: Main Pit tailings deposition elevations with time

Date	8% RoM - Tailings Level RL (m)	10% RoM - Tailings Level RL (m)	11% RoM - Tailings Level RL (m)
29/01/2019	-65.0	-65.0	-65.0
1/01/2020	-44.3	-44.3	-44.3
1/01/2021	-35.8	-34.1	-33.2
1/01/2022	-25.0	-21.1	-19.3
1/01/2023	4.4	7.3	8.7
1/01/2024	21.2	24.0	25.5
1/01/2025	34.9	37.9	39.4
1/01/2026	46.8	50.0	51.6
1/01/2027	57.4	60.9	62.5
1/01/2028	59.6	63.3	65.2
1/01/2029	61.1	65.3	67.4
1/01/2030	62.7	67.3	69.6
1/01/2031	64.2	69.2	71.5
1/01/2032	65.6	70.8	73.4
1/01/2033	66.8	72.3	75.0
1/01/2034	67.9	73.7	76.5
1/01/2035	69.0	75.1	78.0
1/01/2036	70.2	76.5	79.6
1/01/2037	71.4	78.0	81.4
1/01/2038	72.6	79.5	82.8
1/01/2039	73.5	81.0	84.0
31/12/2039	73.9	81.3	84.6
Peak Tailings Level RL	**73.9**	**81.3**	**84.6**

Yours faithfully

SRK Consulting (Australasia) Pty Ltd

Signed by:

Sam Paterson
Principal Consultant

Signed by:

Ben Glover
Consultant

Appendix 5 – Rehabilitation Tables

Rehabilitation Criteria

POST MINING Land Use (FINAL LAND USE DOMAIN)	MINING DOMAIN	REHABILITATION OBJECTIVES	COMPLETION CRITERIA	PERFORMANCE INDICES	EXAMPLE OF JUSTIFICATION / VALIDATION METHODS
INFRASTRUCTURE					
Native Ecosystem (EEC) or Agricultural Land Use	Infrastructure Area; Tailings Storage Facility; Water Management Area; Overburden Emplacement Area; Void (Open Cut void); Underground Mining Area (subsidence management); Beneficiation Facility; and Other	Infrastructure All infrastructure that is not to be used as part of the final land use is removed to ensure the site is safe and free of hazardous materials.	Removal of all services (power, water, communications) that have been connected on the site as part of the operation.	Infrastructure removed.	Statement provided.
			Heritage obligations (e.g. development consent under the Environmental Planning and Assessment Act 1979, approvals under the Heritage Act 1977, etc. have been met (e.g. archival recording, building retention or building demolition with footings preserved).	Permits and approval documents issued; archival reports (where required) complete and submitted.	Copy of any relevant approval documentation and/or archival recordings
			Removal of all plant, equipment and associated infrastructure including processing facilities, stockpile areas, rail infrastructure and loading facilities, underground hydrocarbon storage tanks, office complex, portable offices, exploration core samples, camp facilities, storage racks, samples.	Infrastructure removed.	As-constructed final landform plan, photos etc.
			Removal of all footings or removal to a certain depth (0.4 metres) OR footings covered to an appropriate depth.	Infrastructure removed.	Remaining footings surveyed and marked on the as-constructed final landform plan.
			Removal of all water management infrastructure (including pumps, pipes and power).	Infrastructure removed.	Statement provided and before/after photos.
			All drill cores have been removed and either taken to authorised storage or disposal location.	Cores removed.	Statement provided.
			Surveying and sealing of all drill holes, boreholes and gas wells in	Sealing complete.	Engineering report/statement, Plug and Abandonment log, photos etc.

POST MINING Land Use (FINAL LAND USE DOMAIN)	MINING DOMAIN	REHABILITATION OBJECTIVES	COMPLETION CRITERIA	PERFORMANCE INDICES	EXAMPLE OF JUSTIFICATION / VALIDATION METHODS
			accordance with departmental guidelines and relevant standards.		
Native Ecosystem (CEEC/EEC) or Agricultural Land Use	Infrastructure Area; Tailings Storage Facility; Water Management Area; Overburden Emplacement Area; Void (Open Cut void); Underground Mining Area (subsidence management); Beneficiation Facility; and Other	Infrastructure to Remain All infrastructure that is to remain as part of the final land use is safe.	Where applicable, necessary approvals are in place (e.g. development consent under the Environmental Planning and Assessment Act 1979) where buildings and infrastructure are to be retained as part of final land use	Permits and approval documents issued	Copy of any relevant approvals.
			Potential hazards (e.g. electrical, mechanical) have been effectively isolated.	Hazards isolated.	Statement provided.
			Access tracks that are to remain are in a trafficable condition that is suitable for their intended purposes.	Any required Repairs or Upgrades complete.	Copy of any relevant plans, photos etc.
			Heritage obligations as required under the Environmental Planning and Assessment Act 1979 , Heritage Act 1977, etc. have been met (e.g. archival recording, building retention and restoration).	Permits and approval documents issued; archival reports (where required) complete and submitted.	Copy of any relevant approval documentation and/or archival recordings
			The structural integrity of the infrastructure is suitable and safe for use as part of the intended final land use.	The structural integrity of the infrastructure has been inspected by a suitably qualified engineer and determined to be safe for the intended final land use (to an engineering standard).	Engineering report/statement, photos etc.
			If any underground pipelines, footings or other infrastructure are to remain in situ, they do not pose a hazard for the intended final land use. Note: If any underground pipelines, footings or other infrastructure are to remain in situ in areas to be returned for Agriculture – cropping they are at a depth >0.5m	The location of the infrastructure has been marked on a plan and registered with the relevant local authority (e.g. local Council) and Dial Before You Dig where this is required by the Council or the relevant Authority.	Surveyed and marked on the as-constructed final landform plan. Copy of notification to or correspondence with local Council and Dial Before You Dig

POST MINING Land Use (FINAL LAND USE DOMAIN)	MINING DOMAIN	REHABILITATION OBJECTIVES	COMPLETION CRITERIA	PERFORMANCE INDICES	EXAMPLE OF JUSTIFICATION / VALIDATION METHODS
LAND CONTAMINIATION, LANDFORM STABILITY, BUSHFIRE, SURFACE WATER QUALITY, GROUNDWATER QUALITY, GROUNDWATER REGIME, WATER APPROVALS					
NSW DEPARTMENT OF RESOURCES AND GEOSCIENCES					
Native Ecosystem (CEEC/EEC) or Native Vegetation (non CEEC/EEC) or Agricultural Land Use or Other (Note: where there are multiple land uses, a set of Rehabilitation Objectives and Completion Criteria will need to be developed for each land use)	Infrastructure Area; • Tailings Storage Facility; Water Management Area; Overburden Emplacement Area; Void (Open Cut void); Underground Mining Area (subsidence management); Beneficiation Facility; and Other	Land Contamination There is no residual soil contamination on site that is incompatible with the final land use or that poses a threat of environmental harm.	Contamination will be appropriately remediated to a condition that does not pose a threat of environmental harm or constrain the final land use	Contamination will be appropriately remediated so that appropriate guidelines for land use are met, e.g. Health Investigation Level of the National Environment Protection (Assessment of Site Contamination) Measure (1999).	Contamination Remediation Report prepared by Land Contamination Consultant Site Contamination Audit Report and Site Audit Statement prepared by EPA Accredited Auditor (where required)
			Residual waste materials stored on site (e.g. tailings dams) will be appropriately contained / encapsulated so it doesn't pose any threat of environmental harm or constrain the intended final land use	The structural integrity of the infrastructure has been inspected by a suitably qualified engineer and determined to be suitable and safe as part of the intended final land use and does not pose threat of environmental harm.	Engineered capping design with specifications.
		Landform Stability The final landform is stable and does not present a risk of environmental harm downstream/downslope of the site or a safety risk to the public/stock/native fauna.	Any areas of active erosion are within the parameters for safe and stable landform. Discharge points from rehabilitated landform to natural channels are stable.	The final landform has been constructed in general accordance with the approved Final Landform & Rehabilitation Plan. Signs of erosion and or land instability are recorded, measured and assessed.	Before and after photos Rehabilitation monitoring reports As-constructed surveys Erosion surveys / independent reports that demonstrate long term stability of rehabilitated landform. Depending on the nature, scale and risks associated with a specific site, stability will need to be evaluated over a number of years (e.g. 5 years).
				Erosion surveys to demonstrate that the average annual soil loss from the final landform at completion is to be equal or less than that predicted	

POST MINING Land Use (FINAL LAND USE DOMAIN)	MINING DOMAIN	REHABILITATION OBJECTIVES	COMPLETION CRITERIA	PERFORMANCE INDICES	EXAMPLE OF JUSTIFICATION / VALIDATION METHODS
				by the Revised Universal Sediment Loss Equation (or equivalent) for the approved land use.	
				Spillway (where required) of final void and any remaining dams has been constructed in accordance with hydrological design.	
		Bushfire The risk of bushfire and impacts to the community, environment and infrastructure has been addressed as part of rehabilitation.	Appropriate bushfire hazard controls (where required) have been implemented on the advice from the NSW Rural Fire Service (where required).	Bushfire controls implemented appropriate to the final land use.	Statement provided and before/after photos.
		Surface Water Quality Runoff water quality is similar to, or better than the pre-mining disturbance runoff water quality	Runoff water quality from rehabilitation areas going into clean water systems represent an acceptable level of change from a background condition (baseline study).	Assessment of runoff water quality against local background water quality including: EC TSS pH Metals Biological health in accordance with Australian River Assessment System (AUSRIVAS) or equivalent	Water quality monitoring reports Independent biological health assessment report. Depending on the nature, scale and risks associated with a specific site, achievement of criteria may need to be evaluated over a number of years (e.g. 5 years to 15 years).
			Water quality in all storages left on site (other than final voids) is suitable for the approved final land use	Assessment of water quality against guidelines for the final land use (e.g. agricultural, industrial, recreational)	Independent report, water quality monitoring reports. Depending on the nature, scale and risks associated with a specific site, achievement of criteria may need to be evaluated over a number of years (e.g. 5 years to 15 years).
			Water quality in any approved final voids does not pose a risk to the	Final void study completed, which includes predicted water quality	Independent report, water quality monitoring reports.

POST MINING Land Use (FINAL LAND USE DOMAIN)	MINING DOMAIN	REHABILITATION OBJECTIVES	COMPLETION CRITERIA	PERFORMANCE INDICES	EXAMPLE OF JUSTIFICATION / VALIDATION METHODS
			final land use.	and assessment of toxicity.	Depending on the nature, scale and risks associated with a specific site, achievement of criteria may need to be evaluated over a number of years (e.g. 5 years to 15 years).
		Groundwater Quality & Regime The risk to important groundwater assets (GDE's, Alluvial Aquifers, Landholder bores) has been addressed by the rehabilitation.	Groundwater quality and groundwater regime are within range as predicted in environmental assessments and in accordance with water sharing plans and water allocations held by the site.	The measured water quality at important groundwater assets meets predictions. Modelled drawdown and water take is within predictions. Biological monitoring to demonstrate the health and conditions of GDE's (where applicable)	Independent hydro-geological assessment report Monitoring reports Independent ecological assessment. Depending on the nature, scale and risks associated with a specific site, achievement of criteria may need to be evaluated over a number of years (e.g. 5 years to 15 years).
		Water Approvals Structures that take water are appropriately licensed.	Licenses held, where required.	Hydrological and hydro-geological assessments are undertaken to determine water take at completion from the relevant water sources to confirm that sufficient allocations are held.	Confirmation from relevant Government Agency (e.g. DPI Water) that licences are held.
ECOLOGICAL REHABILITATION (EEC)					
NSW DEPARTMENT OF RESOURCES AND GEOSCIENCES					
Native Ecosystem (CCEC/EEC)	All domains	Ecological Rehabilitation Objective 1 The vegetation composition of the rehabilitation is recognisable as the target vegetation community (e.g. plant community type (PCT) contained within the NSW Vegetation Information System)	Native plant species are characteristic of the target plant community(s) Notes: "Characteristic of target plant community" is defined as "50% of all species in each Growth Form (i.e. trees, shrubs, grasses, forbs and ferns and other) that are known and	The compositional attribute score is a minimum of 50 for each rehabilitation monitoring site. Note:	Before and after photos, Rehabilitation monitoring reports, Independent ecological reports (where required). Depending on the nature, scale and risks associated with a specific site,

POST MINING Land Use (FINAL LAND USE DOMAIN)	MINING DOMAIN	REHABILITATION OBJECTIVES	COMPLETION CRITERIA	PERFORMANCE INDICES	EXAMPLE OF JUSTIFICATION / VALIDATION METHODS
			accepted to form part of the PCT/TEC against benchmark value"	The compositional attribute score is based on the native species richness compared to benchmarks.	achievement of criteria may need to be evaluated over a number of years (e.g. 5 years to 15 years).
		Note: Recognisable is defined as "Diagnostic species present for each Growth form for PCT/TEC using the scientific description of the PCT available on Bionet.			Monitoring in accordance with NSW OEH BAM Methodology.
		Ecological Rehabilitation Objective 2 The vegetation structure of the rehabilitation is recognisable as, or is trending towards the target plant community (e.g. plant community type (PCT) contained within the NSW Vegetation Information System)	Cover and height range of all Growth Forms are characteristic of, or trending towards, the target plant community(s)	The structural attribute score is a minimum of 50 for each rehabilitation monitoring site. Note: The structural attribute score is based on the foliage cover for each growth form group and is compared to benchmarks.	Before and after photos, Rehabilitation monitoring reports, Independent ecological reports (where required). Depending on the nature, scale and risks associated with a specific site, achievement of criteria may need to be evaluated over a number of years (e.g. 5 years to 15 years).
		Note: "Trending Towards the target plant community" requires use of time series data to show canopy height and cover for each Growth Form against benchmark value range (or successional benchmarks)			Monitoring in accordance with NSW OEH BAM Methodology.

POST MINING Land Use (FINAL LAND USE DOMAIN)	MINING DOMAIN	REHABILITATION OBJECTIVES	COMPLETION CRITERIA	PERFORMANCE INDICES	EXAMPLE OF JUSTIFICATION / VALIDATION METHODS
		Ecological Rehabilitation Objective 3 Levels of ecosystem function have been established that demonstrate the rehabilitation is self-sustainable OR is trending towards the target plant community (e.g. plant community type (PCT) contained within the NSW Vegetation Information System)	Ecosystem function is characteristic of, or trending towards the target plant community(s), and is "suitable" for sustaining the target plant community	The functional attribute score is a minimum of 50 for each rehabilitation monitoring site. Note: The functional attribute score is based on the following attributes and is compared to benchmarks: number of large trees tree stem size class tree regeneration length of fallen logs litter cover number of trees with hollows	Before and after photos, Rehabilitation monitoring reports, Independent ecological reports (where required). Depending on the nature, scale and risks associated with a specific site, achievement of criteria may need to be evaluated over a number of years (e.g. 5 years to 15 years). Monitoring in accordance with NSW OEH BAM Methodology.
			Plant competition is "suitable"1 for sustaining the target plant community(s) Suitable means: 1. Weeds - demonstrated decline in cover of high threat weeds measured as a moving average over time. Cover of high threat weeds within range measured at reference sites	The total cover of exotic plant species is recorded at fixed monitoring plots or transects as per BAM and is within the range measured at reference sites	Before and after photos, Rehabilitation monitoring reports, Independent ecological reports (where required) Depending on the nature, scale and risks associated with a specific site, achievement of criteria may need to be evaluated over a number of years (e.g. 5 years to 15 years). Monitoring in accordance with NSW OEH BAM Methodology.

POST MINING Land Use (FINAL LAND USE DOMAIN)	MINING DOMAIN	REHABILITATION OBJECTIVES	COMPLETION CRITERIA	PERFORMANCE INDICES	EXAMPLE OF JUSTIFICATION / VALIDATION METHODS
			Animal habitat is characteristic of the target plant community(s) (as measured by the above composition, structural and functional components)	Invertebrate habitat: - Litter cover, - Woody debris (evidence of litter invertebrates; ant nests, spider holes, ground and arboreal spider webs). - Vertebrate habitat: Woody debris and stags with hollows (or nest boxes), Rock material, Aquatic habitat established at the required densities	Formal surveys of ground and/or litter invertebrates, small reptiles, small mammals, birds
NATIVE VEGETATION REHABILITATION (NON EEC/CEEC)					
NSW DEPARTMENT OF RESOURCES AND GEOSCIENCES					
Native Vegetation (Non CEEC/EEC)	All domains	Vegetation Composition	Rehabilitation areas contain flora species assemblages characteristic of each Growth Form for the target native vegetation communities.	Native plant species richness assessed for each Growth Form	Rehabilitation monitoring reports Independent ecological reports (where required). Depending on the nature, scale and risks associated with a specific site, achievement of criteria may need to be evaluated over a number of years (e.g. 5 years to 15 years).
			Indicative final minimum total tree/shrub densities for seeded areas to be 400 stems/ha.	Tree and shrub densities monitored for establishment and survival	Rehabilitation monitoring reports Independent ecological reports (where required). Depending on the nature, scale and risks associated with a specific site, achievement of criteria may need to be

POST MINING Land Use (FINAL LAND USE DOMAIN)	MINING DOMAIN	REHABILITATION OBJECTIVES	COMPLETION CRITERIA	PERFORMANCE INDICES	EXAMPLE OF JUSTIFICATION / VALIDATION METHODS
					evaluated over a number of years (e.g. 5 years to 15 years).
			Invasive weed species that have the potential to impact upon ecological values are comparable to reference sites	Abundance and cover of invasive weeds species is recorded	Rehabilitation monitoring reports Independent ecological reports (where required). Depending on the nature, scale and risks associated with a specific site, achievement of criteria may need to be evaluated over a number of years (e.g. 5 years to 15 years).
		The rehabilitation is self-sustainable	Evidence of flowering and seeds or second generation juveniles for trees and shrubs or likely to be, based on comparable older rehabilitation sites.	Trees and shrubs are monitored for evidence of second generation juveniles and evidence of flowers and seeds	Rehabilitation monitoring reports, Independent ecological reports (where required). Depending on the nature, scale and risks associated with a specific site, achievement of criteria may need to be evaluated over a number of years (e.g. 5 years to 15 years).
		Habitat features incorporated	Habitat features (e.g. logs, rocks and nest boxes), including structures suitable for target species are incorporated into rehabilitation areas at required densities, as required by Approvals Native rehabilitation areas provide a range of structural features (e.g. trees, shrubs, ground cover, developing litter layer etc.).	Habitat and structural features recorded	Rehabilitation monitoring reports, Independent ecological reports (where required). Depending on the nature, scale and risks associated with a specific site, achievement of criteria may need to be evaluated over a number of years (e.g. 5 years to 15 years).

POST MINING Land Use (FINAL LAND USE DOMAIN)	MINING DOMAIN	REHABILITATION OBJECTIVES	COMPLETION CRITERIA	PERFORMANCE INDICES	EXAMPLE OF JUSTIFICATION / VALIDATION METHODS
AGRICULTURAL REHABILITATION					
NSW DEPARTMENT OF RESOURCES AND GEOSCIENCES					
(FINAL LAND USE DOMAIN)					
Agricultural Land Use	All domains	Revegetation is sustainable for the long term and only requires maintenance that is consistent with the intended final land use.	Land and Soil Capability classification or Agricultural Land Classification criteria met. Rehabilitation areas comprise palatable grasses and legumes appropriate to the district and suitable for cattle grazing. Weed presence is within the range found at analogue sites and does not present a risk to the intended final land use. Cropping / Pasture establishment is in good health and provides adequate cover. Ground cover (vegetation, leaf litter, mulch) is greater than 70%	Land and Soil Capability of at least Class 6 in proposed Agricultural areas The re-established growth medium substrate (e.g. topsoil / subsoil) is capable of supporting the targeted pasture / cropping regime on a sustained basis. Pasture composition assessed, including pasture weeds Demonstration of persistence over time for palatable grasses and legumes.	Results from Industry research, Studies or trials, Rehabilitation monitoring reports, Independent soil reports, Environmental monitoring records, Independent agronomist reports. Depending on the nature, scale and risks associated with a specific site, achievement of criteria may need to be evaluated over a number of years (e.g. 5 years to 15 years).
			Appropriate and reliable access to water for livestock. Appropriate shade and shelter for livestock (i.e. wooded/treed areas) during extreme weather conditions.	Location and density of dams or other watering points appropriate for the intended final land use Location and availability of shade and shelter for livestock appropriate for the intended final land use	Independent agronomist /consultant reports, photos

Appendix 6 – Rehabilitation Seed Mix

Rehabilitation Seed Mix

Central Hunter Iron Bark – Spotted Gum - Grey Box Forest	Type
Angophora floribunda	Tree
Corymbia maculata	Tree
Eucalyptus albens	Tree
Eucalyptus blakelyi	Tree
Eucalyptus crebra	Tree
Eucalyptus dawsonii	Tree
Eucalyptus fibrosa	Tree
Eucalyptus glaucina	Tree
Eucalyptus moluccana	Tree
Eucalyptus punctata	Tree
Eucalyptus tereticornis	Tree
Acacia decurrens	Sub-dominant tree
Acacia implexa	Sub-dominant tree
Acacia linearifolia	Sub-dominant tree
Acacia parvipinnula	Sub-dominant tree
Acacia salicina	Sub-dominant tree
Allocasuarina gymnanthera	Sub-dominant tree
Allocasuarina leuhmanii	Sub-dominant tree
Allocasuarina verticillata	Sub-dominant tree
Brachychiton populneus	Sub-dominant tree
Bursaria spinosa	Sub-dominant tree
Callitris endlicheri	Sub-dominant tree
Notelaea microcarpa	Sub-dominant tree
Acacia amblygona	Shrub
Acacia brownii	Shrub
Acacia crassa	Shrub
Acacia cultriformis	Shrub
Acacia decora	Shrub
Acacia elongata	Shrub
Acacia falcata	Shrub
Acacia paradoxa	Shrub
Acacia spectabilis	Shrub
Daviesia genistifolia	Shrub
Daviesia ulicifolia	Shrub
Daviesia ulicifolia subsp. Stenophylla	Shrub
Hardenbergia violacea	Shrub

Central Hunter Iron Bark – Spotted Gum - Grey Box Forest	Type
Indigofera australis	Shrub
Jacksonia scoparia	Shrub
Podolobium ilicifolium	Shrub
Pultenaea microphylla	Shrub
Pultenaea spinosa	Shrub
Cassinia aculeata	Shrub
Cassinia arcuata	Shrub
Cassinia quinquefaria	Shrub
Dodonaea viscosa subsp cuneata	Shrub
Eremophila deserti	Shrub
Hakea sericea	Shrub
Kunzea ambigua	Shrub
Melaleuca decora	Shrub
Melaleuca nodosa	Shrub
Melichrus urceolatus	Shrub
Myoporum montanum	Shrub
Olearia elliptica	Shrub
Ozothamnus diosmifolius	Shrub
Pandorea pandorana	Shrub
Senna artemesioides subsp. zygophylla	Shrub
Ajuga australis	Shrub
Atriplex semibaccata	Shrub
Calocephalus critreus	Shrub
Calotis cuneifolia	Shrub
Calotis lappulacea	Shrub
Chrysocephalum apiculatum	Shrub
Desmodium brachypodum	Shrub
Einadia hastata	Shrub
Einadia nutans	Shrub
Einadia polygonoides	Shrub
Einadia trigonos	Shrub
Enchylaena tomentosa	Shrub
Eremophila debilis	Shrub
Glycine clandestina	Shrub
Glycine latifolia	Shrub
Glycine tabacina	Shrub
Haloragis heterophylla	Shrub
Hibbertia obtusifolia	Shrub

Central Hunter Iron Bark – Spotted Gum - Grey Box Forest	Type
Hypericum gramineum	Shrub
Mentha satureoides	Shrub
Miareana microphylla	Shrub
Neptunia gracilis	Shrub
Podolepis neglecta	Shrub
Pomax umbellata	Shrub
Solanum cinereum	Shrub
Spartothamnella juncea	Shrub
Swainsona galegifolia	Shrub
Vittadinia spp.	Shrub
Wahlenbergia spp.	Shrub
Aristida spp.	Grass
Austrodanthonia spp.	Grass
Austrostipa aristiglumis	Grass
Austrostipa ramosissima	Grass
Austrostipa scabra	Grass
Austrostipa verticillata	Grass
Bothriochloa biloba	Grass
Bothriochloa decipiens	Grass
Bothriochloa macra	Grass
Capillipedium spicigerum	Grass
Chloris truncata	Grass
Chloris ventricosa	Grass
Cymbopogon refractus	Grass
Dicanthium sericeum	Grass
Dichelachne crinita	Grass
Digitaria spp.	Grass
Elymus scaber	Grass
Enteropogon acicularis	Grass
Eragrostis spp.	Grass
Eulalia aurea	Grass
Heteropogon contortus	Grass
Imperata cylindrica	Grass
Microleana stipoides	Grass
Panicum spp.	Grass
Paspalidium distans	Grass
Poa labillardieri	Grass
Sporobolus creber	Grass

Central Hunter Iron Bark – Spotted Gum - Grey Box Forest	Type
Themeda avenacea	Grass
Themeda triandra	Grass
Carex fascicularis	Monocot
Carex inversa	Monocot
Cyperus gracilis	Monocot
Dianella spp.	Monocot
Fimbristylis dichotoma	Monocot
Gahnia aspera	Monocot
Juncus usitatus	Monocot
Lomandra longifolia	Monocot

Central Hunter Grey Box – Ironbark Woodland	Type
Angophora floribunda	Tree
Corymbia maculata	Tree
Eucalyptus albens	Tree
Eucalyptus blakelyi	Tree
Eucalyptus crebra	Tree
Eucalyptus dawsonii	Tree
Eucalyptus fibrosa	Tree
Eucalyptus glaucina	Tree
Eucalyptus moluccana	Tree
Eucalyptus punctata	Tree
Eucalyptus tereticornis	Tree
Acacia decurrens	Sub – dominant tree
Acacia implexa	Sub – dominant tree
Acacia linearifolia	Sub – dominant tree
Acacia parvipinnula	Sub – dominant tree
Acacia salicina	Sub – dominant tree
Allocasuarina gymnanthera	Sub – dominant tree
Allocasuarina leuhmanii	Sub – dominant tree
Allocasuarina verticillata	Sub – dominant tree
Brachychiton populneus	Sub – dominant tree
Bursaria spinosa	Sub – dominant tree
Callitris endlicheri	Sub – dominant tree
Notelaea microcarpa	Sub – dominant tree
Acacia amblygona	Sub – dominant tree
Acacia brownii	Shrub
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Acacia falcata	Shrub
Acacia paradoxa	Shrub
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Calotis lappulacea	Shrub
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Desmodium brachypodum	Shrub
Einadia hastata	Shrub

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Austrostipa ramosissima	Grass
Austrostipa scabra	Grass
Austrostipa verticillata	Grass
Bothriochloa biloba	Grass
Bothriochloa decipiens	Grass
Bothriochloa macra	Grass
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Chloris truncata	Grass
Chloris ventricosa	Grass
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Dicanthium sericeum	Grass
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Lomandra longifolia	Monocot