RAVENSWORTH
OPEN CUT

GLENCORE

Mining Operations Plan Ravensworth Operations

Plan

1 January 2021 – 31 December 2023

Mining Operations Plan	
Name of Mine	Ravensworth Operations (Consisting of Ravensworth Open Cut and RCHPP)
MOP Commencement Date	1 January 2021
MOP Completion Date	31 December 2023
Mining Authorisations (Lease/Licence No.)	Ravensworth Open Cut ML 1325, ML 1357, ML 1393, ML 1484, ML 1485, ML 1502, ML 1576, ML 1669, ML 1683, CL 378, CL 380, CL 580, CCL 723, CCL 739, A 385 Ravensworth Underground Mine EL 7799, ML 1416, ML 1506, ML 1564, ML 1581, ML 1591, ML 1595, ML 1625
Name of Authorisation / Authorisation holder(s)	Ravensworth Operations Pty Ltd (primary authorisation holder), Cumnock No.1 Colliery Pty Limited, ICRA Cumnock Pty Limited, Resource Pacific Pty Limited, AGL Macquarie Pty Limited, Glencore Newpac Pty Limited.
Name of Mine Operator (if different)	Ravensworth Operations Pty Ltd
Name and Contact Details of the Mine Manager (or equivalent)	Tony Israel (Operations Manager)
Name and Contact Details of Environmental Representative	Klay Marchant Environment and Community Manager 02 6570 0784 0400 239 291 Klay.Marchant@glencore.com.au
Name of Representative of the Authorisation Holder(s)	Klay Marchant
Title	Environment and Community Manager
Signature	
Date	4 November 2020

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1. Introduction

1.1 Background

Ravensworth Operations is a coal mining operation located between the townships of Muswellbrook and Singleton in the Upper Hunter Valley region of New South Wales (NSW) (***Plan 1A***). Ravensworth Operations is comprised of the Ravensworth Open Cut (ROC) and the Ravensworth Coal Handling and Preparation Plant (RCHPP). ROC is operated by Ravensworth Operations Pty Limited (ROPL), which is a wholly owned subsidiary of Glencore.

Ravensworth Operations is managed in accordance with the Project Approval (PA 09_0176) for the Ravensworth Operations Project (the Project), which was granted under the former Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The Project consolidated a number of active and former open cut mines including Ravensworth West, Narama, Cumnock, Ravensworth South and Ravensworth No. 2. The Project also facilitated the expansion of open cut mining activities, including the new Ravensworth North mining area.

The RCHPP incorporates a coal handling and preparation plant (CHPP) and coal terminal. The RCHPP is used to beneficiate and transport coal extracted from Ravensworth Operations and Ravensworth Underground Mine (RUM).

Ravensworth Operations and RUM are collectively referred to as the Ravensworth Complex. RUM is managed under a separate development consent (DA 104/96) granted under the EP&A Act. RUM has been under care and maintenance since October 2014.

This Mining Operations Plan (MOP) relates to proposed mining operations and associated activities at Ravensworth Operations for the period 1 January 2021 to 31 December 2023. This MOP has been prepared in accordance with the *ESG3: Mining Operations Plan (MOP) Guidelines* (DRE, 2013). Table 1-1 lists the MOPs that have previously been prepared for Ravensworth Operations.

Table 1-1 – History of MOPs for Ravensworth Operations

Detail	Status	Issue Date	Expiry Date
Ravensworth North – Mining Operations Plan – Construction Activities	Superseded	2011	2012
Ravensworth Surface Operations MOP extension of coal extraction boundary, advancement of pit and rehabilitation trials	Superseded	May 2013	December 2016
ROC and RCHPP MOP consistent with PA 09_0176	Superseded	1 December 2013	31 December 2018
ROC and RCHPP MOP consistent with PA 09_0176 Amendment A – extended overburden and active mining areas and screening bunds and repairs to Bayswater Creek	Superseded	1 August 2014	31 December 2018
ROC and RCHPP MOP consistent with PA 09_0176 Amendment A and Amendment B – Increase in dump height modification of PA 09_0176	Superseded	1 March 2015	31 December 2018

ROC and RCHPP MOP consistent with PA 09_0176 covering 1 July 2017 to 31 December 2020	Superseded	1 July 2017	31 December 2020
ROC and RCHPP MOP covering 1 July 2017 to 31 December 2020 including the Cumnock Rehabilitation Plan and capping of 7S Tailings Void using conventional capping methods	Superseded	2 July 2019	31 December 2020
ROC and RCHPP MOP covering 1 July 2017 to 31 December 2020, including Amendment B which addressed the Cumnock Rehabilitation Plan, and Amendment C which addressed the monitoring and maintenance plan for Western Emplacement Area (WEA) rehabilitation.	To be Superseded by this MOP	26 September 2019	31 December 2020

1.2 History of Operations

There is an extensive history of mining operations in the Ravensworth area. The Ravensworth South and Ravensworth No. 2 Mine commenced operations in the early 1970s. The Ravensworth No. 2 mine ceased coal production in 1987. Its mining areas were subsequently rehabilitated and final voids are currently used by third parties for disposal of fly ash and tailings. Operations at Ravensworth South Mine ceased in 2000. The final voids were subsequently used for disposal of tailings associated with RUM.

Cumnock Mine commenced operations in the 1950s as an underground mine. Open cut mining was generally undertaken from 1993 until 2008; although mining in a small area known as the Wash Plant Pit continued until 2011. The Cumnock final voids are currently used for tailings emplacement.

The Narama Mine and Ravensworth West Mine commenced operations in the early 1990s. Ravensworth West ceased operations in 2011 and Narama Mine completed coal mining in December 2014.

Mining in the Ravensworth North mining area (approved by PA 09_0176) commenced in 2012 and will continue throughout the period of this MOP.

1.3 Consents, Leases and Licences

1.3.1 Project Approval

The current Project Approval (PA 09_0176) was granted on 11 February 2011. PA 09_0176 authorises the expansion of open cut mining (including development of the Ravensworth North mining area) and an increase in coal production rates.

The Project also consolidated the Cumnock, Narama and Ravensworth West mines under a single approval. The previous development consents for those mines were surrendered following the grant of PA 09_0176.

A modification (MOD 1) to PA 09_0176 was granted on 16 August 2013. MOD 1 facilitated the extraction of an additional 2.7 million tonnes (Mt) of run of mine (ROM) coal in the Narama West mining area.

A second modification (MOD 2) to PA 09_0176 was granted on 19 December 2014 to allow for an increase in overburden emplacement height to incorporate micro-relief into the final landform.

A third modification (MOD 3) to PA 09_0176 was granted on 16 February 2016 to facilitate the construction of a tailings pipeline from RCHPP to the neighbouring Mount Owen Complex (also owned by a subsidiary of Glencore).

PA 09_0176 (as modified) limits coal production from the Ravensworth Complex (i.e. ROC and RUM) to 21 million tonnes per annum (Mtpa) of ROM coal with a maximum open cut (i.e. ROC) production rate of 16 Mtpa of ROM coal. PA 09_0176 allows mining operations to be undertaken until 31 December 2039. PA 09_0176 (as modified) is included as ***Appendix A***.

This MOP satisfies the requirement for a Rehabilitation Management Plan under Schedule 3, Condition 41 of PA 09_0176 (as modified).

1.3.2 Mining and Exploration Authorisations

A number of mining authorities issued under the *Mining Act 1992* (Mining Act) apply to the land at Ravensworth Operations, as shown in ***Plan 1C*** and summarised in ***Table 1-2 .***

Table 1-2 – Summary of Mining Authorisations

Lease	Holder	Expiry
ML 1325	Cumnock No.1 Colliery Pty Limited, ICRA Cumnock Pty Limited	09/09/2035
ML 1357	Ravensworth Operations Pty Limited	17/08/2036
ML 1393	Cumnock No.1 Colliery Pty Limited, ICRA Cumnock Pty Limited	10/02/2027
ML 1484	AGL Macquarie Pty Limited, Resource Pacific Pty Limited	31/01/2024
ML 1485	AGL Macquarie Pty Limited, Resource Pacific Pty Limited	17/08/2036
ML 1502	Cumnock No.1 Colliery Pty Limited, ICRA Cumnock Pty Limited	02/01/2023
ML 1576	Cumnock No.1 Colliery Pty Limited, ICRA Cumnock Pty Limited	23/02/2027
ML 1683	Cumnock No.1 Colliery and ICRA Cumnock	07/02/2034
CL 378	Cumnock No.1 Colliery Pty Limited, ICRA Cumnock Pty Limited	10/03/2027
CL 380	Ravensworth Operations Pty Limited	23/09/2033
CL 580	Ravensworth Operations Pty Limited	31/12/2023
CCL 723	Ravensworth Operations Pty Limited	31/01/2024
CCL 739	Ravensworth Operations Pty Limited	10/03/2029
A 385	Cumnock No.1 Colliery Pty Limited, ICRA Cumnock Pty Limited	02/06/2022
EL 7799*	Glencore Newpac Pty Limited	27/09/2023
ML 1416*	Resource Pacific Pty Limited	20/04/2039
ML 1506*	Resource Pacific Pty Limited	21/03/2023
ML 1564*	Resource Pacific Pty Limited	31/07/2026
ML 1581*	Resource Pacific Pty Limited	21/05/2027

Lease	Holder	Expiry
ML 1591*	Resource Pacific Pty Limited	07/03/2028
ML 1595*	Resource Pacific Pty Limited	04/05/2028
ML 1625*	Resource Pacific Pty Limited	07/11/2029

** Authority relates to RUM but encompasses the land surface*

1.3.3 Other Approvals and Licences

Environment Protection Licence

ROPL holds Environment Protection Licence (EPL) 2652 granted under the *Protection of the Environment Operations Act 1997* (POEO Act). Monitoring results are reported to the NSW Environment Protection Authority (EPA) through the EPL Annual Return.

EPL 2652 authorises the off-site discharge of surplus water via Licensed Discharge Point 2 (LDP002), which is located at the Narama In-pit Storage Dam.

Groundwater and Surface Water Licences

ROPL holds a range of groundwater and surface water licences under the *Water Management Act 2000* (WM Act) and *Water Act 1912* (Water Act), which allow for taking of surface water and groundwater from various water sources. Water is used at Ravensworth Operations for coal washing, mining processes and dust suppression purposes. Licensing requirements are regularly reviewed, and updates are documented in the Annual Review prepared pursuant to PA 09_0176.

Environment Protection and Biodiversity Conservation Act Approval

Ravensworth Operations is the subject of an EPBC Approval (EPBC No. 2010/5389) under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Condition 8 of EPBC No. 2010/5389 requires the preparation and implementation of a Mine Rehabilitation Plan (MRP). The Ravensworth Operations MRP was approved by the then Commonwealth Department of Environment and Energy (DoEE) on 6 January 2014. Revisions to the approved MRP were approved in March 2015, September 2017, October 2018 and October 2019. ***Table 1-3*** lists the information that is required to be included in a MRP and where this information has been provided in this MOP.

Table 1-3 – EPBC Conditions – Mine Rehabilitation Plan

Condition No.	Condition	Section Covered in MOP
	The person taking the action must complete and submit to the Minister for approval a Mine Rehabilitation Management Plan for the progressive rehabilitation and revegetation of the project area by no later than 29 November 2013. This Mine Rehabilitation Plan must include, at a minimum the following information:	This Plan
(a)	The desired outcomes/objectives of the implementing the plan;	Sections 3.2 and 3.3
(b)	Details of the vegetation communities to be re-established and the timing of progressive rehabilitation;	Sections 6.1 and 6.2

Condition No.	Condition	Section Covered in MOP
(c)	Criteria to determine success of re-establishment of vegetation communities;	Section 4.4
(d)	A process to progressively report to the department the rehabilitation management actions undertaken and the outcomes of those actions, and the mechanisms to be used to identify the need for improved management;	Section 7.5
(e)	A description of the potential risks to successful management and rehabilitation on the project site, and a description of the contingency measures that would be implemented to mitigate these risks; and	Sections 2.1 and 8
(f)	Details of parties responsible for reviewing and implementing the Plan.	Section 10
	The approved Mine Rehabilitation Plan must be implemented.	Section 10

1.4 Land Ownership and Land Use

Land ownership within and surrounding the Ravensworth Operations is shown on ***Plan 1C***. The area surrounding Ravensworth Operations is dominated by mining operations which are the major landholders within the area. Glencore and its subsidiaries own the majority of the land within the Project Area defined by PA 09_0176, with the other key landholders being AGL Macquarie, the Hunter Valley Operations Joint Venture (HVO JV) and Ashton Coal Operations Limited (ACOL).

Land at the RCHPP and Ravensworth North is owned by Glencore and its subsidiaries, while land at Narama is owned by Glencore and its subsidiaries, and AGL Macquarie. There is a formal agreement in place between Ravensworth Operations and AGL Macquarie regarding interactions between the two operations on AGL Macquarie owned land.

Land at the former Ravensworth West Mine is owned by Glencore and its subsidiaries. The land at the former Cumnock Mine is owned by Glencore and its subsidiaries, and HVO JV.

The ownership of the land within the Project Area under PA 09_0176 is summarised in ***Table 1-4 .***

Table 1-4 – Summary of Land Ownership within PA 09_0176

Owner	Area of Ownership within Project Approval (PA 09_0176)
Ravensworth Surface Operations	1,731.7 ha
AGL Macquarie	1,430.3 ha
Ravensworth Surface Operations and Cumnock Joint Venture	1,439.7 ha
RCT Joint Venture	91.2 ha
Resource Pacific	234.1 ha

Owner	Area of Ownership within Project Approval (PA 09_0176)
Mount Owen Mine	4.7 ha
Glendell Mine	168.3 ha
Liddell Mine	27.3 ha
I Bowman Pty Ltd.	2.5 ha
Daracon	4.3 ha
HVO JV	178.4 ha
Government Departments	52.4 ha

1.5 Stakeholder Consultation

Glencore has a public commitment to effectively manage the environmental performance of its operations, both domestically and internationally. One of the key focus areas for ongoing dialogue with stakeholders is progress in mine closure and rehabilitation planning, and the implementation process.

Proposed consultation activities for this MOP term are summarised in the following sections and further detailed in the ROPL *Stakeholder Engagement Strategy.*

1.5.1 Community Consultation

ROPL has an ongoing community engagement program which includes regular engagement with the local and regional communities via a range of mechanisms including:

- Operation of a 24-hour Community Response Line;
- Maintenance of the Ravensworth Operations website, which provides online access to regulatory approvals, environmental management plans, environmental monitoring data and other community information;
- Biannual Greater Ravensworth Area newsletters to update the community on the existing operations, environmental performance and site initiatives;
- Face to face meetings with individuals and/or groups as required/requested, including any meetings required in response to complaints;
- Regular meetings with the Aboriginal Cultural Heritage Working Group, allowing for ongoing consultation and involvement of Aboriginal stakeholders in the conservation and/or management of Aboriginal cultural heritage on site;
- Regular forums with nearby neighbours, focussing on land management issues, such as pest and weed control, rehabilitation, biodiversity conservation and cultural heritage management;
- Regular meetings with the ROPL Community Consultative Committee (CCC); and
- Engaging local residents through Glencore's regular 3-yearly Community Survey.

1.5.2 MOP Consultation

This MOP and the associated operational plans for the next reporting period were discussed at the June 2020 and October 2020 CCC Meetings. The MOP was distributed to members of the CCC in September 2020. No comments or issues were raised in relation to the MOP.

These plans have been developed in accordance with Glencore requirements and provide sufficient detail regarding the current stage of mining at Ravensworth Operations. The CCC meeting minutes and presentations are provided to all members of the CCC and are published on the Ravensworth Operations website. ROPL will continue to consult with the CCC regarding the MOP and future mine closure activities.

This MOP was submitted to the Resources Regulator for comment on 3 September 2020. Ravensworth Operations has held a number of discussions with the Resources Regulator during its review of the MOP. Minor adjustments have been made to sections of this MOP to address comments raised during these discussions.

1.5.3 Rehabilitation and Mine Closure Consultation

With closure not planned for Ravensworth Operations until at least 2034, the key stakeholders will continue to be consulted as per the stakeholder engagement activities listed in ***Section 1.5***.

As part of the ongoing development and refinement of the *Operational Mine Closure Plan* (OMCP), ROPL will continue to engage all relevant stakeholders and address any issues raised in the document. ROPL presents updates and discusses rehabilitation programs and status as well as closure activities at all CCC meetings.

A stakeholder engagement strategy for final rehabilitation will be developed as part of the Detailed Mine Closure Plan. A specific risk assessment assessing the social and economic impacts from mine closure will be developed as part of the stakeholder engagement strategy. Until that time, the SEP will be reviewed and updated as necessary to reflect changes to rehabilitation and closure consultation.

1.5.4 MOP Preparation

ROPL has prepared this MOP in consultation with the Resources Regulator. Consultation has generally been undertaken via phone discussions and email correspondence. This MOP has also been prepared with consideration of previous directions provided to ROPL as discussed below.

On 3 October 2018, the Resources Regulator issued a notice under Section 240(1)(c) of the Mining Act directing ROPL to develop a management plan for the Cumnock rehabilitation area. The intended final land use for the former Cumnock Mine is native woodland, specifically the Central Hunter Grey Box Ironbark Woodland. The notice was issued following previous ecological surveys which identified risks to the establishment of native vegetation. In response to the notice, ROPL engaged an ecological specialist to prepare the *Cumnock Rehabilitation Remediation Plan* (Koru Environmental, 2020), which is provided in ***Appendix E***.

On 2 July 2019, the Resource Regulator issued a notice under Section 240B of the Mining Act. Direction 2 of this notice requires ROPL to:

> *"Amend the Mining Operations Plan to include a maintenance and monitoring schedule for all rehabilitation areas at the Western Emplacement Area that include:*
>
> • *Specific and quantifiable monitoring parameters to identify and assess erosion features including rilling, scouring and gullying. The Mining Operations Plan must nominate values or*

ranges to indicate satisfactory performance and "trigger values" or thresholds that indicate the emergence of performance issues or failure of remedial works carried out to satisfy this Notice.

- *Specified timing of the monitoring events.*
- *Appropriate management actions to be implemented if monitoring identified that any trigger values or threshold conditions have been met."*

A meeting was held with the Resources Regulator on 21 August 2019 to discuss the Section 240B notice and the remediation of erosion impacts on the WEA. Further correspondence on the implementation schedule for remediation works was provided to the Resources Regulator on 29 August 2019 which sought an extension to the specified timeframe to complete the proposed remediation works on the WEA. On 12 September 2019, the Resources Regulator amended the Notice to extend the required completion date for the remediation works on the WEA.

On 19 December 2019, the Resources Regulator conducted an inspection of the tailings storage facilities at Ravensworth Operations. The Resources Regulator identified issues associated with tailings emplacement and directed ROPL to include the following in its MOP:

- Risk assessment that addresses the issues related to tailings management;
- Performance requirements of capping strategies to achieve rehabilitation outcomes;
- Final landform and revegetation design that addresses settlement, stability and erosion issues; and
- Rehabilitation schedule.

1.6 Proposed Mining Activities

1.6.1 Project Description

Open cut mining operations involve the removal of overburden and interburden within the approved disturbance boundary followed by the recovery of coal. The target coal seams for Ravensworth Operations are the seams down to the Hebden Seam.

The Ravensworth North mining area will be the only active mining area during the MOP period. Overburden removed from the Ravensworth North mining area will be emplaced in the approved western out-of-pit overburden emplacement area (OEA) located north of the mining area, as well as the approved eastern out-of-pit OEA at Narama. As active mining progresses to the south, the void will progressively be backfilled with overburden.

The Cumnock Voids and West Pit Void (at Ravensworth East) will be used for tailings emplacement, as detailed further in ***Section 1.8.6***. Part of the Narama Void will be used for water storage.

1.6.2 Expected Mine Life

PA 09_0176 allows mining activities to be undertaken until the end of 2039. The mine life is expected to extend to at least 2034.

1.6.3 Proposed Mining

MOP Plans 3A to 3C illustrate the proposed mining activities during the MOP period.

Ravensworth North

Ravensworth North is a multi-seam mining area located west of Bayswater Creek. Mining is progressing in a southwards direction with overburden being emplaced to the north. The northern

extent of the mining area is adjacent to the former Cumnock underground workings. During this MOP period, open cut mining will progress into the former Ravensworth West Mine to extract the coal seams deeper than those targeted by the previous mine.

Mining is currently undertaken using truck and shovel methods, although ROPL has approval to operate a dragline, if required. Prior to commencing mining, the approved disturbance areas are surveyed and suitable topsoil is removed and stockpiled in accordance with the Biodiversity Management Plan. Following topsoil stripping, overburden and interburden are drilled and blasted and/or ripped by dozers. Spoil material is loaded into trucks and transported to the approved OEAs. ROM coal is recovered using excavators and/or loaders and transported by trucks to the existing coal crushing area and ROM stockpile.

1.6.4 Materials Handling and Processing

The RCHPP is located adjacent to the RUM pit top. ROM coal extracted from Ravensworth North is either stockpiled for future processing or placed directly into the enclosed ROM coal hopper. From this point, coal is processed in primary and secondary sizing stations. Coal destined for the export markets is transferred via an overland conveyor to the Raw Coal Stockpile adjacent to a tertiary sizing station, where it is further sized prior to being transferred to the RCHPP by overland conveyor. Dozers push the coal into reclaim tunnels from the stockpile, and conveyors transport the coal directly to the RCHPP for washing, or the ROM surge bin, which feeds into the plant, or the RCT bins, which feed directly into the train loader for unwashed (bypass) coal. Ravensworth Operations coal may be handled on conveyors at a rate of up to 3,500 tph.

The RCHPP also receives washed coal from the Muswellbrook Coal Company for loading onto trains.

1.6.5 Waste Disposal

ROPL manages waste materials generated during its operations in accordance with its approved Waste Management Plan.

The waste management system at Ravensworth Operations categorises waste materials into designated waste streams and ensures that each stream is treated accordingly. The objectives of the waste management system are to:

- Comply with PA 09_0176, EPL 2652 and legislation relevant to waste storage and disposal;
- Minimise waste generation, encourage and facilitate re-use and recycling of waste streams where possible;
- Conduct appropriate segregation, storage, transportation and disposal of waste generated on site;
- Conduct proper hydrocarbon management, wastewater and sewage treatment; and
- Provide education and training programs to site personnel and contractors regarding waste mitigation measures and proper waste handling and disposal.

The existing waste management contractor implements a comprehensive Waste Management System across the site including detailed waste tracking, monitoring, measurement and recycling. ROPL is committed to operating in an environmentally responsible manner and abides by the waste management hierarchy of “avoidance, reduction, reuse, recycling and disposal” as much as practicable to minimise the waste generated by the mine.

Waste management controls include:

- Correct waste storage;

- Waste minimisation;
- Communications and training;
- Recycling and reuse;
- Correct disposal; and
- Waste recording and inspections.

Management of coarse and fine rejects from the RCHPP is detailed further in ***Section 1.8.6*** below.

1.6.6 Sequencing and Staging of Mining Operations

An indicative mining schedule and sequence for the MOP period is provided in ***Table 1-5*** below and depicted in ***MOP Plans 3A to 3C***.

As operations at Ravensworth North continue to expand during the MOP period, overburden will continue to be emplaced at existing rehabilitated areas at Narama. In areas that have machine salvageable topsoil and vegetation (including some existing rehabilitation areas), this material will be stripped and transported to designated stockpile areas. Controls to address environmental risks from mining operations and associated activities are discussed in ***Section 2.2***.

Table 1-5 – Mining Schedule and Sequence

Year	Ravensworth Mining Activities
2021	Mining in the Ravensworth North area will continue to progress southwards and into the former Ravensworth West mining area. Overburden will be emplaced to the north of the mining area (either in the void or within the Western out-of-pit OEA). Overburden may also be transported to the approved OEA at Narama (i.e. Eastern OEA). Coarse rejects and tailings will be disposed of in accordance with the relevant approvals. The proposed mining during this period is shown in **MOP Plan 3A**.
2022	Mining will progress further into the former Ravensworth West mining area. Overburden will be emplaced to the north of the mining area (either in the void or within the Western out-of-pit OEA). Overburden may also be transported to the approved OEA at Narama (i.e. Eastern OEA). Coarse rejects and tailings will be disposed of in accordance with the relevant approvals. The proposed mining during this period is shown in **MOP Plan 3B**.
2023	Mining will continue southwards and intercept the pit-top facilities for the former Ravensworth West mining area. Overburden will be emplaced to the north of the mining area (either in the void or within the Western out-of-pit OEA). Overburden may also be transported to the approved OEA at Narama (i.e. Eastern OEA). Coarse rejects and tailings will be disposed of in accordance with relevant approvals. The proposed mining during this period is shown in **MOP Plan 3C**.

1.7 Asset Register

Table 1-6 outlines the key assets relating to Ravensworth Operations as at the commencement of the MOP period (represented in **MOP Plan 2**). It should be noted that the Asset Register below has been prepared based on the MOP domains.

Table 1-6 – Ravensworth Operations Key Assets

Major Assets	Decommissioning/Final Rehabilitation Activities	Approvals Required	Area/ Length at MOP Commencement
Domain 1 – Infrastructure			
Haul Roads	Remove carbonaceous material from haul road, rip, ameliorate soil and seed	Radiation licence/s Demolition certificates	121.71 ha
Product Stockpile			
RCHPP	Disconnect services, demolish subs near fan site	Phase 1 and, if required, Phase 2 Contamination Assessments	x3
	Remove electrical switchyards & substation	Detailed Closure Plan	x1
	Remove small buildings/tanks, industrial buildings		1,860 m^2
	Demolish aerial conveyors		4,640 m
	Remove concrete pads		10,020 m^2
	Remove 3 thickeners, 2 separators		x3, x2
	Remove carbonaceous material from CHPP, ROM, Stockpiles, roadways		21,345 m^3
	Remediate contaminated soils		4,990 m^3
	Spread topsoil		51,400 m^3
RCHPP	Final trim, Rock rake, ameliorate soils and spread seed		25.7 ha, 128.5t
	Structural works, banks, waterways		2.27 ha
	Remove sediment from product stockpile dams/office dam/ROM stockpile/East/RCT/Construction dams		9,167 m^3

Major Assets	Decommissioning/Final Rehabilitation Activities	Approvals Required	Area/ Length at MOP Commencement
	Minor works on clean water dams		x10
RCT (Rail Delinking)	Remove rail line		3,113 m
	Spread topsoil		7,500 m^3
	Final trim, Rock rake, structural works, ameliorate soils and spread seed		15.1ha, 75.5t
Cumnock & Ravensworth Operations (Mine infrastructure area & ROM stockpile area at Narama)	Remove concrete pads		15,604 m^2
	Reshape disturbed areas/ Final trim, Rock rake, ameliorate soils and spread seed		147 ha, 735 t
	Structural works, banks, waterways		15 ha
	Spread topsoil		294,000 m^3
	Demolish industrial buildings/ admin		15,604 m^2
	Remove bitumen		10,300 m^2
	Remove carbonaceous material		44,100 m^3
Cumnock & Ravensworth Operations (Product conveyor)	Demolish/remove conveyors		5,216 m
	Demolish/remove stacker reclaimer		x1
	Remove concrete pads		900 m^2
	Reshape disturbed areas/ Final trim, Rock rake, ameliorate soils and spread seed		7.1 ha, 35.5 t
	Spread topsoil		14,200 m^3
	Structural works, banks, waterways		0.7 ha
Cumnock & Ravensworth Operations (Reject conveyor)	Demolish/remove conveyors		4,350 m
	Reshape disturbed areas/ Final trim, Rock rake,		18.3 ha, 91.5 t

Major Assets	Decommissioning/Final Rehabilitation Activities	Approvals Required	Area/ Length at MOP Commencement
	ameliorate soils and spread seed		
	Spread topsoil		34,800 m^3
	Structural works, banks, waterways		1.8 ha
Ravensworth West	Final trim, Rock rake, deep rip and spread seed		21.1 ha
	Soil amelioration/gypsum		105.5 t
	Construct safety ditch & bund		1,650 m
	Remove carbonaceous material		63,300 m^2
Domain 2 – Tailings Storage Areas			
Cumnock, Ravensworth Operations (Cumnock mine stage 1 /2)	Cap tailings dam	High risk activity notification Detailed Closure Plan & Capping Strategy	20.8 ha
	Shape unshaped overburden dumps		11.3 ha
	Final trim, Rock rake, deep rip and spread seed		21 ha
	Structural works, banks, waterways		2.1ha
	Spoil amelioration		105 t
	Spread topsoil		42,000 m^3
Cumnock, Ravensworth Operations (Wash Plant pit at Cumnock - tailings)	Cap tailings dam		7.9 ha
	Final trim, Rock rake, deep rip and spread seed		7.9 ha
	Structural works, banks, waterways		0.79 ha
	Spoil amelioration		39.5 t
	Spread topsoil		15,800 m^3
Cumnock, Ravensworth Operations, HVO (Stage 3 at Cumnock, include tailings)	Cap tailings dam		62.9 ha
	Spoil amelioration		345.95 t
	Final trim, Rock rake, deep rip and spread seed		69.19 ha
	Spread topsoil		125,800 m^3

Major Assets	Decommissioning/Final Rehabilitation Activities	Approvals Required	Area/ Length at MOP Commencement
	Structural works, banks, waterways		6.29 ha
7 South Tailings Dam	7 South Tailings Storage Facility will be decommissioned, capped and utilised as an overburden emplacement during the MOP period		
Domain 3 – Water Management Areas			
Narama Void	Pump water from Final Narama Void to Ravensworth North Final Void	De-list key dams from Prescribed Dams EDG01 – Borehole Sealing Requirements on Land Detailed Closure Plan	14.976 GL
	Removal of water pipelines: • Narama Void to Ravensworth West Void • Narama Void to RCHPP highway dam • RCHPP highway dam to Liddell CHPP		12,160 m
	Rehabilitation area associated with pipelines: • Narama Void to Ravensworth West void • Narama void to RCHPP highway dam • RCHPP highway dam to Liddell CHPP		12.1 ha
	Removal of water pumping infrastructure		3 pumps
	Rock rake, topsoil, ameliorate soils and spread seed around Narama void		66 ha, 44,000 m^3
Dams	Drain and remove sediment from floor		28,500 m^3
	Source and spread topsoil & gypsum		11,411.4 m^3

Major Assets	Decommissioning/Final Rehabilitation Activities	Approvals Required	Area/ Length at MOP Commencement
	Final trim, Rock rake, ameliorate soils and spread seed		5.7 ha
	Structural works on banks of waterways		1 ha
Bayswater creek	Construct diversion banks		1,150 m
	Construct spillway on Bayswater creek		300 m
Narama Dam	Remove infrastructure at Dam i.e. pontoons, pumps, telemetry system		x2
	Dozer push contaminated material and cart and spread topsoil		78,500 m^3
	Final trim, Rock rake, ameliorate soils and spread seed, Ameliorate soils/gypsum		2 ha, 10 t
	Structural works, banks waterways		2 ha
Bores	Capping of exploration/water bores		x30
Ravensworth West (final void, overburden dumps, revegetation areas)	Reshape ramp floor/ construct water course		5,250 m^3
	Structural works/banks/waterways		1.63 ha
	Highwall treatment/ trench, safety berm & security fence		2,300 m
	Warning signs		x1
Domain 4 – Overburden Emplacement Areas			
No buildings or plant located within this domain	N/A	N/A	N/A
Domain 5 – Active Mining Areas			
No buildings or plant located within this domain	N/A	N/A	N/A
Domain 6 – Ravensworth North Offset Areas			

Major Assets	Decommissioning/Final Rehabilitation Activities	Approvals Required	Area/ Length at MOP Commencement
Offset		Approval for relinquishment of offset area	300.1 ha

1.8 Activities over the MOP Period

1.8.1 Exploration Activities

Mine exploration activities will continue to be undertaken within ROPL's mining authorities (listed in ***Table 1-2***) during the MOP period.

The results from ROPL's exploration activities will be used to investigate aspects such as geological/geotechnical features, seam structure and coal/overburden characteristics as input to detailed mine planning and feasibility studies.

The Ground Disturbance Permit (GDP) process will be completed prior to undertaking any exploration activity. The GDP identifies environmental, heritage and relevant regulatory obligations and management measures to mitigate and minimise potential impacts. In conjunction with the GDP process, ROPL will minimise the impacts of its exploration activities using the following controls:

- Implement the recommendations of due diligence assessments, including heritage and ecology;
- Minimise disturbance (i.e. use existing tracks and if required, only slash and remove vegetation from access tracks and drill pad areas);
- Appropriate sized machinery will be utilised during site establishment, decommissioning and rehabilitation activities (if required);
- Decommissioning, removal of waste, sealing of boreholes and site rehabilitation will be conducted in accordance with the '*Exploration Code of Practice: Rehabilitation'* (DRG, 2017) and *Exploration Code of Practice: Environmental Management'* (DRE, 2015); and
- Rehabilitation activities including site stabilisation, topsoil replacement, and application of ameliorants and appropriate seed mix to return to site to its former condition.

The Ravensworth Complex Water Management Plan (WMP) outlines the groundwater monitoring programme at Ravensworth Operations. ROPL may use completed exploration boreholes to expand its existing groundwater monitoring network. The conversion of any exploration borehole to a groundwater-monitoring bore will be subject to further consideration from ROPL's groundwater specialists and will comply with regulatory water licensing requirements.

1.8.2 Construction Activities

Upgrades to infrastructure during the MOP period include:

- Access road construction;
- Sediment dam construction;
- Emu Creek Levee construction;
- Upgrades to powerlines and pipelines;
- Relocation of reload facility; and
- Fibre optic installation.

Water Management Structures

The *Ravensworth Complex Water Management Plan* outlines the water management system for Ravensworth Operations during construction and operation of the site.

Ravensworth has been granted approval from the Department of Planning Industry and Environment (DPIE) and the DPIE-Water division for the modification works along Bayswater Creek diversion. These modification works may be undertaken during the MOP term.

Ravensworth Operations will utilise the water storage capacity of the existing water storages at site. There will be a requirement to maintain existing and construct new erosion and sediment control structures including sediment dams, sediment fencing and drainage lines during the MOP term. ROPL has approval to construct a mine water dam near the southern extent of the Project Approval area). However, there are no plans at the time of preparing this MOP to construct this dam during the MOP period.

A key design criterion of the water management system, including proposed water storage areas and the integration with existing water management system components, is to maximise the potential for capture, transfer and storage on site, for re-use as part of on site processes.

The Emu Creek Levee will be constructed during the MOP period to prevent floodwaters from potentially entering the Ravensworth North mining area. The levee will be located at the confluence of Emu Creek and Bayswater Creek and has been designed to contain a 1 in 100 year flood event.

1.8.3 Mine Operations

As stated in ***Section 1.6.6***, mining during the MOP period is planned to continue in the currently operating Ravensworth North mining areas. Operations at Ravensworth North are scheduled to continue throughout the MOP period and beyond until 2034.

Ravensworth North is a multi-seam open cut mining operation located immediately west of Bayswater Creek. The mining area is progressing southwards into the former Ravensworth West Open Cut mine. The completed mining in the northern extent of this mining area is adjacent to the former Cumnock underground mine workings.

1.8.4 Rock/Overburden Emplacement

Once the mining area is cleared of vegetation and topsoil, the material lying above the target coal seams, known as overburden, is broken up through drilling and blasting to enable it to be removed. The top layer of overburden is generally weathered material that may not require blasting and this material may be removed prior to blasting.

The mine plan has been developed to maximise opportunities for in-pit waste emplacement, thereby minimising the extent of out-of-pit OEAs. The western out-of-pit OEA at Ravensworth North will continue to be used during the MOP period. Overburden will also be emplaced in the Eastern out-of-pit OEA at Narama during the MOP period.

The Eastern OEA is located mostly on the rehabilitated voids associated with the former Ravensworth No. 2, Ravensworth South and Narama mining operations. The eastern out-of-pit OEA has been designed to progress in advance of the proposed mining sequence so that a barrier is created between the proposed mining operations and receiver areas to the south-east. Existing rehabilitation is present in a large area of the proposed eastern out-of-pit OEA. The existing rehabilitation material (vegetation and topsoil) will be stripped and transported to designated storage areas prior to the emplacement of overburden material from Ravensworth North. Further details on topsoil stripping are provided in ***Section 2.3.7***.

The conceptual final landform for Ravensworth Operations has been designed to be consistent with the 2010 EA, MOD 2 EA and the rehabilitation objectives in Schedule 3, Condition 40 of PA 09_0176. Objectives include:

- A safe stable non-polluting landform;
- Designed to minimise the visual impacts of the development;
- Designed to be in keeping with the natural terrain features of the area;
- Incorporate micro-relief;
- Be free draining; and
- Avoid straight drainage structures, as far as practical.

The out-of-pit OEAs will be developed progressively over the life of the mine to maximum heights of approximately 230 metres RL and 190 metres RL for the western and eastern out-of-pit OEAs, respectively.

1.8.5 Completed Reject Emplacement Areas

7 South Tailings Dam

The 7 South Tailings Dam is located approximately 1 km south-east of the ROC mine infrastructure area. This tailings dam is located within the void formerly known as Ravensworth South 7th Ramp and within ML 1484 and 1485.

The 7 South Tailings Dam is approximately 800 m long, 140 m wide and up to 30 m deep. During previous operations, tailings were pumped from the RCHPP via a pipeline, subjected to secondary flocculation and deposited in the western end of the void. Emplacement of tailings was discontinued in early 2013.

The 7 South Tailings Dam will no longer be capped with fly ash, as was the previous intention. Instead, the emplacement area will be incorporated into the eastern OEA. The tailings emplacement will be covered with 40 to 125 m of overburden, including 19 m of capping materials. Prior to emplacement of overburden, the softest area of the tailings will be covered with a geotextile and geogrid. Capping will consist of six to ten relatively thin layers of selected overburden, resulting in 19 m of capping. After capping, overburden is placed in operational lifts of 15 to 30 m until the final landform is achieved.

Capping of 7 South Tailings Dam commenced in 2020 and is scheduled to be completed in the third quarter of 2021. Overburden emplacement within the eastern out-of-pit OEA will continue throughout the MOP period.

Cumnock Void 1/2 Tailings Storage Facility

Cumnock Void 1/2 was commissioned as a tailings storage facility (TSF) in January 2013 and was used for this purpose until January 2014. The *Closure Plan: Cumnock Void 1/2 Tailings Storage Facility* (WSP, 2020) (Cumnock Closure Plan) has been prepared to address the issues raised by the Resources Regulator in its letter dated 19 December 2019.

Capping and backfilling of the Cumnock Void 1/2 TSF is scheduled to commence during the MOP period. The conceptual final landform has adopted the following parameters to ensure that it is safe, stable and non-polluting:

- Maximum slope batter of 6H:1V; and
- Maximum slope length of 220 m.

Formation of the conceptual final landform will require approximately 900,000 m^3 of cut and 850,000 m^3 of fill. The required fill material will be sourced from the rehabilitated Eastern out-of-pit OEA and the land immediately west of the void.

Capping of the emplaced tailings will commence once the material has developed the necessary shear strength profile. ATC Williams (2017) estimated that the adopted shear strength profile will be reached in 2022.

A progressive approach to capping and rehabilitation will be assessed in the detailed design stage. The intent of the concept final landform allows Void 2 to be capped and rehabilitated sooner than Void 1, with runoff from the capping of Void 2 reporting to Void 1. This concept will be further during detailed design to ensure sediment storage and storm surcharge capacity is available, and the need for a spillway is not triggered during the construction period. Further information is provided in **Appendix D.**

The proposed capping layer will be approximately 1.3 m thick and comprised predominantly of mine spoil from previously rehabilitated areas. Prior to use, proposed capping materials will be subject to geotechnical and geochemical investigations to confirm their suitability for capping purposes. Capping materials will be transported to Cumnock Void 1/2 by trucks and spread by dozers.

Decommissioning of the Cumnock Void 1/2 TSF will be the subject of a High Risk Activity notification under Section 33 of the *Work Health and Safety (Mines and Petroleum Sites) Regulation 2014* (WHS (Mines) Regulation).

1.8.6 Processing Residues and Tailings

Coarse Rejects

Rejects are conveyed from the RCHPP to a reject bin, where it is collected and transported to the open cut voids by haul trucks. These trucks transport rejects via internal haul roads for co-disposing in the OEAs in accordance with PA 09_0176.

Tailings

A Life of Mine Tailings Storage Strategy has been prepared for Ravensworth Operations. This Tailings Storage Strategy outlines the proposed tailings storages and tailings disposal strategies.

Tailings will be pumped to the approved tailings areas to minimise additional surface disturbance. Across the site, there are a number of existing reject and tailings emplacement areas currently servicing coal processing facilities. During the MOP period, the following emplacement areas may be used:

- Cumnock Voids 1/2 and 3 – These voids are located in the western area of the site and will be utilised for tailings storage and deposition;
- Cumnock Wash Plant Pit Void - This void is located in the north-western extent of the site and will be utilised for tailings storage; and
- West Pit Void at Ravensworth East – This void is located in the Ravensworth East southern area approved and currently being utilised by Mt Owen Complex. Tailings will be transferred from the RCHPP to Mt Owen using the GRAWTS.

As explained in ***Section 1.8.5***, closure of the Cumnock Void 1/2 TSF is scheduled to occur during the MOP period. The closure process does not preclude further deposition of tailings in the void. In fact, targeted deposition may reduce the quantity of earthworks required to produce a free draining final

landform. The Closure Plan will be revisited if further tailings deposition is planned for the Cumnock Void 1/2 TSF.

The locations of tailings storage facilities during the MOP period are illustrated in ***MOP Plans 3A to 3C***. Tailings management is outlined further in ***Sections 1.8.6*** and ***2.3.10***.

1.8.7 Decommissioning and Demolition Activities

The mine infrastructure facilities associated with the former Ravensworth West mine are located within the footprint of mining for 2023 (and later years). Accordingly, any remaining infrastructure within this area will need to be decommissioned and removed during the MOP period to facilitate the southward progression of approved mining operations. Pursuant to Schedule 2, Condition 10 of PA 09_0176, demolition activities will be conducted in accordance with *AS2601-2001: The Demolition of Structures,* or its latest version.

1.8.8 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 the 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 sterile cover crops 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 where they are deemed a substantial contributor to dust emissions. Temporary revegetation of these areas is designed to improve visual amenity and to reduce dust emissions.

1.8.9 Progressive Rehabilitation and Completion

Progressive rehabilitation will be undertaken as required by Schedule 3, Condition 40 of PA 09_0176. The rehabilitation process that will be employed to achieve the aims of the *OMCP* are summarised as follows:

- Stabilising disturbed landforms and ensuring they are free-draining;
- Revegetating these areas in accordance with their planned final land use; and
- Ongoing monitoring and maintenance of rehabilitated areas to confirm if rehabilitation is progressing in accordance with this MOP and relevant rehabilitation criteria.

Key aspects of rehabilitation will be to:

- Predominantly re-establish those vegetation communities and fauna habitats currently occurring or previously occurring at the site and connect as far as reasonably practical, the habitat areas to the north and south of the disturbance areas with a vegetated corridor. Local indigenous species will be used in the revegetation of woodland areas, which will be linked with existing vegetated areas to improve ecological function and provide habitat; and
- Establish and protect Biodiversity Offset Areas, including the Ravensworth North Offset Area Clifton Offset Area, Stewart Offset Area and Hillcrest Offset Area.

Rehabilitation activities during the MOP period are discussed further in ***Section 6.2*** and shown in ***MOP Plans 3A to 3C***.

Rehabilitation and closure activities at Ravensworth Operations generally include the following measures:

- Implementation of erosion and sediment controls (where necessary) such as contour drains and dams, toe drains and silt trap dams;
- Shaping of overburden consistent with statutory approvals and surrounding landforms;
- Topsoil and/or ameliorants are generally placed at an approximate thickness of 100 mm over shaped overburden areas;
- In areas allocated for woodland rehabilitation, deep ripping occurs along the contours over the entire area. For proposed pasture areas, the surface is ripped and rock-raked to remove rocks at the surface;
- Where required, the ground is selectively treated with gypsum at a rate of approximately 10 t/ha to combat the high clay content and to prevent surface sealing, thus enabling water penetration into the overburden;
- After ameliorant application, the rehabilitation area is generally deep ripped on the contour. Any large rocks brought to the surface may be used in spillways and drains or used to create habitat;
- The rehabilitation area is seeded and fertilised; and
- Where possible, salvaged features such as logs and hollows are placed within the woodland rehabilitation areas to aid with habitat creation.

ROPL continues to work with organisations to develop strategies for directly placing seed species in waste materials.

1.8.10 Material and Production Schedule

The material production schedule during the MOP period is provided in ***Table 1-7*** below.

Table 1-7 – Material Production Schedule during the MOP period

Material	Unit	2021	2022	2023
Stripped topsoil	bcm	64,259	99,586	59,162
Rock/overburden	Mbcm	58.6	65.9	65.6
ROM Coal	kt	12,554	14,064	14,065
Coarse Reject	kt	3,026	3,399	3,011
Product Coal	kt	8497	9356	9383

2. Environmental Issues Management

2.1 Environmental Risk Assessment

Ravensworth Operations have developed an Environmental Management System (EMS) to provide strategic context for environmental management, and to ensure all activities across the site are undertaken in accordance with regulatory requirements.

The methodology used for environmental risk assessments is generally in accordance with the Glencore *Sustainable Development Guideline Risk and Change Management Procedure* which follows the general principles outlined in *ISO 31000:2009 Risk Management*. This is the commonly used methodology for the mining industry and Glencore sites. Those facilitating the risk assessments at Ravensworth Operations are appropriately trained and experienced in risk management. As outlined in the Glencore *Risk Management Guidelines* the following framework was used to conduct the risk assessment:

1. Establish the context for the risk analysis process;
2. Identify environmental and community aspects and potential risks;
3. Analyse risks; and
4. Evaluate risks to determine the key issues requiring further assessment.

2.1.1 Broad Brush Risk Assessment

An Environment and Community Broad Brush Risk Assessment (ECBBRA) was completed in June 2020. The ECBBRA is conducted annually to inform the planning of operations to avoid significant environmental issues. The ECBBRA was completed in accordance with the Glencore Coal Assets Australia Risk Management Standard (GCAA-625378177-2844). The ECBBRA completed in 2020 identified zero high risk issues, 15 medium risk issues and 19 low risk issues. The medium risks identified by the ECBBRA relate to the following operational aspects:

- Blasting;
- Dust emissions;
- Weed and pest management;
- Management of cultural heritage sites;
- Rehabilitation; and
- Surface water management.

Environmental Management Plans (EMPs) have been prepared and are regularly updated to include controls to manage the risks identified by the ECBBRA.

2.1.2 Rehabilitation Risk Assessment

A specific MOP Rehabilitation and Tailings Decommissioning Risk Assessment was conducted in July 2020. This risk assessment identified 24 risks, with 12 being classified as medium risks and 12 classified as low risks. No high risks were identified by the assessment. The identified medium risks related to:

- Inadequate consideration of rehabilitation and proposed landforms in mine planning;

- Failure / inability to meet rehabilitation objectives in Project Approval 09_0176, the MOP and other relevant completion criteria (namely evidence of safe, stable, non-polluting, and other sustaining metrics of Table 17 of PA 09_0176);
- Insufficient / inadequate material (topsoil/subsoil/ mulch/habitat features) for rehabilitation (including TSFs);
- Impacts to known and unknown cultural & European heritage items;
- Failed or poor quality rehabilitation;
- Failure of borehole and/or incomplete rehabilitation of borehole sites;
- Final landform designs are not long-term stable (to allow relinquishment) including engineered covers, high-walls, landforms, drainage, mine seals etc.;
- Location, size and treatment of final voids, highwalls and ramps are not consistent with Project Approval 09_0176;
- Erosion of final landforms resulting in instability on slopes and drainage lines;
- Final landform unsuitable for final land use;
- Long term instability and poor functioning of creek diversions on rehabilitated landforms; and
- Rehabilitation adversely affected by climate change, bushfire, drought and flood.

Plans to treat these risks are included in the OMCP. The MOP Rehabilitation and Tailings Decommissioning Risk Assessment is provided in **Appendix B**.

2.1.3 Closure Risk Assessment

A specific Closure Risk Assessment was undertaken in May 2020. The Closure Risk Assessment was completed in accordance with the Glencore Coal Assets Australia Closure and Residual Risk Guideline (GCAA-625378177-16367). The Closure Risk Assessment identified 52 risks, with 24 being classified as medium risks and 28 being classified as low risks. No high risks were identified. The residual risks in relation to mine closure include:

- Inadequate consideration of rehabilitation and proposed landforms in mine planning;
- Location, size and treatment of final voids, highwalls and ramps;
- Significant landform modification required to achieve post-mining landforms that comply with approvals and other obligations;
- Contamination (e.g. hydrocarbons, Polychlorinated Biphenyls (PCBs), asbestos, radiation etc);
- Monitoring and maintenance program is inadequate to measure and assess achievement of post-mining land use, criteria and rehabilitation objectives; and
- Monitoring and maintenance program not undertaken as required.

Details regarding treatment plans for these residual risks are provided in the OMCP.

2.2 Environmental Risk Management

Ravensworth Operations continually evaluates and monitors their environmental performance and legislative compliance to minimise impacts on the surrounding community through its EMS.

The Ravensworth Operations EMS provides for the environmental management and monitoring of air quality, noise, water and blasting. In addition, Ravensworth Operations undertakes monitoring in accordance with its EPL 2652.

A number of environmental management strategies and procedures have been designed and implemented to manage, monitor and effectively minimise potential impacts of specific processes at Ravensworth Operations on the surrounding environment. These procedures and strategies provide the framework for ongoing management of environmental impacts and specify management practices to minimise impacts through design, operation and ongoing monitoring of existing operations.

Table 2-1 outlines the key Environmental Management Plans (EMPs) and Procedures covering Ravensworth Operations. The most current version of the approved EMPs are available online at *http://www.ravensworthoperations.com.au/EN/Publications/Pages/Management-Plans.aspx*.

Table 2-1 – Environmental Management Plans Submitted/Approved at MOP Commencement

Document	Reference	Status
Ravensworth Operations		
Ravensworth Complex Noise Management Plan	PA 09_0176 Schedule 3, Condition 9	Approved
Ravensworth Complex Blast Management Plan	PA 09_0176 Schedule 3, Condition 17	Approved
Ravensworth Complex Air Quality and Greenhouse Gas Management Plan	PA 09_0176 Schedule 3, Condition 24	Approved
Ravensworth Complex Water Management Plan	PA 09_0176 Schedule 3, Condition 31	Approved
Ravensworth Complex Biodiversity Management Plan	PA 09_0176 Schedule 3, Condition 31	Approved
Rehabilitation Management Plan	PA 09_0176 Schedule 3, Condition 41	This MOP document
Ravensworth Complex Heritage Management Plan	PA 09_0176 Schedule 3, Condition 42	Approved
Aboriginal Cultural Heritage Management Plan (ACHMP)	PA 09_0176 Schedule 3, Condition 42	Approved
Ravensworth Complex Environmental Management Strategy	PA 09_0176 Schedule 5, Condition 1	Approved

These EMPs are reviewed and revised in accordance with Schedule 5, Condition 4 of PA 09_0176.

2.2.1 Air Quality

Dust and air quality is managed in accordance with the Ravensworth Complex *Air Quality and Greenhouse Gas Management Plan*.

Air quality design controls which are implemented at Ravensworth Operations include:

- Progressive rehabilitation;
- Temporary stabilisation (see ***Section 1.8.8***);
- Enclosure of overland conveyors;

- Enclosure of the RCHPP;
- Spray systems for permanent raw and product coal stockpiles where coal moisture content warrants dust suppression. The stacker conveyor for the raw coal stockpile also has an adjustable luff angle to minimise dust emissions due to drop height at the stockpile;
- Water supply via several on site dams;
- Automatic sprays for the dump hopper to minimise dust from coal processing activities;
- Haul road and raw coal dust suppression;
- Dust camera network; and
- Trials of water cannons or similar apparatus.

In the event that activities are causing increased dust emissions from Ravensworth Operations, additional control measures will be implemented and corrective actions undertaken to minimise the potential for windblown dust from the site. In order to enable an efficient response and implementation of control measures during instances where dust generation is observed, Ravensworth Operations personnel will undertake the following actions in accordance with the Ravensworth Complex *Air Quality and Greenhouse Gas Management Plan*:

- In the event that dust emissions are visible above the drill deck height during drilling operations, the operator is to cease operations and check that the dust suppression system is operational;
- In the event that road dust is visible above truck tray height, truck operators are to call for additional suppression and modify operations.
- An integral aspect of the management of potential air quality impacts is the continued implementation of an extensive air quality monitoring program, which incorporates the use of continuous air quality monitors within the area surrounding the site. The *Air Quality and Greenhouse Gas Management Plan* provides a summary of the air quality monitoring program associated with the Ravensworth Complex, with this including:
    - Depositional Dust Gauges (DDGs) – monthly frequency;
    - Particulate matter less than 10 microns (PM_{10}) – every six days;
    - Total Suspended Particulate matter (TSP) – every six days;
    - Tapered Element Oscillating Microbalance (TEOM) monitors – continuous;
    - Meteorological monitoring – continuous and;
    - Real time dust cameras.

2.2.2 Erosion and Sediment Control

Erosion and sedimentation impacts are managed in accordance with the approved Ravensworth Complex *Erosion and Sediment Control Plan* (ESCP) which forms part of the Ravensworth Complex *Water Management Plan.*

The main operational erosion and sediment controls used by Ravensworth Operations include:

- Training;

- Clean water diversion drains and banks;
- Catch drains;
- Sediment fences and other temporary controls;
- Completion of revegetation works;
- GDP process;
- Sediment dams; and
- Ongoing maintenance of erosion and sediment control structures.

All active mining and rehabilitation areas across site have appropriate containment facilities such as drains and sedimentation basins to retain runoff water on site. These sedimentation dams are regularly inspected and maintained to ensure that there is sufficient capacity available for sediment containment. Erosion and sediment controls will continue to be implemented at Ravensworth Operations during the MOP period to mitigate the impacts on nearby watercourses and the surrounding environment. Standard erosion and sediment control techniques will be used in accordance with the requirements *Managing Urban Stormwater: Soils and Construction Volume 1 (Landcom 2004)* (the *Blue Book*). Further detail regarding the management of erosion and sedimentation is outlined in the *Ravensworth Complex Water Management Plan.*

2.2.3 Surface Water and Groundwater

Surface water and groundwater impacts from mining activities are managed in accordance with the *Ravensworth Complex Water Management Plan*. A comprehensive water management system has been designed for the site to effectively manage the water captured within the proposed disturbance areas and minimise the potential impact of the operations on the surrounding environment. Through the implementation of the comprehensive water management system, the mine will not have any significant impacts on downstream water users.

Ravensworth Operations maintains a large network of surface water monitoring locations, including visual and computer controlled pit water dams, sedimentation dams and local watercourses. Each location is sampled by consultants to assess water quality and the presence of any pollutants. The water management program includes monitoring of the following elements of the water management system and surrounding creeks:

- Surface water quality and flows in upstream and downstream watercourses;
- Channel stability in upstream and downstream watercourses;
- Stream health conditions in upstream and downstream watercourses;
- On site water management structures for Ravensworth Operations (mine water dams, sediment dams); and
- Discharge to Bowmans Creek under the Hunter River Salinity Trading Scheme (HRSTS).

The ECBBRA outlines several water management risks. Key risks include:

- Pipeline failure;
- Dam overflows; and
- Erosion and sedimentation.

Some of the key controls include:

- Environmental training;
- Inspections and maintenance of dams;
- Bunding and drainage
- Citect computer system;
- Double casing of high risk pipelines;
- Differential flow meters to Citect;
- Pipeline Standard;
- Pipeline Audit;
- Desilting of dams;
- Inspections and audits
- Operational manuals; and
- Separation of hydrocarbons from drainage.

Further sections of Emu Creek (ephemeral) will continue to be mined through during the MOP period in accordance with PA 09_0176. During this process, water will be managed in accordance with the approved site *Ravensworth Complex Water Management Plan*. Ravensworth Operations discussed impacts to Emu Creek with the then NSW Office Water (NOW) in whilst preparing the 2014 *Ravensworth Complex Water Management Plan.* These discussion confirmed that instead of undertaking the temporary Emu Creek diversion proposed in the 2010 EA, surface water runoff from the remaining Emu Creek catchment would be taken pursuant to harvestable rights. This water is managed and utilised within the existing water management system as outlined in the *Water Management Plan*. A specific *Emu Creek Diversion Management Plan* will be completed closer to the re-establishment of Emu Creek, which is anticipated to occur around Year 19 of the Ravensworth Operations Project.

The Creek Diversion Management Plan – Bayswater Creek and Emu Creek has been prepared as an appendix to the *Ravensworth Complex Water Management Plan* and outlines a conceptual design of the Bayswater Creek diversion and Emu Creek diversion at Ravensworth Operations. During preparation of the 2014 *Ravensworth Complex Water Management Plan*, consultation was undertaken with the then NOW regarding the proposed remediation of Bayswater Creek Diversion. This report was subsequently approved on 18 February 2014. This report details what works need to be undertaken for the diversion. Ravensworth Operations will be undertaking installation of interim measures to provide a stable drop structure until the implementation of the design report.

The *Ravensworth Complex Surface and Groundwater Response Plan* (component of the *Water Management Plan*) details the trigger levels for mandatory reporting to NSW Environment Protection Authority which is to be undertaken in accordance with the EPL.

Groundwater management will be completed in accordance with the *Ravensworth Complex Water Management Plan* which has been developed to facilitate compliance with the conditions of the Project Approval and groundwater licenses for Ravensworth Operations. The *Ravensworth Complex Water Management Plan* has also been developed to enable Ravensworth Operations to measure and assess changes to the groundwater regime that could be attributed to mining activities. The groundwater monitoring program aims to:

- Determine if groundwater extraction volumes are within licence conditions and modelled predictions;
- Identify deviations from the baseline water quality conditions; and
- Identify deviations from the baseline groundwater level trends.

The *Ravensworth Complex Water Management Plan* provides additional detail regarding monitoring and management of potential surface and groundwater impacts.

The major water storage facility at Ravensworth Operations is the Narama In-pit Storage Dam (NISD). The NISD is a declared dam (with an associated notification area) under the *Dams Safety Act 2015*. The NISD was designed to have a capacity of 1,000ML; however the maximum operating capacity is currently limited to RL 69.5 due to blasting and operational restrictions. The dam is also a licensed discharge point for the site (EPL LDP002) with a volumetric discharge limit of 400 ML/day. The main storage for water at Ravensworth Operations is the Narama pit, where the water storage has the capacity to link to other key storages in the water sharing scheme as well as the NISD. The GRAWTS facilitates the transfer of water from the NISD and other dams at Ravensworth Operations.

The main water source for the RCHPP is the Highway Dam, which has a capacity of approximately 260ML. The Highway Dam is recharged from various water sources across the GRA.

2.2.4 Contaminated Land

Hydrocarbon contaminated material resulting from spillages are cleaned up using oil absorbent material. This oil affected material is then taken offsite by appropriately licensed transporters to a licensed facility for treatment and disposal in accordance with site procedures as part of the EMS. Hydrocarbon contaminated water is contained and treated at the sites industrial water treatment plant and treated water is recycled for re-use. In the event of accidental contamination of on-site dams, contaminated water is removed by vacuum truck and disposed off-site by an OEH approved licensed contractor.

Ravensworth Operations has a bioremediation area which meets the requirements of *Environmental Guidelines: Solid Waste Landfill* (EPA, 2016). All hydrocarbon contaminated waste material within pit, hardstand and truck wash areas is bio-remediated and disposed on site. Ravensworth Operations will continue to implement general land contamination management and mitigation measures during the MOP period as required. Any potential contamination issues will be assessed and dealt with in the mine closure and decommissioning processes. The site has been designed to prevent contamination and the storage and handling of chemicals which is to be undertaken in accordance with Australian Standards and relevant Government guidelines.

2.2.5 Flora and Fauna

Threatened flora and fauna populations are monitored in accordance with the *Biodiversity Management Plan*. The *Biodiversity Management Plan* was developed to be consistent with the Glencore standards to implement scientifically sound technologies and procedures for the effective management and conservation of biodiversity and rehabilitation of disturbed land to a planned post-closure use.

The majority of proposed rehabilitation to be completed at Ravensworth Operations consists of returning the site to a woodland habitat. This aims to mitigate effects of mining activities on native vegetation communities, fauna habitat and fauna species by planning and implementing programmes to maintain and improve the biological value of land.

In order to mitigate the unavoidable ecological impacts associated with the site, Ravensworth Operations has developed a comprehensive *Biodiversity Management Plan* that aims to maintain or improve the biodiversity conservation of the region. The ECBBRA identified vegetation removal as an activity that may potentially cause a loss of threatened flora and fauna. Key controls in place to minimise the risk to flora and fauna are outlined in the *Biodiversity Management Plan*. These include:

- Ground disturbance permit;
- Demarcation and pegging out of areas;
- Erosion and Sediment Control Plan;
- Pre clearance surveys;
- Tree felling procedures;
- Seed collection and propagation procedures;
- Bushfire management;
- Augmentation of Green and Golden Bell Frog habitat;
- Salvage of hollows;
- Fencing;
- Weed and pest management;
- Management and monitoring within the offset areas;
- Flora and fauna monitoring; and
- Rehabilitation monitoring and maintenance.

The location of the biodiversity offset areas provide for the development of broad regional vegetation linkages across the Hunter Valley Floor. To facilitate the development of future regional biodiversity corridors, the Biodiversity Offset and Rehabilitation Strategy has been designed to develop linkages with existing conservation areas within the region, and biodiversity offset areas established for the surrounding mining operations within the Greater Ravensworth Area.

Table 2-2 lists the biodiversity offset areas for Ravensworth Operations, established in accordance with Schedule 3, Condition 32 of PA 09_0176.

Flora and fauna monitoring requirements are documented in the *Biodiversity Management Plan* and are reported in the Annual Review. For further details refer to the *Biodiversity Management Plan*. ***Section 2.2.6*** outlines the management of weeds and feral animals within the biodiversity offset areas. The *Biodiversity Management Plan* outlines the Offset Monitoring Program at Ravensworth Operations. It provides details on fauna monitoring (including Green and Golden Bell Frog) and vegetation community monitoring.

Table 2-2 – Biodiversity Offsets

Offset Area	Minimum Size (hectares)
Ravensworth North Offset Area	284
Hillcrest Offset Area	1,402

Offset Area	Minimum Size (hectares)
Clifton Offset Area	107
Stewart Offset Area	165

2.2.6 Weeds and Pests

Weed management will be undertaken in accordance with the *Biodiversity Management Plan* and may include:

- Regular inspections of Ravensworth Operations' lands to identify areas requiring management;
- Consultation with neighbouring land owners and the relevant government stakeholders;
- Implementation of weed management measures (in consultation with suitably qualified experts) which may include hand removal, mechanical removal and application of approved herbicides (when conditions are favourable);
- Identification of weed infestations during pre-clearance surveys;
- Follow-up inspections to assess the effectiveness of the weed management measures;
- Control of access to the site;
- Management of weeds in cleared areas such as powerline easements, pipeline easements and drainage lines;
- Ensure that equipment introduced to the site is cleaned to remove plant residues; and
- Use of chemical sprays to control weed infestations.

The *Cumnock Rehabilitation Remediation Plan* recommends the following strategies to control the presence of exotic grasses, weeds and other invasive species within the Cumnock rehabilitation areas:

- Small scale herbicide application;
- Mechanical removal of grasses;
- Regular slashing or mowing; and
- Introduction of cattle grazing.

The *Biodiversity Management Plan* also outlines the following key weed management techniques for ROPL's offset areas:

- Weed management controls implemented at the Ravensworth Complex are also applicable to offset areas;
- Emerging threatening weeds to be targeted by control programs;
- Monitoring and inspections to assess the effectiveness of the weed control program and to ascertain the requirement for further work; and
- Ongoing consultation with the relevant authorities regarding weed listings, weed occurrence and management technologies.

The management strategy for feral animals involves a monitoring and trapping/baiting program. The program is carried out by experienced consultants and adhered to all best practise guidelines set by BCD and the Livestock Health and Pest Authority. Control methods include the use of 1080 baiting, and soft jaw leg-hold trapping to target wild dogs, boars and foxes.

Weed and pest control activities at Ravensworth Operations are reported in Annual Reviews.

2.2.7 Blasting

Monitoring and management of blasting is completed in accordance with the *Ravensworth Complex Blast Management Plan*. Ravensworth Operations utilises a real time Blast Monitoring System. After each blast, the Drill and Blast Engineers and the Environment & Community Department review the monitoring results and initiate corrective action if excessive overpressure or ground vibration results are recorded.

Blasting operations at Ravensworth Operations will be undertaken during the MOP period.

Blasting operations within 500 metres of AGL Macquarie's land or other mining operations are conducted in accordance with protocols developed in consultation with those asset owners.

Schedule 3, Conditions 10 to 17 of PA 09_0176 (***Appendix A***) and EPL 2652 outline the blasting requirements applicable to Ravensworth Operations. Blasting activities at Ravensworth Operations are reported in its Annual Reviews.

2.2.8 Noise

Noise monitoring at Ravensworth Operations is undertaken in accordance with the approved *Ravensworth Complex Noise Management Plan*, which has been prepared in accordance with PA 09_0176. Noise control procedures used at the site include:

- Mining equipment is maintained to high standards to ensure high availability and to meet noise emission criteria;
- Noise monitoring is undertaken;
- All new equipment is procured to manufacturers noise specifications; and
- Enclosing the RCHPP and conveyors in buildings and protective structures to contain noise generated.

Refer to the *Ravensworth Complex Noise Management Plan* for information regarding noise management, controls, and monitoring. Monitoring results are documented in the Ravensworth Operations Annual Review. There are several conditions in PA 09_0176 and EPL 2652 relating to noise management.

2.2.9 Visual and Lighting

The visually prominent features of Ravensworth Operations operation continues to be the OEAs, with the majority of mining activities being concealed within the open cut mining pit. The OEAs will become increasingly visible over the MOP period as they are built up above the surrounding landscape. The Ravensworth Operations design has considered potential visual impacts on surrounding areas including the distance to potentially affected areas and shielding provided by natural topographic features and the landforms associated with approved rehabilitated mining areas.

Lighting impacts are managed in accordance with Glencore and site based documentation. Key strategies implemented at Ravensworth Operations to minimise offsite visual and lighting impacts include:

- Placement of the eastern out-of-pit OEA, so that the OEAs will act as a topographic shield for areas to the east, once rehabilitated;
- Positioning of infrastructure areas to maximise, to the extent practicable, shielding from natural topographical features;
- Landform design and maximisation of progressive rehabilitation to limit impacts on natural topography of the site;
- Additional screening plantings will be utilised in strategically located positions to augment existing plantings and limit views into the operations.
- External fixed lights which do not shine above the horizontal;
- Light shields to direct light on fixed lights;
- Communication (via toolbox talks, crew talks and the site familiarisation) of potential impacts of lighting to operators of mobile plant;
- Inspections throughout the night shifts;
- Ensuring that all external lighting associated with the operations complies with *Australian Standard AS4282 (INT) 1995 – Control of Obtrusive Effects of Outdoor Lighting*; and
- Colouring all buildings potentially visible to the public have been coloured in suitable natural tones.

2.2.10 Heritage

Aboriginal Heritage

Aboriginal Cultural Heritage is managed in accordance with the approved *Ravensworth Complex Aboriginal Cultural Heritage Management Plan* (ACHMP). The ACHMP has been developed to address the management of Aboriginal cultural heritage sites across the Ravensworth Complex, and to ensure compliance with statutory requirements.

Ravensworth Operations have sought to avoid and minimise potential impacts on the significant archaeological values of the site throughout the project planning process. This has included the avoidance of direct impacts on Davis Creek which contains identified grinding grooves, which has been identified as an archaeological feature of high cultural and archaeological significance. In addition, Ravensworth Operations has sought to minimise potential indirect impacts on this site through the management of potential blasting impacts, and the design of the comprehensive water management system. Ravensworth Operations proposes to undertake salvage programs at any sites that will be directly impacted by mining operations in accordance with procedures developed in consultation with the Aboriginal community and Heritage NSW.

Ravensworth Operations has committed to a comprehensive mitigation strategy that will provide for the long term management of Aboriginal heritage sites identified on site, but located outside of proposed disturbance areas, and the long term conservation of identified sites within the Ravensworth North Offset Area. The ongoing management and conservation strategies for these sites are detailed further in the ACHMP.

Historic Heritage

Historic heritage is managed in accordance with the approved *Ravensworth Complex Heritage Management Plan*.

A Historical Heritage Assessment was completed as part of the 2010 EA. The identified and potential heritage components of the site are of low local significance with no to low research potential. The listed historic heritage items within and surrounding the project area are of relatively higher significance as reflected by their listing on relevant registers/databases. Ravensworth Operations will implement the following historical heritage management measures associated with continued operations including managing blasting practices to meet relevant blast impact assessment criteria at listed heritage sites/items within the vicinity of the site.

In the event that unexpected archaeological remains or potential heritage items are discovered during the MOP period, all works in the immediate area will cease, the remains and potential impacts will be assessed by a qualified archaeologist or heritage consultant and if necessary, Heritage NSW and DPIE will be notified in accordance with the *Heritage Act 1977.*

2.2.11 Bushfire

A Bushfire Broad Brush Risk Assessment (BFBBRA) is scheduled for completion in 2020. The BFBBRA will be conducted in consultation with representatives from the surrounding community, Rural Fire Service, Singleton Council and Ravensworth Operations.

Slashing of grasses is conducted on a regular basis where cattle grazing cannot be utilised. Slashing of grasses is undertaken in areas such as road reserves, infrastructure areas and sensitive and high risk growth areas to reduce excessive fuels such as weeds and grasses.

Ravensworth Operations have large fully equipped water carts on site to respond to any bushfire emergencies, with appropriate personnel trained in the proper use of this equipment. There is a register of chemicals contained on site. All flammable materials are stored in accordance with the relevant guidelines. The key mitigation measures for managing bushfire risk at Ravensworth Operations include:

- Mechanical removal of fuel sources by mowing and slashing;
- Maintenance of fire breaks;
- Maintenance of firefighting equipment; and
- Restriction of ignition sources.

The *Biodiversity Management Plan* outlines bushfire management of ecological features, including the offset areas. Controls include:

- Exclusion of bushfire from rehabilitation, revegetation and regeneration areas to allow replanted and regenerating communities to mature to a stage where they are able to withstand bushfire and regenerate naturally following such an event (nominally at least 15 years, but dependent on the success of plant establishment and the vegetation community present);
- Consideration of known records of threatened species, endangered populations and Threatened Ecological Communities;
- Asset and livestock protection; and
- Appropriate incorporation of all relevant ecological requirements into the Bushfire Management Plan.

2.2.12 Other Issues and Risks

Additional information relating to the management of operations is addressed in detail in the Ravensworth Operations EMPs, which have been developed in consultation with relevant government agencies and interested parties and are approved in accordance with the Ravensworth Operations Project Approval (PA 09_0176). Other risks that have been identified include:

Topsoil Management

To minimise the risk that rehabilitation will not meet external expectations, the following topsoil management measures will be implemented:

- Prior to clearing, topsoil and subsoil materials will be characterised to assess potential constraints/opportunities for use in rehabilitation;
- Where practicable, measures will be adopted to maintain the viability of any biological resources within the topsoil that may be suitable for use in rehabilitation (e.g. soil seed bank);
- Preference will be given to placing topsoil directly on re-contoured areas. Where possible, topsoil will be stripped when moist to help maintain soil structure and to reduce dust generation;
- Topsoil stockpiles are to be located away from mining, traffic areas and watercourses;
- Appropriate sediment controls will be installed to prevent soil loss;
- Topsoil stockpiles to be kept longer than six months will be sown with a suitable cover crop to minimise soil erosion and invasion of weed species;
- Prior to re-spreading, weed growth will be scalped from the top of the stockpiles to minimise the transport of weeds into rehabilitated areas;
- Any topsoil stockpiles with evidence of any weed growth will be treated prior to use in rehabilitation; and
- Stockpiles will be appropriately identified.

Material Characterisation

The *Biodiversity Management Plan* outlines the requirement to complete material and soil characterisation. Material and soil characterisation will be undertaken at an appropriate scale across the site, prior to clearing activities or the re-handling of topsoil that has been stored on site for a period of 2 years or more. Representative samples will be taken to characterise the nature of the soil material.

There are no known acid mine drainage issues at Ravensworth Operations. Therefore this aspect is not a major consideration in relation to rehabilitation on site during the MOP period. Controls to be put in place should there be an acid mine drainage issue are outlined in ***Section 2.3.4***.

2.3 Issues Which May Affect Rehabilitation

2.3.1 Final Landform Design

The following controls will be implemented to ensure that stable final landforms are achieved at ROPL are:

- Surface water management (refer to **Section 2.2.3**);
- Drainage design in accordance with the Blue Book;
- Engineering and erosion stability assessment input into final landform design;
- Rehabilitation inspections and monitoring; and
- Slope and rehabilitation design (natural landform) at ROPL.

The final landform at Ravensworth North will be progressively developed through the life of mine. Micro-relief features will be developed in all parts of the final landform above natural ground level. The process of designing micro-relief landform features and incorporating them into the rehabilitated landform is closely linked to the detailed mine planning process. Due to the need to develop the micro-relief features around discrete catchment areas, the detailed design and incorporation of the micro-relief features in the landform is heavily dependent upon mine development.

The actual elevation and size of overburden emplacements can alter in practice due to variables such as:

- Overburden swell factor;
- Changes to detailed mine plan sequencing due to market requirements;
- The performance of different plant and equipment; and
- Operational constraints from weather conditions.

The successful implementation of micro-relief in rehabilitated landforms is best achieved by developing the detailed design of the micro-relief features progressively as part of the detailed mine planning process undertaken for each mining sequence. It is important to incorporate the conceptual final landform designs into the bulk overburden emplacement designs to ensure sustainable final design outcomes can be achieved. The final landform will include a drainage pattern capable of conveying runoff from the newly created areas whilst minimising the risk of erosion and sedimentation. Elements such as drainage paths, contour drains, ridgelines, and emplacements will be shaped, where possible, in undulating informal profiles in keeping with natural landforms of the surrounding environment.

2.3.2 Geology and Geochemistry

The resource coal targeted for extraction at Ravensworth Operations includes seams of the Foybrook and Burnamwood Formations, which form part of the Wittingham Coal Measures. The coal seams targeted extend from the shallow Broonie Seams, through the Bayswater, Lemington, Pikes Gully, Arties, Liddell and Barrett Seams, to the Hebden Seam. The strata dips gently (<5 degrees) to the south-east within the mine towards the Bayswater Syncline and flattens to the south-west around the Ravensworth North monocline. A thin igneous dyke runs through the pit area on a north-easterly orientation and intersects a small volcanic plug in the north of the pit area. This volcanic breccia has been well defined by drilling.

Spoil material is regularly tested to determine the quality of material for rehabilitation. Recent soil testing on spoil material from Ravensworth indicates the following:

- Spoil material tested was alkaline, highly saline and strongly sodic;
- The effective cation exchange capacity (eCEC) is moderate, indicating good nutrient retention and holding capacity;
- Certain soils are dispersible due to their sodicity and magnicity and should be managed accordingly;
- Phosphorus levels are suited to P sensitive plantings, including Australian natives; and
- Where required, Gypsum will be applied to assist in balancing the cations and preventing dispersion.

2.3.3 Material Prone to Spontaneous Combustion

Ravensworth Operations operates in accordance with a *Spontaneous Combustion Principal Mining Hazard Management Plan* which outlines the process for the placement of carbonaceous materials to ensure that the potential for spontaneous combustion to occur is minimised. The plan identifies potential sources of carbonaceous material and details methods to be used when handling and disposing of carbonaceous materials. A specific training module has been developed to communicate the requirements of this procedure to appropriate personnel.

Incidences of spontaneous combustion could potentially occur during stockpiling ROM coal. The principal method used to control spontaneous combustion is to ensure that stockpiled coal is transferred to the crusher as soon as possible. If coal cannot be transferred due to delays in schedules and the stockpile begins to generate heat with time, then coal in the stockpile will be spread out to allow the heat to dissipate as required. The height of the stockpile is kept as low as possible to enable access and treatment of coal. In the event that stockpiled coal is ignited or smouldering, the stockpiles are typically spread out in layers approximately 300mm thick, doused with water to extinguish the fire and compacted. The treated coal is then prioritised through the coal crushing process. Daily inspections are conducted to observe stockpile conditions and spontaneous combustion outbreaks.

Historically spontaneous combustion at Ravensworth Operations is isolated to old dragline waste emplacement areas and ROM stockpiles. This is currently managed by the *Spontaneous Combustion Principal Mining Hazard Management Plan*, which includes:

- Inspections;
- Selective placement of carbonaceous/ inert materials;
- Monitoring;

- Thermography;
- Training; and
- Treatment plans (including Trigger Action Response Plans (TARPs)).

Ravensworth Operations currently utilises truck and shovel methods, that enables greater control to limit potential for spontaneous combustion.

2.3.4 Material Prone to Acid Mine Drainage

There are no known Acid Mine Drainage (AMD) issues at Ravensworth Operations. Therefore, this aspect is not a major consideration in relation to rehabilitation on site during the MOP period.

Testing has been conducted on exploration samples to determine propensity for AMD generation, across the site. No evidence of AMD has been found to date.

In the event that AMD is identified on site, mitigation measures will be implemented and may include selective dumping, monitoring and recording.

2.3.5 Mine Subsidence

Some surface areas are potentially affected by subsidence from the previous Cumnock underground mining and RUM underground mining. Much of the areas which are affected by subsidence are heavily disturbed areas which are still used for active mining.

The management of mine subsidence is outlined in the RUM Care and Maintenance MOP.

2.3.6 Erosion and Sediment Control

Management of erosion and sediment at Ravensworth Operations will be undertaken in accordance with the approved *Erosion Sediment Control Plan* (forms part of the *Ravensworth Complex Water Management Plan*.

Main risks associated with erosion and sediment control is pollution of waters and impacts and degradation on rehabilitation areas.

The main operational erosion and sediment controls used by Ravensworth Operations in rehabilitation areas include:

- Clean water diversion drains and banks;
- Catch drains;
- Sediment fences and other temporary controls;
- Sediment dams;
- Inspections;
- Monitoring; and
- Training.

The conceptual final landform for Ravensworth Operations has been designed to blend into the surrounding environment. These landforms offer a diversity of habitat that can enhance the value of rehabilitated ecological systems. All final landform design will be reported in the Annual Review. The OMCP has been updated to provide additional details regarding landform design.

Erosion in rehabilitation areas is reviewed as part of regular inspections and as a component of the rehabilitation monitoring programs. ***Section 7.1*** outlines rehabilitation monitoring in additional detail.

The final landform after the rehabilitation of the area will include a drainage pattern capable of conveying runoff from the newly created areas whilst minimising the risk of erosion and sedimentation. Erosion and sediment control structures will be reviewed as part of the annual rehabilitation inspection, and any management actions required will be implemented as soon as practicable.

2.3.7 Topsoil Stripping and Management

The *Ravensworth North Topsoil Stripping Management Plan* has been developed to manage topsoil stripping activities at Ravensworth North. This involved the completion of an initial desktop assessment and subsequent field assessment of the available soil materials at Ravensworth North. The investigations found that the topsoil resources within the approved disturbance area are generally suitable for stripping and reuse as topdressing during rehabilitation of the mine.

The total volume of soil available for stripping within the Ravensworth North disturbance area is estimated at approximately 1,874,000 m^3. Allowing for 10% volume loss, the total volume of soil available for use as topdressing is approximately 1,686,000 m^3. This identified that there is likely be an initial deficit of topsoil materials for topdressing of rehabilitation areas to the recommended depth of 100 – 200 mm. To mitigate this potential deficit, Ravensworth Operations has adopted the practice of salvaging and treating certain subsoils for reuse in rehabilitation. The volume of suitable subsoil and topsoil at Ravensworth North has been estimated at 2,777,000 m^3. Allowing for 10% volume loss, the total volume of soils available for use as topdressing is approximately 2,499,000 m^3.

Additional soil materials may be salvaged from the Ravensworth West rehabilitation areas that will be re-disturbed for mining. Depths of soil materials will be assessed for the Ravensworth West rehabilitation area and near Emu Creek.

Based on a topdressing depth of 200 mm across all rehabilitation areas, it is anticipated that a small deficit in materials may occur. However, any shortage of suitable materials will continue to be managed through the control of topdressing depths and soil substitution through the appropriate use of other suitable organic mediums.

2.3.8 Rehabilitation of Exploration Disturbance

Ravensworth Operations has developed procedures for the management of exploration activities so that they are conducted in an environmentally responsible manner and with due consideration to the community. Ravensworth Operations will be responsible for the final rehabilitation of any exploration sites.

At the completion of the exploration, the following will be completed:

- Capping and backfilling of boreholes outside the mining footprint in accordance with *Exploration Code of Practice: Rehabilitation* (DPIE-DRG, 2017);
- Rehabilitation of disturbance areas in accordance with the MOP;
- Access roads are to be rehabilitated so that they do not alter the natural path of overland flow;
- Disturbed areas surrounding the drill sites will be returned to the same topography as that immediately preceding drilling;

- Any vegetation removed as part of site and access track clearing requirements will be used in site rehabilitation works;
- Stripped topsoil stockpiled as part of site preparations will be replaced; and
- Erosion and sediment control devices will be maintained and remain in place until the drill sites and associated tracks are completely rehabilitated.

2.3.9 Construction

Construction activities proposed during the MOP period will be limited to the minor works outlined in ***Section 1.8.2***.

The primary objective relating to the rehabilitation of construction areas is to stabilise all batters, road verges, drains, banks, and cleared areas through revegetation. Temporary rehabilitation works are scheduled to commence as soon as practicable following disturbance. Disturbance of native vegetation will be kept to a minimum and clearing will be constrained to the footprint area of the infrastructure.

Prior to the re-establishment of vegetation cover, temporary control measures will be utilised for erosion and sediment control. These measures may include the use of sediment fences, sand bags, rip rap, or any combination of those materials. Other procedures implemented may include restricted access during wet weather or to areas under rehabilitation, reporting of erosion and sediment hazards or incidents and regular checking and maintenance of structures.

All clearing associated with construction will be completed within the Project Approval area. All disturbance activities will be assessed prior to commencement through implementation of the *Ground Disturbance Permit Procedure.* The assessment requires completion of a permit, approved by the Environment and Community Manager (or delegate).

2.3.10 Mineral Processing Residues and Tailings

During the MOP period, coarse rejects from the RCHPP will be transported for disposal at the approved reject emplacement areas, and tailings will be pumped to the approved tailings emplacement facilities.

The GRAWTS pipeline was completed in 2018. This pipeline facilitates the transfer of water and tailings between the Ravensworth Complex, the Mount Owen Complex and Liddell Operations. Once emplacement of tailings is completed in Cumnock Void 3, tailings from the RCHPP will be transferred to West Pit Void at Ravensworth East (within the Mount Owen Complex). Mt Owen Pty Limited will be responsible for management of the West Pit Void.

Decommissioning of tailings storage facilities will be completed in accordance with high risk activity (HRA) notifications under the *Work Health and Safety (Mines and Petroleum Sites) Regulation 2014* and Glencore's *Tailings Storage Facilities Protocol* (GCAA-625378177-15551). Current tailings management is undertaken in accordance with the *ROC Life of Mine Tailings Storage Strategy*. A Final Tailings Dam Management Plan will be completed at least five years before mine closure which will include a risk assessment conducted by an experienced geotechnical engineer.

Once the proposed tailings and reject emplacement areas can safely support earthmoving equipment, they will be rehabilitated and covered with a minimum of two metres of overburden. This overburden will be contoured (for water management), spread with topsoil, ripped, seeded, and will be geotechnically stable against floods, erosion and subsidence. The RCHPP manages the disposal of tailings and reject material and are planning on using the following tailings emplacement facilities during the MOP period:

- Cumnock Wash Plant Pit and Stage 3 Voids – these pits are being used as tailings facilities, until they are filled during the MOP period. HVO JV currently deposits tailings in Cumnock Stage 3 void in accordance with the Joint TSF Agreement and has approximately 1,594,382 m^3 of total available volume; and
- Transfer of tailings to West Pit Void (at Mount Owen Complex) as part of the GRAWTS. This is the first stage of fully integrated life of mine tailings management strategy across three Glencore coal mining operations. Tailings will be pumped to the West pit at Ravensworth East from approximately 2017 until 2021 at approximately 2.4 Mt per annum, in accordance with Modification 3 of PA 09_0176.

Table 2-3 outlines the tailings test results from the *Life of Mine Tailings Strategy* (ATC Williams, 2012).

The aim of the *Life of Mine Tailings Strategy* includes:

1. Deposition of tailings with pipe head flocculation (also known as secondary flocculation);
2. Controlled placement of tailings to provide an initial thick crust; and
    a. Stage 1: Continuous filling
    b. Stage 2: Controlled filling
3. Placed capping layers.

To facilitate rehabilitation requirements, the filling of each storage will be completed in two stages:

Stage 1:

Continuous filling of tailings to a level that is generally 3.5 to 4.0 m below the full supply level of the storage. Filling will then be diverted to the next storage in the sequence (apart from ongoing placement of Stage 2 tailings, as discussed below).

Stage 2:

This stage of filling is planned to be controlled, such that the rate of rise is limited to 1.0 m/year, to comply with the requirements for capping by controlled placement of tailings.

During the active deposition of tailings, material will continue to be tested for physical and chemical characteristics.

Table 2-3 – Tailings Test Results

Test	Unit	Sample Seam		
		Upper Liddell	Lower Lemington 12	RN17(ULM1-6
Soil Particle Density (G):		1.71	1.95	1.88
Particle Size Distribution:	-75πm% -2πm%	81 15.18	75 7.48	85 17.54
Plasticity:	Liquid Limit Plasticity Index	32 25	Non Plastic	35 23
Initial Undrained Settled Density:	g/ m^3	-	1.185-1.200	-
Initial Drained Settled Density:	g/ m^3	-	1.250-1.275	-

Test	Unit	Sample Seam		
		Upper Liddell	Lower Lemington 12	RN17(ULM1-6
Shrinkage Limit Density:	water content %	-	28-43%	-

3. Post Mining Land Use

3.1 Regulatory Requirements

Mining consents and leases are listed in ***Table 1-1*** . Regulatory requirements for post mining land use and rehabilitation are listed below in ***Table 3-1*** .

Table 3-1 – Regulatory and Approval Requirements

<table>
<tr><th>Source</th><th>Requirement</th><th>Timing</th></tr>
<tr><td colspan="3">PA 09_0176</td></tr>
<tr><td>Schedule 2, Condition 5</td><td>Mining operations for the project may take place until 31 December 2039.</td><td>End of Mine Life</td></tr>
<tr><td>Schedule 3, Condition 30</td><td>The Proponent shall:
(c) reinstate Emu Creek generally in accordance with the concept design outlined in the EA (as depicted in the figure in Appendix 3.6) and minimising net loss of stream length, as soon as practicable following mining and rehabilitation in the applicable area, to the satisfaction of the Secretary;
(d) rehabilitate and revegetate the Bayswater Creek diversion to provide a hydraulically and geomorphically stable stream as soon as practicable following mining and rehabilitation in the applicable area, to the satisfaction of the Secretary; and
(e) submit as-executed reports to the Secretary and NOW, certified by a practising engineer, confirming that the reinstated/rehabilitated Emu Creek and Bayswater Creek are sufficiently hydraulically and geomorphologically stable, prior to commissioning the reinstated/rehabilitated creeks.</td><td>End of Mine Life</td></tr>
<tr><td>Schedule 3 Condition 32</td><td>The Proponent shall implement the biodiversity offset strategy as outlined in Table 16 and as generally described in the EA, to the satisfaction of the Secretary.
<table>
<tr><th>Area</th><th>Offset Type</th><th>Minimum Size (ha)</th></tr>
<tr><td>Ravensworth North Offset Area</td><td>Existing vegetation and vegetation to be established</td><td>284</td></tr>
<tr><td>Hillcrest Offset Area</td><td>Existing vegetation and vegetation to be established</td><td>1,402</td></tr>
<tr><td>Clifton Offset Area</td><td>Existing vegetation and vegetation to be established</td><td>107</td></tr>
<tr><td>Stewart Offset Area</td><td>Existing vegetation and vegetation to be established</td><td>165</td></tr>
<tr><td>Rehabilitation Area</td><td>Woodland vegetation to be established</td><td>1,767</td></tr>
<tr><td>Total</td><td></td><td>3,725</td></tr>
</table></td><td>Life of Mine</td></tr>
<tr><td>Schedule 3 Condition 35</td><td>Long Term Security of Offsets
The Proponent shall make suitable arrangements to provide appropriate long term security for the:</td><td>Life of Mine</td></tr>
</table>

	(a) Ravensworth North Offset Area and Hillcrest Offset Area, by the end of December 2011; (b) Clifton Offset Area and Stewart Offset Area, by the end of December 2013; and (c) woodland vegetation to be established in the Rehabilitation Area, at least 2 years prior to the completion of mining activities associated with the project, to the satisfaction of the Secretary.	
Schedule 3 Condition 40	*Rehabilitation Objectives* The Proponent shall: (a) carry out rehabilitation progressively, that is, as soon as reasonably practicable following disturbance; and (b) achieve the rehabilitation objectives in the EA and the MOD 2 EA (depicted conceptually in the figures in Appendix 7), and comply with the objectives in Table 17.	Life of Mine
Schedule 3 Condition 41	*Rehabilitation Management Plan* The Proponent shall prepare and implement a Rehabilitation Management Plan for the project to the satisfaction of the Secretary of DRE. This plan must: a) be prepared in consultation with the Department, OEH, EPA, DPI-Water, Council and the CCC, and be submitted to DRE for approval by the end of June 2011; b) be prepared in accordance with any relevant DRE guideline, and be consistent with the rehabilitation objectives in the EA and Table 17 above; c) build, to the maximum extent practicable, on the other management plans required under this approval; and d) address all aspects of rehabilitation and mine closure, including final land use assessment, rehabilitation objectives, domain objectives, completion criteria and rehabilitation monitoring, and include: • an evaluation of end land use options for final void/s; and • a life of mine tailings management strategy, including an environmental risk assessment demonstrating that the emplacements can be designed, managed and rehabilitated appropriately.	*This MOP.*
Statement of Commitments 6.4.2	A detailed mine closure plan will be developed for the Project and submitted to the Secretary for approval at least five years prior to anticipated mine closure, in accordance with Glencore standards for mine closure. The plan will be prepared in consultation with relevant stakeholders including the Department, I&I NSW, Singleton Council, other relevant government agencies as agreed with the Department, and the local community.	Within 5 years of closure
Statement of Commitments 6.4.3	The rehabilitation strategy for the Project will be integrated with the proposed Biodiversity Management Plan for the Project through creating extensive areas of woodland within rehabilitated areas associated with the Project that target the following vegetation communities: • Central Hunter Box-Ironbark Woodland; • Central Hunter Swamp Oak Forest; • Central Hunter Bulloak Forest Regeneration; and Grassland.	Life of Mine
Statement of Commitments 6.4.4	The Proponent will re-establish Emu Creek within the rehabilitated landscape. The reinstated Emu Creek will be designed in accordance with relevant guidelines and in consultation with the NSW Office of Water (NOW). The reinstated Emu Creek will be re-established within a suitable substrate within the rehabilitated landform and will resemble a natural creek system with native vegetation planted along the	End of Mine Life

	drainage channels as part of the rehabilitation, to maximise the long term stability of the drainage system and to enhance the in-stream and riparian habitat created. The detailed design of the proposed reinstatement of Emu Creek will be undertaken in accordance with all relevant approvals from NOW.	
Statement of Commitments 6.4.5	Recovery and management of any topsoil will be undertaken in accordance with the controls provided in Section 5.1.1.5 of the EA.	Life of Mine
Mining Leases		
CCL 723 CL 580 ML 1416 ML 1484 ML 1485 ML 1502 ML 1506 ML 1564 ML 1576 ML 1581 ML 1591 ML 1595	The Mining Operations Plan must present a schedule of proposed mine development for a period of up to seven (7) years and contain diagrams and documentation which identify:- b) mining and rehabilitation method(s) to be used and their sequence; e) progressive rehabilitation schedules; i) where the mine will cease extraction during the term of the Plan, a closure plan including final rehabilitation objectives/methods and post mining land use/vegetation	Requirement for the life of mine
CCL 723 CL 580 ML 1357 ML 1416 ML 1484 ML 1485 ML 1502 ML 1506	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.	End of Mine Life
CCL 723 CL 580 ML 1325 ML 1416 ML 1484 ML 1485 ML 1502 ML 1506 ML 1564 ML 1576 ML 1581 ML 1591 ML 1595 ML 1625 ML 1669 ML 1683	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 Minister 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.	If required
	If so directed by the Minister the registered holder shall rehabilitate to the satisfaction of the Minister and within such time as may be allowed by the Minister any lands within the subject area which may have been disturbed by the operations hereby authorised.	If required
	Disturbed land must be rehabilitated to a sustainable/agreed end land use to the satisfaction of the Secretary.	End of Mine Life
	The lease holder must comply with any direction given by the Director-General regarding the stabilisation and revegetation of any mine residues, tailings or overburden dumps situated on the lease area.	If required

ML 1564 ML 1576 ML 1581 ML 1591 ML 1595	Land must be rehabilitated to a stable and permanent form suitable for a subsequent land use acceptable to the Director-General and in accordance with the Mining Operations Plan so that: • There is no adverse environmental effect outside the disturbed area and that the land is properly drained and protected from soil erosion. • The state of the land is compatible with the surrounding land and land use requirements. • The landforms, soils, hydrology and flora require no greater maintenance than that in the surrounding land. • In cases where revegetation is required and native vegetation has been removed or damaged, the original species must be re-established with close reference to the flora survey included in the Mining Operations Plan. If the original vegetation was not native, any re-established vegetation must be appropriate to the area and at an acceptable density. • The land does not pose a threat to public safety.	Life of Mine
ML 1325	Subject to any specific condition of this authority providing for rehabilitation of any particular part of the subject area affected by mining or activities associated therewith, the lease holder shall: a) shape and revegetate to the satisfaction of the Minister, any part of the subject area that may , in the opinion of the Minister have been damaged or deleteriously affected by mining operations and ensure such areas are permanently stabilised	Life of Mine
CL 378 ML 1357	Subject to any specific condition of this lease providing for rehabilitation of any particular part of the subject area affected by mining or activities associated therewith, the registered holder shall; a) reinstate, level, regrass, reforest and contour to the satisfaction of the Minister, any part of the subject area that may, in the opinion of the Minister have been damaged or deleteriously affected by mining operations, and (b) fill in, seal or fence, to the satisfaction of the Minister, any excavation within the subject area,	End of Mine Life
CL 378 CCL 723 CCL 739 ML 1357 ML 1484 ML 1485 ML 1506 ML 1576 ML 1581 ML 1591 ML 1595 ML 1625 ML 1669 ML 1683	In the event of operations being conducted on the surface of any road, track or firetrail traversing the subject area or in the event of such operations causing damage to or interference with any such road, track or firetrail the lease holder, at his own expense, shall if directed to do so by the Minister provide to the satisfaction of the Minister an alternate road, track or firetrail in a position as required by the Minister and shall allow free and uninterrupted access along such alternate road, track or firetrail and, if required to do so by the Minister, the lease holder shall upon completion of operations rehabilitate the surface of the original road, track or firetrail to a condition satisfactory to the Minister.	Life of Mine
	Access tracks must be kept to a minimum and be positioned so that they do not cause any unnecessary damage to the land. Temporary access tracks must be ripped, topsoiled and revegetated as soon as possible after they are no longer required for mining operations. The design and construction of access tracks must be in accordance with specifications fixed by the Department of Infrastructure, Planning and Natural Resources.	

3.2 Post Mining Land Use and Landscape Goals

The final land use at Ravensworth Operations will be predominantly returned to a woodland ecological community, interspersed with pasture which is to be consistent with PA 09_0176. The post mining land use and landscape goals for Ravensworth Operations are:

- Create a stable final landform with acceptable post mining land capability and agricultural suitability;
- Provide for the safety of employees and the public during and following the closure of the mining operations;
- Minimise the potential for long-term environmental impact and liability;
- 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;
- Reduce the need for long term monitoring and maintenance by achieving effective rehabilitation;
- Complete the closure, decommissioning and rehabilitation works as quickly and cost effectively as possible whilst achieving the objectives outlined above;
- Ensure that the rehabilitated post-closure landform, including remaining structures will be physically and chemically stable and will not present a hazard to public health and safety;
- Rehabilitation of disturbed areas to, provide a sustainable plant cover;
- Implement appropriate control and remediation strategies in the event that contamination sources are identified, to prevent off-site impacts;
- Where infrastructure is to remain following closure, the area will be safe and not pose an environmental or safety risk; and
- Ensure that the design periods and factors of safety for all site works take into account extreme events and other natural processes such as erosion.

A conceptual final rehabilitation plan which details land use is shown on ***MOP Plan 4***.

3.3 Rehabilitation Objectives

Rehabilitation objectives are outlined in Schedule 3, Condition 40 of PA 09_0176 and summarised in ***Table 3-2*** below.

Table 3-2 – Regulatory and Approval Requirements

Feature	Objective
Mine Site (as a whole)	• 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 incorporate micro-relief; o be free draining (with the exception of the final void); and o avoid straight run drainage drop structures, as far as practical.
Final void	• Designed as a long term groundwater sink and to maximise groundwater flows across back-filled pits to the final void. • Minimise: o the size and depth of final void; o the drainage catchment of final void; and

Feature	Objective
	○ any high wall instability risk
Revegetation	• Restore self-sustaining ecosystems, including establishing at least 1,767 ha of woodland vegetation in accordance with the biodiversity offset strategy in this approval.
Surface infrastructure	• To be decommissioned and removed, unless DRE agrees otherwise.
Community	• Ensure public safety. • Minimise the adverse socio-economic effects associated with mine closure.

Other rehabilitation objectives for Ravensworth Operations are to:

- Re-establish those vegetation communities and fauna habitats currently occurring across the Project Approval area and connect as far as reasonably practical, the habitat areas to the north and south of the disturbance areas with a vegetated corridor. Local indigenous species will be used in the revegetation of woodland areas, which will be linked with existing vegetated areas to improve ecological function and provide habitat.
- Establish areas for sustainable grazing purposes, commensurate with adjacent land use types in the south-east of Ravensworth Operations.
- Establish and protect Biodiversity Offset Areas, including the Ravensworth North Offset Area (284 hectares) and Hillcrest Offset Area (1,402 hectares).
- In recognition of the importance of vegetation corridors to regional biodiversity, the Project has been designed to link rehabilitation areas to the proposed Ravensworth North Offset Area within the northern extent of Ravensworth Operations and to existing remnant vegetation to the south. Existing native vegetation within the offset area will be retained and augmented to provide habitat for a number of threatened species within the area.

The progressive rehabilitation strategy will be designed to meet the above land use goals and objectives. However, in recognition of the operational life of the Project (planned closure 2034), the potential for other sustainable and economically productive post-closure land uses will continue to be investigated in light of the local and regional government land uses strategies that may have further evolved towards the end of the mine life. This process will be undertaken as part of the Glencore detailed mine closure process in consultation with the relevant government and community stakeholders. The post mining land use objectives are described in further detail in the OMCP, with a Detailed Mine Closure Plan to be prepared at least five years prior to closure.

The post mining land use goals and objectives for Ravensworth Operations will be achieved through successful implementation of the completion criteria for each domain detailed further in ***Section 5***.

MOP Plan 4 outlines the proposed final landform at Ravensworth Operations. Rehabilitated surfaces will consist of a mix of pasture and woodland rehabilitation.

Rehabilitation and closure objectives are outlined in ***Section 4.2***. Specific objectives have been developed for each of the primary and secondary domains. Additional detail regarding rehabilitation and closure phases are provided in ***Section 5***.

4. Rehabilitation Planning and Management

4.1 Domain Selection

Primary domains can be defined as land management units within the mine site, usually with unique operational and functional purpose and therefore similar geophysical characteristics. Primary domains outline current land use during the MOP period.

Secondary domains are land management units characterised by a similar post mining land use objective. Secondary domains define the final land use at mine closure.

It is likely that most domains will require a different rehabilitation methodology to achieve the intended post mining land use. Domains for Ravensworth Operations have been determined in consideration of the specific requirements of the mining location and local environment. The Ravensworth Operations area have been divided up into five primary domains and five secondary domains. These are shown in ***MOP Plans 3A – 3C***. Domains cover areas that have a similar rehabilitation outcome and closure criteria. The proposed post mining land use for each domain is provided in ***Table 4-1*** .

Detailed rehabilitation closure criteria have been developed for Ravensworth Operations.

Table 4-1 – Ravensworth Operations Domain Table

Primary Domain	Code	Secondary Domain	Code
Infrastructure (Mining and RCHPP)	1	Final Void	A
Tailings Storage Area	2	Water Management Area	B
Water Management Area	3	Rehabilitation Area – Pasture	C
Overburden Emplacement	4	Rehabilitation Area – Woodland	D
Active Mining	5	Infrastructure	E
Ravensworth North Offset Areas	6		

MOP Plan 2 outlines mine domains at MOP commencement.

4.2 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.

Rehabilitation objectives for each domain, and the relevant regulatory and approval requirements, are listed in ***Table 4-2*** .

Table 4-2 – Domain Rehabilitation Objectives

Domain	Rehabilitation Objectives
Primary Domains	
Domain 1 Infrastructure	All infrastructure that is not required post-closure is removed. Removal of all hazardous materials and contaminated materials. Landform generally blends in with surrounding landscape and is stable. Class V – Nature Conservation. Native ecosystems established consistent with analogue vegetation communities. Ecosystem health. Ecosystem structure. Ecosystem composition. Stable landform that is non - polluting.
Domain 2 Tailings Storage Area	All hazardous materials and contaminated materials are removed. All tailings infrastructure removed with tailings emplacement facilities filled, capped and rehabilitated. Landform generally blends in with surrounding landscape and is stable. Class V – Nature Conservation. Native ecosystems established consistent with analogue vegetation communities. Ecosystem health. Ecosystem structure. Ecosystem composition.
Domain 3 Water Management Area	All hazardous materials and contaminated materials are removed. Water quality non-polluting and appropriate for conservation end land use. Water quality leaving site to be in accordance with the EPL water quality criteria. Creek diversions completed in accordance with Diversion Management Plan.
Domain 4 Overburden Emplacement	All hazardous materials and contaminated materials are removed. Landform generally blends in with surrounding landscape and is stable. Class V – Nature Conservation. Native ecosystems established consistent with analogue vegetation communities. Ecosystem health. Ecosystem structure. Ecosystem composition.

Domain	Rehabilitation Objectives
Domain 5 Active Mining	All hazardous materials and contaminated materials removed. Landform generally blends in with surrounding landscape and is stable. Class V – Nature Conservation. Native ecosystems established consistent with analogue vegetation communities. Ecosystem health. Ecosystem structure. Ecosystem composition.
Domain 6 Ravensworth North Offset Areas	Native ecosystems maintained. Class V – Nature Conservation. Ecosystem health. Ecosystem structure. Ecosystem composition.
Secondary Domains	
Domain A - Final Void	The final landform will be designed to minimise the size and depth of the final void. The final landform will minimise the surface catchment draining towards the final void. The final void will be designed to minimise wall instability risk. The final void will be constructed as a long term groundwater sink and will maximise groundwater flows across backfilled pits to the final void Risk of acid rock drainage is minimised. Landform generally blends in with surrounding landscape and is stable. Filling with overburden and rehabilitation of this area consistent with Plan 4. The final land use of the Final Void for Ravensworth has not yet been determined.
Domain B - Water Management Area	All hazardous materials and contaminated materials are removed. Landform generally blends in with surrounding landscape and is stable. Water quality non-polluting and appropriate for conservation end land use. Water quality leaving site to be in accordance with the EPL water quality criteria.
Domain C – Rehabilitation Area – Pasture	All hazardous materials and contaminated materials are removed. Landform generally blends in with surrounding landscape and is stable. Class VI – Low intensity grazing. Grassland vegetation.
Domain D - Rehabilitation Area – Woodland	All hazardous materials and contaminated materials are removed. Landform generally blends in with surrounding landscape and is stable. Class V – Nature Conservation. Native ecosystems established consistent with analogue vegetation communities. Ecosystem health.

Domain	Rehabilitation Objectives
	Ecosystem structure. Ecosystem composition.
Domain E - Infrastructure	All infrastructure that is not required post closure is removed. All hazardous materials and contaminated materials removed. Stable landform that is non-polluting.

4.3 Rehabilitation Phases

The ultimate rehabilitation and closure objective for Ravensworth Operations is to create stable, non-polluting post mining landforms that allow the achievement of the post mining land use. This will be achieved through a series of conceptual stages which are described as:

- Stage 1: Decommissioning – removal of on-site infrastructure such as hard stand areas, buildings, contaminated materials, hazardous materials;
- Stage 2: Landform Establishment – incorporates gradient, slope, aspect, drainage, substrate material characterisation and morphology;
- Stage 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;
- Stage 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;
- Stage 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
- Stage 6: Land Relinquishment - lands that have met the required mine rehabilitation and closure requirements for lease relinquishment.

Rehabilitation phases within the MOP period are outlined in ***MOP Plans 3A to 3C.*** No rehabilitation at Ravensworth Operations is planned to be relinquished during the MOP period. There will be rehabilitation areas within phases of decommissioning, landform establishment, growth medium development, ecosystem establishment and ecosystem development throughout the MOP period.

There will be large areas of overburden emplacement areas that will be under the growth medium development phase at the end of the MOP period (***MOP Plan 3C***). Rehabilitation that will be classified as under the growth medium development phase will be a mix of pasture and rehabilitation.

4.4 Performance Criteria, Measures and Indicators

The completion criteria, measures and associated indicators have been developed in accordance with the relevant Ravensworth Operations approvals. 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 quantitatively 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, 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 a 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 performance measures and associated indicators have been designed to provide an appropriate benchmark or guide against which to assess the management of project lands and the resulting improvements. The performance measures and indicators in this MOP are designed to form the basis of the Performance Criteria and provide the ability to track the development of sustainable ecosystems through a series of conceptual stages which are presented in ***Section 5***.

5. Rehabilitation Tables

Where there is duplication between primary and secondary domains (eg. water management and infrastructure), referencing between the two domain types has been used. Using this approach has reduced the unnecessary repetition between the primary and secondary domains and streamlined this section.

Table 5-1 – Rehabilitation Table – Decommissioning Phase

Domain Objective	Indicator	Performance Measure	Completion Criteria	Justification / Source	Complete (Yes/No)	Progress at start of MOP	Progress at end of MOP
Domain 1 – Infrastructure (Ravensworth Operations)							
Removal of all infrastructure not required at closure	Removal of infrastructure	All infrastructure removed	All buildings, fixed plant and other infrastructure that is not required as part of the post-closure land use will be demolished and removed from the site.	OMCP	No	Still used.	Still used.
	Removal of infrastructure	All infrastructure removed	Where infrastructure areas are decommissioned. The hardstand areas, roadways and car parks will be ripped up with the waste material (e.g. bitumen, concrete) being placed in the tailings/coarse reject emplacement areas or incorporated into the final void.	OMCP	No	Still used.	Still used.
	Removal of infrastructure	All infrastructure removed	All pumps and pipelines are drained, decommissioned and removed from site.	OMCP	No	Still used.	Still used.
	Removal of infrastructure	All infrastructure removed	Remove all petroleum, chemicals and explosive products from the site.	OMCP	No	Still used.	Still used.
	Removal of infrastructure	All infrastructure removed	Remove all mobile equipment from the sites, salvage and sell machinery/infrastructure to assist with closure costs.	OMCP	No	Still used.	Still used.

Domain Objective	Indicator	Performance Measure	Completion Criteria	Justification / Source	Complete (Yes/No)	Progress at start of MOP	Progress at end of MOP
Domain 2 – Tailings Storage Area							
No proposed decommissioning activities in tailings storage areas.							
Domain 3 – Water Management Area							
Water management at site to meet completion criteria	Removal of oily water	Removal of oily water treatment system	The removal of the oily water treatment system following the demolition of the workshop and associated facilities.	OMCP	No	Still used.	Still used.
	Removal of sediment	Removal of sediment on dams	Removal of excess sediment from the surface dams for future use by the subsequent land owner or alternatively filling the dams if they are no longer required.	OMCP	No	Still used.	Still used.
	Dam reshaping	Dam reshaping as required	Re-shaping dams (where required) in accordance with their intended use, this may involve re-sizing, facilitating cattle access or providing that they are shaped to enhance habitat functionality for specific fauna species.	OMCP	No	Still used.	Still used.
	Retained water management	Retained water management	Where dams are to be retained (possibly the Narama In Pit Storage Dam), ensure that drainage structures are designed to capture runoff from sufficient catchment area so that the dam can be utilised for its intended use.	OMCP	No	Still used.	Still used.
	Erosion and sediment controls installed	Erosion and sediment controls installed	The installation of appropriate sediment and erosion control measures.	OMCP	No	Still used.	Still used.
	Dewatering of the Narama Pit	Dewatering of the Narama Pit	The Narama Pit will be dewatered as required, with water transferred to other water storages.	New Criteria MOD 3 EA	No	Still used.	Still used.

Domain Objective	Indicator	Performance Measure	Completion Criteria	Justification / Source	Complete (Yes/No)	Progress at start of MOP	Progress at end of MOP
Domain 4 – Overburden Emplacement							
No proposed decommissioning activities in existing OEAs.							
Domain 5 – Active Mining Area							
Salvage of all possible topsoil/growing material	Topsoil/growing material salvage	Salvage of all possible Topsoil/growing material	All relevant information on topsoil characteristics and stripping details will be recorded for later use in determining use in future rehabilitation and for the interpretation of rehabilitation monitoring results. The target objective is to have topsoil that is stripped to be directly placed on rehabilitation. When this is not possible, place material on suitable stockpile location.	Biodiversity Management Plan	No	Operations Ongoing	Operations Ongoing
	Stockpile height	Stockpiles less than 3 metres high	Stockpiles will be generally less than 3 metres (m) high and will be set out in windrows to maximise surface exposure and biological activity.	Biodiversity Management Plan	No	Operations Ongoing	Operations Ongoing
	Stockpile storage	Less than 3 months of stockpile storage	Stockpiles to be kept longer than three months will be sown with a suitable cover crop to minimise soil erosion and invasion of weed species.	Biodiversity Management Plan	No	Operations Ongoing	Operations Ongoing
	Weed growth	Ensure soil material is weed free	To minimise the transport of weeds into rehabilitated areas any stockpiles that have evidence of significant weed growth will be treated prior to the use in rehabilitation.	Biodiversity Management Plan	No	Operations Ongoing	Operations Ongoing
Domain 6 – Offset Areas							
No proposed decommissioning activities in offset areas during the MOP period.							

Domain Objective	Indicator	Performance Measure	Completion Criteria	Justification / Source	Complete (Yes/No)	Progress at start of MOP	Progress at end of MOP
Domain A – Final Void							
The final void will not yet be formed during the MOP period.							
Domain B – Water Management Area							
Water Management as per Domain 1.							
Domain C – Rehabilitation Pasture							
Salvage of all possible topsoil/growing material	Topsoil/growing material salvage	Salvage of all possible topsoil/growing material	Some existing rehabilitation will be disturbed for overburden emplacement during the MOP period. All relevant information on topsoil characteristics and stripping details will be recorded for later use in determining use in future rehabilitation and for the interpretation of rehabilitation monitoring results.	Biodiversity Management Plan	No	Operations Ongoing	Operations Ongoing
	Stockpile height	Stockpiles less than 3 metres high	Stockpiles will be generally less than 3 metres (m) high and will be set out in windrows to maximise surface exposure and biological activity.	Biodiversity Management Plan	No	Operations Ongoing	Operations Ongoing
	Stockpile storage	Less than 3 months of stockpile storage	Stockpiles to be kept longer than three months will be sown with a suitable cover crop to minimise soil erosion and invasion of weed species.	Biodiversity Management Plan	No	Operations Ongoing	Operations Ongoing
	Weed growth	Ensure soil material is weed free	To minimise the transport of weeds into rehabilitated areas any stockpiles that have evidence of significant weed growth will be treated prior to the use in rehabilitation.	Biodiversity Management Plan	No	Operations Ongoing	Operations Ongoing

Domain Objective	Indicator	Performance Measure	Completion Criteria	Justification / Source	Complete (Yes/No)	Progress at start of MOP	Progress at end of MOP
	Removal of existing rehabilitation	Biodiversity Management Plan	Prior to the emplacement of overburden, the existing rehabilitation areas (mix of pasture and woodland) will be cleared, with the surface material stockpiled in accordance with the Biodiversity Management Plan.	Biodiversity Management Plan	No	Operations Ongoing	Operations Ongoing
Domain D - Woodland							
Salvage of all possible Topsoil/growing material	Topsoil/growing material salvage	Salvage of all possible Topsoil/growing material	Some existing rehabilitation will be disturbed for overburden emplacement during the MOP period. All relevant information on topsoil characteristics and stripping details will be recorded for later use in determining use in future rehabilitation and for the interpretation of rehabilitation monitoring results.	Biodiversity Management Plan	No	Operations Ongoing	Operations Ongoing
	Stockpile height	Stockpiles less than 3 metres high	Stockpiles will be generally less than 3 metres (m) high and will be set out in windrows to maximise surface exposure and biological activity.	Biodiversity Management Plan	No	Operations Ongoing	Operations Ongoing
	Stockpile storage	Less than 3 months of stockpile storage	Stockpiles to be kept longer than three months will be sown with a suitable cover crop to minimise soil erosion and invasion of weed species.	Biodiversity Management Plan	No	Operations Ongoing	Operations Ongoing
	Weed growth	Ensure soil material is weed free	To minimise the transport of weeds into rehabilitated areas any stockpiles that have evidence of significant weed growth will be treated prior to the use in rehabilitation.	Biodiversity Management Plan	No	Operations Ongoing	Operations Ongoing

Domain Objective	Indicator	Performance Measure	Completion Criteria	Justification / Source	Complete (Yes/No)	Progress at start of MOP	Progress at end of MOP
	Removal of existing rehabilitation	Biodiversity Management Plan.	In advance of the mining progression at Ravensworth North, the existing rehabilitation areas at Ravensworth West will be cleared, with the surface material stockpiled in accordance with the Biodiversity Management Plan.	Biodiversity Management Plan	No	Operations Ongoing	Operations Ongoing
Domain E – Infrastructure							
Infrastructure management as per Domain 2.							

Table 5-2 – Rehabilitation Table – Landform Establishment

Domain Objective	Indicator	Performance Measure	Completion Criteria	Justification / Source	Complete (Yes/No)	Progress at start of MOP	Progress at end of MOP
Domain 1 – Infrastructure (Ravensworth Operations)							
Reshaping of areas in accordance with the MOP following removal of infrastructure.	Deep Ripping	Annual Rehabilitation Inspection.	Where infrastructure is to be removed. The respread top-layer will be deep ripped on the contour to allow/assist bedding of the topdressing materials.	*Biodiversity Management Plan*	No	Operations ongoing.	Operations ongoing.
	Slopes	Schedule 3, Condition 40 of PA 09_0176	Where infrastructure is to be removed. To achieve the rehabilitation objectives, slopes are generally consistent with MOD 2 EA	OMCP	No	Operations ongoing.	Operations ongoing.
	Carbonaceous material	Annual Rehabilitation Inspection.	Where infrastructure is to be removed. Excess coal material remaining at closure will be scraped-up and either reprocessed or disposed of within the tailings/coarse reject emplacement areas on site. Any remaining carbonaceous material (e.g. coal reject) on the base of the coal stockpile area will be either capped with inert material or scraped up and removed to the tailings/coarse reject emplacement area.	*Waste Management Plan (RAVCX-307024981-6054)*	No	Not required yet.	Not required yet.

Domain Objective	Indicator	Performance Measure	Completion Criteria	Justification / Source	Complete (Yes/No)	Progress at start of MOP	Progress at end of MOP
Domain 2 – Tailings Storage Area							
Safe capping and rehabilitation of tailings storage facilities.	Tailings capping	Inspections Signoff	Decommissioning of tailings storage facilities in accordance with approval granted under High Risk Activity under *Work Health and Safety (Mines) Regulation 2014* and the requirements of the *GCAA Tailings Storage Facilities Protocol (GCAA-625378177-15551).*	*Tailings Storage Facilities Protocol (GCAA-625378177-15551)*	No	Capping of 7 South Tailings Storage in progress Capping of Cumnock Void 1/2 TSF not yet commenced	Capping of 7 South Tailings Storage complete Capping of Cumnock Void 1/2 TSF is subject to geotechnical investigation
	Tailings capping	Inspections Signoff	Tailings storage facilities will be sufficiently dry prior to capping. A Final Tailings Dam Management Plan will be completed at least 5 years before mine closure, with this to include a risk assessment. Tailings are capped as per *the GCAA Tailings Storage Facilities Protocol (GCAA-625378177-15551).*	*Tailings Storage Facilities Protocol (GCAA-625378177-15551)*	No	Capping of 7 South Tailings Storage in progress Capping of Cumnock Void 1/2 TSF not yet commenced	Capping of 7 South Tailings Storage complete Capping of Cumnock Void 1/2 TSF is subject to geotechnical investigation
	Material Characterisation	Soil Testing Results	Prior to revegetation activities, spoils and topsoils will be characterised to determine the type and application rate that may be required for the addition of soil ameliorants (e.g. gypsum, lime, fertiliser, biosolids, etc.).	*Biodiversity Management Plan*	No	Revegetation not yet commenced	Revegetation not yet commenced

Domain Objective	Indicator	Performance Measure	Completion Criteria	Justification / Source	Complete (Yes/No)	Progress at start of MOP	Progress at end of MOP
	Slopes	Schedule 3, Condition 40 of PA 09_0176	To achieve the rehabilitation objectives, slopes are generally consistent with MOD 2 EA. Slopes in the Cumnock Void 1/2 final landform to be consistent with the Cumnock Closure Plan.	*OMCP* *Cumnock Closure Plan*	No	Shaping not yet completed	Backfilling of 7 South Tailings Storage in progress Cumnock Void 1/2 TSF not commenced
	Growth Medium Placement	Annual Rehabilitation Inspection	The placed growth medium will be visually inspected prior to commencement of deep ripping activity.	*Biodiversity Management Plan*	No	Revegetation not yet commenced	Revegetation not yet commenced
	Deep Ripping	Annual Rehabilitation Inspection.	The respread top-layer will be deep ripped on the contour to allow/assist bedding of the topdressing materials.	*Biodiversity Management Plan*	No	Revegetation not yet commenced	Revegetation not yet commenced
Domain 3 – Water Management Area							
Long term re-establishment of creek diversions.	Drainage	Drainage Lines Installed	Suitable erosion control measures (e.g. catch drains, sediment dams, silt fences, mulches, etc.) will be implemented to minimise soil loss from areas undergoing rehabilitation.	*Water Management Plan*	No	Operations ongoing.	Operations ongoing.
	Drainage	Drainage Lines Installed	Elements such as drainage paths, contour drains, ridgelines, and emplacements will be shaped, as much as practical, to undulating profiles in keeping with natural landforms of the surrounding environment.	*Water Management Plan*	No	Operations ongoing.	Operations ongoing.

Domain Objective	Indicator	Performance Measure	Completion Criteria	Justification / Source	Complete (Yes/No)	Progress at start of MOP	Progress at end of MOP
	Drainage	Drainage Lines Installed	Sedimentation dams are incorporated into the final landform to collect runoff from rehabilitated areas and the dam capacity is designed to allow time for suspended sediment to settle out.	*Water Management Plan*	No	Operations ongoing.	Operations ongoing.
	Emu Creek Reinstatement	Emu Creek reinstated in accordance with PA 09_0176 and management plan	Once the mining operation and overburden emplacement has advanced past the original alignment of Emu Creek, the Emu Creek Diversion Dam 1 will be decommissioned and the creek line will be reinstated.	*Water Management Plan*	No	Not yet required.	Not yet required.
	Emu Creek Reinstatement	Emu Creek reinstated in accordance with PA 09_0176 and management plan	Emu Creek will be reinstated by approximately Year 19 of the conceptual mine progression.	*Water Management Plan*	No	Not yet required.	Not yet required.
	Emu Creek Reinstatement	Emu Creek reinstated in accordance with PA 09_0176 and management plan	Native vegetation will be planted along the drainage channels as part of the rehabilitation, to maximise the long term stability of the drainage system that will be constructed on filled and reshaped material.	*Water Management Plan*	No	Not yet required.	Not yet required.
	Emu Creek Reinstatement	Emu Creek reinstated in accordance with PA	Dams and drainage channels with shallow sloping edges to allow the	*Biodiversity Management Plan*	No	Not yet required.	Not yet required.

Domain Objective	Indicator	Performance Measure	Completion Criteria	Justification / Source	Complete (Yes/No)	Progress at start of MOP	Progress at end of MOP
		09_0176 and management plan	planting of aquatic macrophytes and sedges.				
	Emu Creek Reinstatement	Emu Creek reinstated in accordance with PA 09_0176 and management plan	A meandering design to slow down water movement and retain water within the landscape longer.	*Biodiversity Management Plan*	No	Not yet required.	Not yet required.
	Emu Creek Reinstatement	Emu Creek reinstated in accordance with PA 09_0176 and management plan	Drainage channels with features to enhance habitat complexity such as pool and riffle sequences.	*Biodiversity Management Plan*	No	Not yet required.	Not yet required.
	Emu Creek Reinstatement	Emu Creek reinstated in accordance with PA 09_0176 and management plan	Salvaged habitat features such as fallen timber and boulders will be carefully positioned within the bed of drainage channels and edges of dams to provide in-stream structures and habitat.	*Biodiversity Management Plan*	No	Not yet required.	Not yet required.
	Emu Creek Reinstatement	Emu Creek reinstated in accordance with PA 09_0176 and management plan	(c) reinstate Emu Creek generally in accordance with the concept design outlined in the EA and minimising net loss of stream length, as soon as practicable following mining and rehabilitation in the applicable	Schedule 2, Condition 30 of PA 09_0176	No	Not yet required.	Not yet required.

Domain Objective	Indicator	Performance Measure	Completion Criteria	Justification / Source	Complete (Yes/No)	Progress at start of MOP	Progress at end of MOP
			area, to the satisfaction of the Secretary.				
	Bayswater Creek Diversion	Remediate Bayswater Creek drop structure	Remediate Bayswater Creek drop structure to provide hydraulically stable structure to prevent excess scouring and erosion.	*Water Management Plan*	No	Not yet commenced.	Remediation works of drop structure to be completed within MOP term
	Bayswater Creek Diversion	Rehabilitate and revegetate Bayswater Creek in accordance with PA 09_0176 and management plan	(d) rehabilitate and revegetate the Bayswater Creek diversion to provide a hydraulically and geomorphically stable stream as soon as practicable following mining and rehabilitation in the applicable area, to the satisfaction of the Secretary.	Schedule 2, Condition 30 of PA 09_0176	No	Not yet required.	Not yet required.
	Emu Creek Reinstatement	Engineering Reports Submitted	(e) submit as-executed reports to the Secretary and NOW, certified by a practising engineer, confirming that the reinstated/rehabilitated Emu Creek and Bayswater Creek are sufficiently hydraulically and geomorphologically stable, prior to commissioning the reinstated/rehabilitated creeks.	Schedule 2, Condition 30 of PA 09_0176	No	Not yet required.	Not yet required.
Minimise soil loss	Erosion and soil loss	Erosion and soil loss	Erosion control structures are installed at intervals	*Water Management Plan*	No	Operations ongoing.	Operations ongoing.

Domain Objective	Indicator	Performance Measure	Completion Criteria	Justification / Source	Complete (Yes/No)	Progress at start of MOP	Progress at end of MOP
			commensurate with the slope of the landform. Average soil loss per annum is no greater than that in reference sites that exhibit similar landform characteristics. Dimensions and frequency of occurrence of erosion rills and gullies are generally no greater than that in reference sites that exhibit similar landform characteristics.				
No water pollution from site.	Water Quality	Discharged water meeting performance measures	Discharged surface water meets the following requirements: (a) discharge limits (both volume and quality) set for the project in any EPL; or (b) relevant provisions of the POEO Act or *Protection of the Environment Operations (Hunter River Salinity Trading Scheme) Regulation 2002*.	*Water Management Plan*	No	Water management structures in place.	Water management structures in place.
	Water Quality	Discharged water meeting performance measures	The quality of water leaving the site should not cause significant deterioration of downstream water quality. Runoff water from rehabilitation is within the range of water quality recorded from analogue sites and does not pose a threat to downstream water quality.	*Water Management Plan*	No	Water management structures in place.	Water management structures in place.

Domain Objective	Indicator	Performance Measure	Completion Criteria	Justification / Source	Complete (Yes/No)	Progress at start of MOP	Progress at end of MOP
	Filling of Narama Pit	Backfilled Narama Pit	The Narama Pit is to be backfilled as part of closure as per the Ravensworth Operations final landform.	MOD3 EA	No	Water storage	Still water storage at end of MOP
Domain 4 – Overburden Emplacement							
Reshaping and seeding completed in accordance with the MOP	Land Shaping	Annual Rehabilitation Inspection	The out of pit overburden dumping areas will be developed progressively over the life of the mine to a maximum height of approximately 230 metres RL and 190 metres RL for the northern and eastern dump respectively, or final landform as agreed with Director General.	MOD 2 EA	No	Operations ongoing. Currently being completed.	Operations ongoing. Continue to be completed.
	Slopes	Schedule 3, Condition 40 of PA 09_0176	To achieve the rehabilitation objectives, slopes are generally consistent with MOD 2 EA	MOD 2 EA	No	Operations ongoing. Currently being completed.	Operations ongoing. Continue to be completed.
	Growth Medium Placement	Annual Rehabilitation Inspection	The placed growth medium will be visually inspected prior to commencement of deep ripping activity.	*Biodiversity Management Plan*	No	Operations ongoing. Currently being completed.	Operations ongoing. Continue to be completed.
	Deep Ripping	Annual Rehabilitation Inspection.	The respread top-layer will be deep ripped on the contour to allow/assist bedding of the topdressing materials.	*Biodiversity Management Plan*	No	Operations ongoing. Currently being completed.	Operations ongoing. Continue to be completed.
Domain 5 – Active Mining Area							

Domain Objective	Indicator	Performance Measure	Completion Criteria	Justification / Source	Complete (Yes/No)	Progress at start of MOP	Progress at end of MOP
Filling, reshaping and rehabilitation of current voids in accordance with the MOP and OMCP	Progressive rehabilitation	Annual Rehabilitation Inspection	Carry out rehabilitation progressively, that is as soon as reasonably practical following disturbance.	Schedule 3, Condition 40 of PA 09_0176	Yes	Progressive rehabilitation completed.	Progressive rehabilitation continuing.
	Progressive rehabilitation	Annual Rehabilitation Inspection	Revegetation areas contain flora species assemblages characteristic of each strata for the desired native vegetation community.	*Biodiversity Management Plan*	No	Progressive rehabilitation completed.	Progressive rehabilitation continuing.
	Ameliorants	Results	Ameliorants (such as gypsum, organics and fertilisers) are spread at the recommended rate per hectare as recommended by soil analysis appropriate to the final land use.	*Biodiversity Management Plan*	No	Testing currently being completed.	Testing to continue.
	Slopes	Schedule 3, Condition 40 of PA 09_0176	To achieve the rehabilitation objectives, slopes are generally consistent with MOD 2 EA.	MOD 2 EA	No	Operations ongoing. Currently being completed.	Operations ongoing. Continue to be completed.
	Growth Medium Placement	Annual Rehabilitation Inspection	The placed growth medium will be visually inspected prior to commencement of deep ripping activity.	*Biodiversity Management Plan*	No	Operations ongoing. Currently being completed.	Operations ongoing. Continue to be completed.
	Deep Ripping	Annual Rehabilitation Inspection.	The respread top-layer will be deep ripped on the contour to allow/assist bedding of the topdressing materials.	*Biodiversity Management Plan*	No	Operations ongoing. Currently being completed.	Operations ongoing. Continue to be completed.
Domain 6 – Offset Areas							

Domain Objective	Indicator	Performance Measure	Completion Criteria	Justification / Source	Complete (Yes/No)	Progress at start of MOP	Progress at end of MOP
No proposed landform establishment in offset areas during the MOP period.							
Domain A – Final Void							
	Void Size	Void design covers approximately 363 hectares.	A final void will remain at Ravensworth Operations in the southern extent of the site. The proposed final void will have a capacity of approximately 347 million bank cubic metres with a surface area of approximately 363 hectares.	*OMCP*	No	No final void.	No final void.
	Preparation of Void MP	Preparation of Void MP	As part of the final void design, a Detailed Final Void Management Plan will be developed five years prior to planned mine closure in accordance with detailed mine planning and Glencore standards.	*Mine Closure Planning Protocol (GCAA-625378177-10325)*	No	No final void.	No final void.
	Low Wall Design as per Void MP	Low wall slopes	Determination of geotechnical stability should be based on an assessment of the spoil material, the likely degree of settlement, and the degree of weathering expected in the long term.	*Mine Closure Planning Protocol (GCAA-625378177-10325)*	No	No final void.	No final void.
	Final Void Design as per Void MP	Highwall slopes	To ensure the safety of the final void, the surrounding final slopes should be left in a condition where the risk of slope failure is minimised.	*Mine Closure Planning Protocol (GCAA-625378177-10325)*	No	No final void.	No final void.
Domain B – Water Management Area							

Domain Objective	Indicator	Performance Measure	Completion Criteria	Justification / Source	Complete (Yes/No)	Progress at start of MOP	Progress at end of MOP
Water Management as per Domain 1.							
Domain C – Rehabilitation Pasture							
Rehabilitation of areas with pasture species mix to ensure long term stable landform.	Grazing land	Annual Rehabilitation Inspection	Pasture composition comprises palatable grasses and legumes appropriate to the district and suitable for cattle grazing.	*Biodiversity Management Plan*	No	Operations ongoing. Currently being completed.	Operations ongoing. Continue to be completed.
	Slopes	Schedule 3, Condition 40 of PA 09_0176	To achieve the rehabilitation objectives, slopes are generally consistent with MOD 2 EA	MOD 2 EA	No	Operations ongoing. Currently being completed.	Operations ongoing. Continue to be completed.
	Growth Medium Placement	Annual Rehabilitation Inspection	The placed growth medium will be visually inspected prior to commencement of deep ripping activity.	*Biodiversity Management Plan*	No	Operations ongoing. Currently being completed.	Operations ongoing. Continue to be completed.
	Deep Ripping	Annual Rehabilitation Inspection.	The respread top-layer will be deep ripped on the contour to allow/assist bedding of the topdressing materials.	*Biodiversity Management Plan*	No	Operations ongoing. Currently being completed.	Operations ongoing. Continue to be completed.
Domain D – Woodland							
Rehabilitation of areas to re-establish native	Slopes	Schedule 3, Condition 40 of PA 09_0176	To achieve the rehabilitation objectives, slopes are generally consistent with MOD 2 EA	MOD 2 EA	No	Operations ongoing. Currently being completed.	Operations ongoing. Continue to be completed.

Domain Objective	Indicator	Performance Measure	Completion Criteria	Justification / Source	Complete (Yes/No)	Progress at start of MOP	Progress at end of MOP
woodland communities	Growth Medium Placement	Annual Rehabilitation Inspection	The placed growth medium will be visually inspected prior to commencement of deep ripping activity.	*Biodiversity Management Plan*	No	Operations ongoing. Currently being completed.	Operations ongoing. Continue to be completed.
	Deep Ripping	Annual Rehabilitation Inspection.	The respread top-layer will be deep ripped on the contour to allow/assist bedding of the topdressing materials.	*Biodiversity Management Plan*	No	Operations ongoing. Currently being completed.	Operations ongoing. Continue to be completed.
	Woodland Seed Mix	Annual Rehabilitation Inspection.	Performance against benchmark values published by NSW Government or collected at analogue sites.	*Biodiversity Management Plan*	No	Operations ongoing. Currently being completed.	Operations ongoing. Continue to be completed.
Domain E – Infrastructure							
Infrastructure management as per Domain 2.							

Table 5-3 – Rehabilitation Table – Growth Medium Development

Domain Objective	Indicator	Performance Measure	Completion Criteria	Justification / Source	Complete (Yes/No)	Progress at start of MOP	Progress at end of MOP
Domain 1 – Infrastructure (Ravensworth Operations)							
Use of ameliorants effectively to assist in improved rehabilitation.	Ameliorants	Annual Rehabilitation Inspection.	Ameliorants (such as gypsum, organics and fertilisers) are spread at the recommended rate per hectare as recommended by soil analysis appropriate to the final land use.	*Biodiversity Management Plan*	No	Operations ongoing.	Operations ongoing.
Domain 2 – Tailings Storage Area							

Domain Objective	Indicator	Performance Measure	Completion Criteria	Justification / Source	Complete (Yes/No)	Progress at start of MOP	Progress at end of MOP
Use of ameliorants effectively to assist in improved rehabilitation	Ameliorants	Annual Rehabilitation Inspection.	Ameliorants (such as gypsum, organics and fertilisers) are spread at the recommended rate per hectare as recommended by soil analysis appropriate to the final land use.	*Applied soil analysis to guide on ground decisions*	No	Not yet completed.	Not yet completed.
Use of seed mix as per this MOP	Woodland Seed Mix	Annual Rehabilitation Inspection.	Performance against benchmark values published by NSW Government or collected at analogue sites.	*Biodiversity Management Plan*	No	Operations ongoing.	Operations ongoing.
Soil Chemistry within designated range	Soil	Annual Rehabilitation Inspection	Topsoil or a suitable alternative has been spread uniformly at the specified depth appropriate to the final land use	*Biodiversity Management Plan*	No	Operations ongoing.	Operations ongoing.
	Soil Quality	Annual Rehabilitation Inspection	Bare areas of soil >400m^2 are tested for pH, EC, ESP, Macro nutrients and trace elements.	Limits soil testing to areas that are not performing, allowing for soil testing to be targeted and management actions implemented in specific areas	No	Operations ongoing.	Operations ongoing.
Domain 3 – Water Management Area							
No water pollution from site.	Water Quality	Discharged water meeting performance measures	Discharged surface water meets the following requirements: (a) discharge limits (both volume and quality) set for the project in any EPL; or	*Water Management Plan*	No	Water management structures in place.	Water management structures in place.

Domain Objective	Indicator	Performance Measure	Completion Criteria	Justification / Source	Complete (Yes/No)	Progress at start of MOP	Progress at end of MOP
			(b) relevant provisions of the POEO Act or *Protection of the Environment Operations (Hunter River Salinity Trading Scheme) Regulation 2002*.				
	Water Quality	Discharged water meeting performance measures	The quality of water leaving the site should not cause significant deterioration of downstream water quality. Runoff water from rehabilitation is within the range of water quality recorded from analogue sites and does not pose a threat to downstream water quality.	*Water Management Plan*	No	Water management structures in place.	Water management structures in place.
Domain 4 – Overburden Emplacement							
Use of ameliorants effectively to assist in improved rehabilitation.	Ameliorants	Annual Rehabilitation Inspection.	Ameliorants (such as gypsum, organics and fertilisers) are spread at the recommended rate per hectare as recommended by soil analysis appropriate to the final land use.	*Applied soil analysis to guide on ground decisions*	No	Operations ongoing.	Operations ongoing.
	Ameliorants	Annual Rehabilitation Inspection.	Ameliorants (such as gypsum, organics and fertilisers) are spread at the recommended rate per hectare as recommended by soil analysis appropriate to the final land use.	*Applied soil analysis to guide on ground decisions*	No	Operations ongoing.	Operations ongoing.
Use of seed mix as per this MOP	Woodland Seed Mix	Annual Rehabilitation Inspection.	Performance against benchmark values published by NSW Government or collected at analogue sites	*Biodiversity Management Plan*	No	Operations ongoing.	Operations ongoing.
Use of seed mix as per this MOP	Pasture Seed Mix	Annual Rehabilitation Inspection.	Pasture composition comprises palatable grasses and legumes appropriate to the district and suitable for cattle grazing.	Closure Criteria	No	Operations ongoing.	Operations ongoing.

Domain Objective	Indicator	Performance Measure	Completion Criteria	Justification / Source	Complete (Yes/No)	Progress at start of MOP	Progress at end of MOP
Soil Chemistry within designated range	Soil	Annual Rehabilitation Inspection.	Topsoil or a suitable alternative has been spread uniformly at the specified depth appropriate to the final land use	*Biodiversity Management Plan*	No	Operations ongoing.	Operations ongoing.
Domain 5 – Active Mining Area							
Use of ameliorants effectively to assist in improved rehabilitation.	Ameliorants	Annual Rehabilitation Inspection.	Ameliorants (such as gypsum, organics and fertilisers) are spread at the recommended rate per hectare as recommended by soil analysis appropriate to the final land use.	Applied soil analysis to guide on ground decisions	No	Operations ongoing.	Operations ongoing.
Use of seed mix as per this MOP	Woodland Seed Mix	Annual Rehabilitation Inspection.	Performance against benchmark values published by NSW Government or collected at analogue sites.	*Biodiversity Management Plan*	No	Operations ongoing.	Operations ongoing.
Use of seed mix as per this MOP	Pasture Seed Mix	Annual Rehabilitation Inspection.	Pasture composition comprises palatable grasses and legumes appropriate to the district and suitable for cattle grazing.	Closure Criteria	No	Operations ongoing.	Operations ongoing.
Soil Chemistry within designated range	Soil	Annual Rehabilitation Inspection.	Topsoil or a suitable alternative has been spread uniformly at the specified depth appropriate to the final land use	Standards Australia (2003) *Biodiversity Management Plan*	No	Operations ongoing.	Operations ongoing.
Domain 6 – Offset Areas							
No proposed growth medium development in offset areas during the MOP period.							
Domain A – Final Void							

Domain Objective	Indicator	Performance Measure	Completion Criteria	Justification / Source	Complete (Yes/No)	Progress at start of MOP	Progress at end of MOP
The final land use for the final void has not yet been determined. The *Conceptual Void Management Plan* identified a number of potential final land uses. A decision on the final land use of the final void will be made closer to mine closure.							
Domain B – Water Management Area							
Water Management as per Domain 1.							
Domain C – Rehabilitation Pasture							
Use of ameliorants effectively to assist in improved rehabilitation.	Ameliorants	Annual Rehabilitation Inspection	Ameliorants (such as gypsum, organics and fertilisers) are spread at the recommended rate per hectare as recommended by soil analysis appropriate to the final land use	*Biodiversity Management Plan*	No	Operations ongoing.	Operations ongoing.
Use of seed mix as per this MOP	Pasture Seed Mix	Annual Rehabilitation Inspection.	Pasture composition comprises palatable grasses and legumes appropriate to the district and suitable for cattle grazing.	*Biodiversity Management Plan*	No	Operations ongoing.	Operations ongoing.
Soil Chemistry within designated range	Soil	Annual Rehabilitation Inspection	Topsoil or a suitable alternative has been spread uniformly at the specified depth appropriate to the final land use.	Standards Australia (2003) *Biodiversity Management Plan*	No	Operations ongoing.	Operations ongoing.
	Soil Quality	Annual Rehabilitation Inspection	Bare areas of soil >400m^2 are tested for pH, EC, ESP, Macro nutrients and trace elements.	Limits soil testing to areas that are not performing, allowing for soil testing to be targeted and management	No	Operations ongoing.	Operations ongoing.

Domain Objective	Indicator	Performance Measure	Completion Criteria	Justification / Source	Complete (Yes/No)	Progress at start of MOP	Progress at end of MOP
				actions implemented in specific areas			
Domain D - Woodland							
Use of ameliorants effectively to assist in improved rehabilitation.	Ameliorants	Annual Rehabilitation Inspection.	Ameliorants (such as gypsum, organics and fertilisers) are spread at the recommended rate per hectare as recommended by soil analysis appropriate to the final land use.	*Biodiversity Management Plan*	No	Operations ongoing.	Operations ongoing.
Use of seed mix as per this MOP	Woodland Seed Mix	Annual Rehabilitation Inspection.	Performance against benchmark values published by NSW Government or collected at analogue sites.	*Biodiversity Management Plan*	No	Operations ongoing.	Operations ongoing.
Soil Chemistry within designated range	Soil	Annual Rehabilitation Inspection.	Topsoil or a suitable alternative has been spread uniformly at the specified depth appropriate to the final land use.	Standards Australia (2003) *Biodiversity Management Plan*	No	Operations ongoing.	Operations ongoing.
	Soil Quality	Annual Rehabilitation Inspection	Bare areas of soil >400m^2 are tested for pH, EC, ESP, Macro nutrients and trace elements.	Limits soil testing to areas that are not performing, allowing for soil testing to be targeted and management actions implemented	No	Operations ongoing.	Operations ongoing.

Domain Objective	Indicator	Performance Measure	Completion Criteria	Justification / Source	Complete (Yes/No)	Progress at start of MOP	Progress at end of MOP
				in specific areas			
Domain E – Infrastructure							
Infrastructure management as per Domain 2.							

Table 5-4 – Rehabilitation Table – Ecosystem and Land Use Establishment

Domain Objective	Indicator	Performance Measure	Completion Criteria	Justification / Source	Complete (Yes/No)	Progress at start of MOP	Progress at end of MOP
Domain 1 – Infrastructure (Ravensworth Operations)							
Establishment of ecosystem as part of rehabilitation and closure	Weed presence	Minimal weeds in domain	Weed presence does not pose a risk to the establishment of rehabilitation areas.	*Biodiversity Management Plan*	No	Operations ongoing	Operations ongoing
	Pest animal presence	Minimal pests in domain	Pest animal presence does not pose a risk to the establishment of rehabilitation areas.	*Biodiversity Management Plan*	No	Operations ongoing	Operations ongoing
Domain 2 – Tailings Storage Area							
Establishment of ecosystem as part of rehabilitation and closure	Weed presence	Minimal weeds in domain	Weed presence does not pose a risk to the establishment of rehabilitation areas.	*Biodiversity Management Plan*	No	Operations ongoing	Operations ongoing
	Pest animal presence	Minimal pests in domain	Pest animal presence does not pose a risk to the establishment of rehabilitation areas.	*Biodiversity Management Plan*	No	Operations ongoing	Operations ongoing
Domain 3 – Water Management Area							
Water Management as per the *Water Management Plan* and EPL.	Size and number of ponds	Several ponds are constructed and are used as Green and Golden Bell Frog habitat.	The installation of appropriate habitat structures (e.g. ponds) for Green and Golden Bell Frog habitat.	*Biodiversity Management Plan*	No	Water management structures in place.	Water management structures in place.
	Water Quality	Discharged water meeting performance measures	Discharged surface water meets the following requirements: (a) discharge limits (both volume and quality) set for the project in any EPL; or	*Water Management Plan*	No	Water management structures in place.	Water management structures in place.

Domain Objective	Indicator	Performance Measure	Completion Criteria	Justification / Source	Complete (Yes/No)	Progress at start of MOP	Progress at end of MOP
			(b) relevant provisions of the POEO Act or *Protection of the Environment Operations (Hunter River Salinity Trading Scheme) Regulation 2002*.				
	Water Quality	Discharged water meeting performance measures	The quality of water leaving the site should not cause significant deterioration of downstream water quality. Runoff water from rehabilitation is within the range of water quality recorded from analogue sites and does not pose a threat to downstream water quality.	*Water Management Plan*	No	Water management structures in place.	Water management structures in place.
Domain 4 – Overburden Emplacement							
Establishment of ecosystem as part of rehabilitation and closure. Inclusion of habitat structures.	Habitat features	Habitat Features	Habitat features, including structures suitable for target species are incorporated into rehabilitation areas at required densities, where appropriate.	*Biodiversity Management Plan*	No	Features used in rehabilitation.	Features continue to be used in rehabilitation.
	Weed presence	Minimal weeds in domain	Weed presence does not pose a risk to the establishment of rehabilitation areas.	*Biodiversity Management Plan*	No	Weed and pest management ongoing.	Weed and pest management to continue.
	Pest animal presence	Minimal pests in domain	Pest animal presence does not pose a risk to the establishment of rehabilitation areas.	*Biodiversity Management Plan*	No	Weed and pest management ongoing.	Weed and pest management to continue.
Domain 5 – Active Mining Area							
Establishment of ecosystem as part of rehabilitation.	Habitat Features	Habitat Features	Habitat features, including structures suitable for target species are incorporated into	*Biodiversity Management Plan*	No	Features used in rehabilitation.	Features continue to

Domain Objective	Indicator	Performance Measure	Completion Criteria	Justification / Source	Complete (Yes/No)	Progress at start of MOP	Progress at end of MOP
			rehabilitation areas at required densities, where appropriate.				be used in rehabilitation.
	Weed presence	Minimal weeds in domain	Weed presence does not pose a risk to the establishment of rehabilitation areas.	*Biodiversity Management Plan*	No	Weed and pest management completed	Weed and pest management to continue.
	Pest animal presence	Minimal pests in domain	Pest animal presence does not pose a risk to the establishment of rehabilitation areas.	*Biodiversity Management Plan*	No	Not yet complete	Weed and pest management to continue.
Domain 6 – Offset Areas							
Minimal weeds and pests within offset areas	Weed presence	Minimal weeds in domain	Weed presence does not pose a risk to the establishment of rehabilitation areas.	*Biodiversity Management Plan*	No	Weed and pest management completed	Weed and pest management to continue.
	Pest animal presence	Minimal pests in domain	Pest animal presence does not pose a risk to the establishment of rehabilitation areas.	*Biodiversity Management Plan*	No	Weed and pest management completed	Weed and pest management to continue.
Domain A – Final Void							
The final land use for the final void has not yet been determined. The *Conceptual Void Management Plan* identified a number of potential final land uses. A decision on the final land use of the final void will be made closer to mine closure.							
Domain B – Water Management Area							
Water Management as per Domain 1.							
Domain C – Rehabilitation Pasture							

Domain Objective	Indicator	Performance Measure	Completion Criteria	Justification / Source	Complete (Yes/No)	Progress at start of MOP	Progress at end of MOP
Effective maintenance and management of rehabilitation areas.	Species composition	Annual Rehabilitation Monitoring	Pasture composition comprises palatable grasses and legumes appropriate rot the district and suitable for cattle grazing.	*Biodiversity Management Plan*	No	Not yet complete	Rehabilitation improving to meet this criteria.
	Weed presence	Minimal weeds in domain	Weed presence does not pose a risk to the establishment of rehabilitation areas.	*Biodiversity Management Plan*	No	Weed and pest management completed	Weed and pest management to continue
	Pest animal presence	Minimal pests in domain	Pest animal presence does not pose a risk to the establishment of rehabilitation areas.	*Biodiversity Management Plan*	No	Weed and pest management completed	Weed and pest management to continue
Domain D – Woodland							
Effective maintenance and management of rehabilitation areas.	Habitat features	Habitat Features	Habitat features, including structures suitable for target species are incorporated into rehabilitation areas at required densities, where appropriate	*Biodiversity Management Plan*	No	Features used in rehabilitation.	Features continue to be used in rehabilitation.
	Species composition	Canopy density	Canopy tree density (for Eucalypts) should generally be around 300-400 stems/ha to achieve the desired Central Hunter Grey Box Ironbark Woodland in the Cumnock rehabilitation area.	*Cumnock Rehabilitation Remediation Plan.*	No	Commenced	Species composition continues to improve to meet the target ecological communities.
	Weed presence	Minimal weeds in domain	Weed presence is managed such that it does not pose a risk to the establishment of the target woodland communities.	*Biodiversity Management Plan*	No	Weed management ongoing	Weed management to continue.

Domain Objective	Indicator	Performance Measure	Completion Criteria	Justification / Source	Complete (Yes/No)	Progress at start of MOP	Progress at end of MOP
				Cumnock Rehabilitation Remediation Plan.			
	Pest animal presence	Minimal pests in domain	Pest animal presence is managed such that it does not pose a risk to the establishment of target woodland communities.	*Biodiversity Management Plan*	No	Pest management ongoing	Pest management to continue.
	Development of habitat for species	Rehabilitation monitoring	Performance against benchmark values published by NSW Government or collects at analogue sites	*Biodiversity Management Plan*	No	Not yet complete.	Rehabilitation improving to meet this criteria.
Domain E – Infrastructure							
Infrastructure management as per Domain 2.							

Table 5-5 – Rehabilitation Table – Ecosystem and Land Use Sustainability

Domain Objective	Indicator	Performance Measure	Completion Criteria	Justification / Source	Complete (Yes/No)	Progress at start of MOP	Progress at end of MOP
Domain 1 – Infrastructure (Ravensworth Operations)							
Development of ecosystem as part of rehabilitation and closure	Soil Quality	Evidence of ecosystem establishment	Bare areas of >400m^2 are tested for pH, EC, ESP, macro nutrients and trace elements.	Limits soil testing to areas that are not performing, allowing for soil testing to be targeted and management actions implemented in specific areas	No	Operations ongoing.	Operations ongoing.
	Final land use	Rehabilitation inspection	Woodland rehabilitation will consist of the following vegetation communities: • Central Hunter Box – Ironbark Woodland; • Central Hunter Swamp Oak Forest; and • Central Hunter Bulloak Forest Regeneration.	*Statement of Commitment 6.4.3 from EA*	No	Operations ongoing.	Operations ongoing.
	Final Rehabilitation	Rehabilitation inspection	Revegetation areas contain flora species assemblages characteristic of each strata for the desired native vegetation communities.	*Biodiversity Management Plan*	No	Operations ongoing.	Operations ongoing.

Domain Objective	Indicator	Performance Measure	Completion Criteria	Justification / Source	Complete (Yes/No)	Progress at start of MOP	Progress at end of MOP
	Biometric vegetation attributes	Rehabilitation inspection	Performance against Benchmark values published by NSW Government or collected at analogue sites.	*Biodiversity Management Plan*	No	Operations ongoing.	Operations ongoing.
	Faunal species	Representation of a range of species	Monitoring confirms target native fauna species are recorded utilising rehabilitation areas or habitat suitable for target species present.	*Biodiversity Management Plan*	No	Operations ongoing.	Operations ongoing.
Domain 2 – Tailings Storage Area							
Development of ecosystem as part of rehabilitation and closure	Soil Quality	Evidence of ecosystem establishment	Bare areas of >400m^2 are tested for pH, EC, ESP, macro nutrients and trace elements.	Limits soil testing to areas that are not performing, allowing for soil testing to be targeted and management actions implemented in specific areas	No	Operations ongoing.	Operations ongoing.
	Final Rehabilitation	Rehabilitation inspection	Revegetation areas contain flora species assemblages characteristic of each strata for the desired native vegetation communities.	*Biodiversity Management Plan*	No	Operations ongoing.	Operations ongoing.
	Biometric vegetation attributes	Rehabilitation inspection	Performance against Benchmark values published by NSW Government or collected at analogue sites.	*Biodiversity Management Plan*	No	Operations ongoing.	Operations ongoing.

Domain Objective	Indicator	Performance Measure	Completion Criteria	Justification / Source	Complete (Yes/No)	Progress at start of MOP	Progress at end of MOP
	Faunal species	Representation of a range of species	Monitoring confirms target native fauna species are recorded utilising rehabilitation areas or habitat suitable for target species present.	*Biodiversity Management Plan*	No	Operations ongoing.	Operations ongoing.
	Final Rehabilitation	Rehabilitation inspection	Revegetation areas contain flora species assemblages characteristic of each strata for the desired native vegetation communities.	*Biodiversity Management Plan*	No	Operations ongoing.	Operations ongoing.
Domain 3 – Water Management Area							
Management as per the *Water Management Plan* and EPL.	Water Quality	Discharged water meeting performance measures	Discharged surface water meets the following requirements: (a) discharge limits (both volume and quality) set for the project in any EPL; or (b) relevant provisions of the POEO Act or *Protection of the Environment Operations (Hunter River Salinity Trading Scheme) Regulation 2002*.	*Water Management Plan*	No	Water management features in place.	Water management features in place.
	Water Quality	Discharged water meeting performance measures	The quality of water leaving the site should not cause significant deterioration of downstream water quality. Runoff water from rehabilitation is within the range of water quality recorded from analogue sites and does not pose a threat to downstream water quality.	*Water Management Plan*	No	Water management features in place.	Water management features in place.
Domain 4 – Overburden Emplacement							

Domain Objective	Indicator	Performance Measure	Completion Criteria	Justification / Source	Complete (Yes/No)	Progress at start of MOP	Progress at end of MOP
Establishment of ecosystem as part of rehabilitation and closure.	Soil Quality	Evidence of ecosystem establishment	Bare areas of >400m^2 are tested for pH, EC, ESP, macro nutrients and trace elements.	Limits soil testing to areas that are not performing, allowing for soil testing to be targeted and management actions implemented in specific areas	No	Rehabilitation ongoing.	Rehabilitation continuing to improve.
	Final land use	Rehabilitation inspection	Where infrastructure has been removed and rehabilitation is completed, woodland rehabilitation will consist of the following vegetation communities: • Central Hunter Box – Ironbark Woodland; • Central Hunter Swamp Oak Forest; and • Central Hunter Bulloak Forest Regeneration.	*Statement of Commitment 6.4.3 from EA*	No	Rehabilitation ongoing.	Rehabilitation continuing to improve.
	Final Rehabilitation	Rehabilitation inspection	Revegetation areas contain flora species assemblages characteristic of each strata for the desired native vegetation communities.	*Biodiversity Management Plan*	No	Rehabilitation ongoing.	Not yet complete
	Biometric vegetation attributes	Rehabilitation inspection	Performance against Benchmark values published by NSW Government or collected at analogue sites.	*Biodiversity Management Plan*	No	Rehabilitation ongoing.	Not yet complete

Domain Objective	Indicator	Performance Measure	Completion Criteria	Justification / Source	Complete (Yes/No)	Progress at start of MOP	Progress at end of MOP
	Faunal species	Representation of a range of species	Monitoring confirms target native fauna species are recorded utilising rehabilitation areas or habitat suitable for target species present.	*Biodiversity Management Plan*	No	Rehabilitation ongoing.	Not yet complete
Domain 5 – Active Mining Area							
Establishment of ecosystem as part of rehabilitation and closure.	Soil Quality	Evidence of ecosystem establishment	Bare areas of >400m^2 are tested for pH, EC, ESP, macro nutrients and trace elements.	Limits soil testing to areas that are not performing, allowing for soil testing to be targeted and management actions implemented in specific areas	No	Rehabilitation ongoing.	Rehabilitation continuing to improve.
	Final land use	Rehabilitation inspection	Where infrastructure has been removed and rehabilitation is completed, woodland rehabilitation will consist of the following vegetation communities: • Central Hunter Box – Ironbark Woodland; • Central Hunter Swamp Oak Forest; and • Central Hunter Bulloak Forest Regeneration.	*Statement of Commitment 6.4.3 from EA*	No	Rehabilitation ongoing.	Rehabilitation continuing to improve.

Domain Objective	Indicator	Performance Measure	Completion Criteria	Justification / Source	Complete (Yes/No)	Progress at start of MOP	Progress at end of MOP
	Final Rehabilitation	Rehabilitation inspection	Revegetation areas contain flora species assemblages characteristic of each strata for the desired native vegetation communities.	*Biodiversity Management Plan*	No	Rehabilitation ongoing.	Not yet complete
	Biometric vegetation attributes	Rehabilitation inspection	Performance against Benchmark values published by NSW Government or collected at analogue sites.	*Biodiversity Management Plan*	No	Rehabilitation ongoing.	Not yet complete
	Faunal species	Representation of a range of species	Monitoring confirms target native fauna species are recorded utilising rehabilitation areas or habitat suitable for target species present.	*Biodiversity Management Plan*	No	Rehabilitation ongoing.	Not yet complete
Domain 6 – Offset Areas							
No proposed ecosystem development in offset areas during the MOP period.							
Domain A – Final Void							
The final land use for the final void has not yet been determined. The *Conceptual Void Management Plan* identified a number of potential final land uses. A decision on the final land use of the final void will be made closer to mine closure.							
Domain B – Water Management Area							
Water Management as per Domain 1.							
Domain C – Rehabilitation Pasture							
Effective maintenance and management of	Soil Quality	Evidence of ecosystem establishment	Bare areas of >400m^2 are tested for pH, EC, ESP, macro nutrients and trace elements.	Limits soil testing to areas that are not performing, allowing for	No	Rehabilitation ongoing.	Rehabilitation continuing to improve.

Domain Objective	Indicator	Performance Measure	Completion Criteria	Justification / Source	Complete (Yes/No)	Progress at start of MOP	Progress at end of MOP
rehabilitation areas.				soil testing to be targeted and management actions implemented in specific areas			
	Biometric vegetation attributes	Rehabilitation inspection	Performance against Benchmark values published by NSW Government or collected at analogue sites.	*Biodiversity Management Plan*	No	Rehabilitation ongoing.	Rehabilitation continuing to improve.
Domain D – Rehabilitation Woodland							
Effective maintenance and management of rehabilitation areas.	Faunal species	Representation of a range of species	Monitoring confirms target native fauna species are recorded utilising rehabilitation areas or habitat suitable for target species present.	*Biodiversity Management Plan*	No	Rehabilitation ongoing.	Rehabilitation continuing to improve.
	Soil Quality	Evidence of ecosystem establishment	Bare areas of >400m^2 are tested for pH, EC, ESP, macro nutrients and trace elements.	Limits soil testing to areas that are not performing, allowing for soil testing to be targeted and management actions implemented in specific areas	No	Rehabilitation ongoing.	Rehabilitation continuing to improve.

Domain Objective	Indicator	Performance Measure	Completion Criteria	Justification / Source	Complete (Yes/No)	Progress at start of MOP	Progress at end of MOP
	Final land use	Rehabilitation inspection	Where infrastructure has been removed and rehabilitation is completed, woodland rehabilitation will consist of the following vegetation communities: • Central Hunter Box – Ironbark Woodland; • Central Hunter Swamp Oak Forest; and • Central Hunter Bulloak Forest Regeneration.	*Statement of Commitment 6.4.3 from EA*	No	Rehabilitation ongoing	Rehabilitation continuing to improve.
	Final Rehabilitation	Rehabilitation inspection	Revegetation areas contain flora species assemblages characteristic of each strata for the desired native vegetation communities.	*Biodiversity Management Plan*	No	Rehabilitation ongoing.	Not yet complete
Domain E – Infrastructure							
Infrastructure management as per Domain 2.							

Table 5-6 – Rehabilitation Table – Land Relinquishment

Domain Objective	Indicator	Performance Measure	Completion Criteria	Justification / Source	Complete (Yes/No)	Progress at start of MOP	Progress at end of MOP
Domain 1 – Infrastructure (Ravensworth Operations)							
Commitments covered in ***Table 5-5*** – Ecosystem and Land Use Sustainability							
Domain 2 – Tailings Storage Area							
Commitments covered in ***Table 5-5*** – Ecosystem and Land Use Sustainability							

Domain Objective	Indicator	Performance Measure	Completion Criteria	Justification / Source	Complete (Yes/No)	Progress at start of MOP	Progress at end of MOP
Domain 3 – Water Management Area							
	Water Quality	Discharged water meeting performance measures	Discharged surface water meets the following requirements: (a) discharge limits (both volume and quality) set for the project in any EPL; or (b) relevant provisions of the POEO Act or *Protection of the Environment Operations (Hunter River Salinity Trading Scheme) Regulation 2002*.	*Water Management Plan*	No	Ongoing	Ongoing
	Water Quality	Discharged water meeting performance measures	The quality of water leaving the site should not cause significant deterioration of downstream water quality. Runoff water from rehabilitation is within the range of water quality recorded from analogue sites and does not pose a threat to downstream water quality.	*Water Management Plan*	No	Ongoing	Ongoing
Domain 4 – Overburden Emplacement							
Commitments covered in ***Table 5-5*** – Ecosystem and Land Use Sustainability							
Domain 5 – Active Mining Area							
Commitments covered in ***Table 5-5*** – Ecosystem and Land Use Sustainability							
Domain 6 – Offset Areas							
Commitments covered in ***Table 5-5*** – Ecosystem and Land Use Sustainability							
Domain A – Final Void							

Domain Objective	Indicator	Performance Measure	Completion Criteria	Justification / Source	Complete (Yes/No)	Progress at start of MOP	Progress at end of MOP
Commitments covered in ***Table 5-5*** – Ecosystem and Land Use Sustainability							
Domain B – Water Management Area							
Commitments covered in ***Table 5-5*** – Ecosystem and Land Use Sustainability							
Domain C – Rehabilitation Pasture							
Commitments covered in ***Table 5-5*** – Ecosystem and Land Use Sustainability							
Domain D – Rehabilitation Woodland							
Commitments covered in ***Table 5-5*** – Ecosystem and Land Use Sustainability							
Domain E – Infrastructure							
Commitments covered in ***Table 5-5*** – Ecosystem and Land Use Sustainability							

6. Rehabilitation Implementation

6.1 Status at MOP Commencement

This section describes the status of each domain at the start of this MOP period. This information is also presented graphically in ***MOP Plan 2***. The rehabilitation status of domains which are currently active (areas subject to on-going mining operations), are not described in detail.

6.1.1 Domain 1 - Infrastructure

This domain is active. The current key infrastructure associated with Ravensworth Operations includes:

- RCHPP;
- Conveyers and bins associated with the RCHPP;
- Stockpiles associated with the RCHPP;
- Mining Infrastructure Area (MIA) and Temporary MIA;
- Powerlines and associated infrastructure;
- Infrastructure associated with tailings and rejects emplacement;
- Pipelines and water management infrastructure; and
- Roads and tracks.

6.1.2 Domain 2 – Tailings Emplacement

This domain is active. No rehabilitation of tailings facilities associated with Ravensworth Operations has been completed. The active tailings emplacement facilities within the MOP area currently include the Cumnock Wash Plant Pit and Stage 3 Voids. As explained in **Section 1.8.6**, closure of the Cumnock Void 1/2 TSF is scheduled to commence during the MOP period but does not preclude further tailings emplacement in these voids. It is anticipated that capping and overburden emplacement will occur beyond this MOP period.

Prior to 2013, the 7 South Tailings Emplacement Facility was used for tailings emplacement associated with the RCHPP. Capping of the emplaced tailings is expected to be completed in 2021. This will be followed by overburden emplacement, which is expected to continue beyond the end of the MOP period.

Rehabilitation of these tailings emplacement areas is not scheduled to commence until after this MOP period.

6.1.3 Domain 3 – Water Management Area

This domain is currently active, and there are numerous clean water, mine water and sediment dams associated with Ravensworth Operations.

Narama Void, Ravensworth West Void and the Narama In-Pit Storage Dam (NISD) are the main water storages for Ravensworth Complex. The NISD is listed as a declared dam (with a notification area)

under the *Dams Safety Act 2015*. The key water storage structure for the RCHPP is the Highway Dam, has a volume of 260ML and is managed by the RCHPP.

6.1.4 Domain 4 – Overburden Emplacement

Domain 5 – This domain is currently active, however progressive rehabilitation (woodland and pasture), as well as temporary stabilisation and visual mitigation activities have been undertaken as areas have become available.

The current disturbance areas for active overburden emplacement include:

- Narama Overburden Emplacement Area – 312.9 hectares; and
- Ravensworth North Overburden Emplacement Area – 310.9 hectares.

6.1.5 Domain 5 – Active Mining Area

This domain is active with mining currently being undertaken at Ravensworth North. Progressive rehabilitation, as well as temporary stabilisation and visual mitigation activities have been undertaken as areas become available. Approximately 259.6 ha of land is currently disturbed for active mining at Ravensworth North.

6.1.6 Domain 6 – Offset Area

This domain is active and subject to ongoing monitoring and management by Ravensworth Operations.

6.1.7 Domain A – Final Void

There is no final void currently associated with the Ravensworth North operations. The area of the proposed final void is shown in ***MOP Plan 4***. A number of final land use options have been proposed in the *Operational Mine Closure Plan* and *Conceptual Void Management Plan.*

6.1.8 Domain B – Water Management Area

This domain is active.

6.1.9 Domain C – Rehabilitation - Pasture

At MOP commencement, pasture rehabilitation had been undertaken in various locations at Ravensworth Operations

6.1.10 Domain D – Rehabilitation - Woodland

At MOP commencement, rehabilitation activities had been undertaken at various locations at Ravensworth Operations.

6.1.11 Domain E – Infrastructure

This domain is still active.

6.2 Proposed Rehabilitation Activities this MOP Period

During this MOP period, rehabilitation at Ravensworth Operations will continue on overburden waste emplacement and general disturbance areas at the site. A woodland species mix will be used for areas of permanent rehabilitation, whereas a pasture species mix will be used in areas of temporary rehabilitation.

Areas that are rehabilitated will be actively managed and monitored as detailed below, and as outlined in the OMCP. Rehabilitation maintenance activities including weed and animal pest control and re-seeding will be undertaken based on annual monitoring results and as required following opportunistic inspections.

The *Cumnock Rehabilitation Remediation Plan* recognises the need to improve canopy densities within the Cumnock area. In most areas identified for rework, the objective is to increase Eucalypt densities to around 300 to 400 stems/ha. This will be achieved through direct seeding using a seed mix that is commensurate with the desired Central Hunter Grey Box – Ironbark Woodland. There are other areas at Cumnock where selective thinning is required to reduce stem densities. The improvement of canopy densities will assist in regulating weeds and encouraging growth of native mid and understorey species.

Mining and rehabilitation activities over the term of this MOP are shown in ***MOP Plan 3A to Plan 3C***. A description of proposed activities for each domain is provided in the following sections.

Final landform shaping will be completed for some areas at Ravensworth North during the MOP period. A large part of the site will still be used during the MOP period for active mining/emplacement or as infrastructure areas. Areas that continue to be used for operational purposes will not be rehabilitated during the MOP period.

The shape of the final landform after mining is integral to the success of the rehabilitation process. The final landform must be structurally stable, with acceptable slopes and unimpeded drainage lines. The final shaped landform is to be constructed in accordance with the approved MOP.

The conceptual final landform for Ravensworth Operations has been designed to blend into the surrounding environment. The natural landforms have the potential to significantly reduce the need for engineered drop structures and are also not dependent on contour drains in the longer term. These landforms offer a diversity of habitat that can enhance the value of rehabilitated ecological systems. All final landform design will be reported in the Annual Review. The OMCP was updated in 2020 to provide additional details regarding landform design and slopes.

Table 6-1 below summarises the forecast rehabilitation progress at Ravensworth Operations during the MOP period.

Table 6-1 – Rehabilitation and Disturbance Rates during the life of the MOP

MOP Plan	Year	Ravensworth Operations	
		Rehabilitation (ha)	Disturbance (ha)
3A	2021	30	7.6
3B	2022	55	25.7
3C	2023	56	49.1
	Total	141	82.4

6.2.1 Domain 1 - Infrastructure

This domain will remain active during the MOP period. At mine closure the infrastructure in this domain that is not required as part of a post closure land use will be removed. **Plan 3C** illustrates the infrastructure that will be remaining at the end of the MOP term.

6.2.2 Domain 2 – Tailings Emplacement

The capping of 7 South Tailings Dam will occur during the MOP period as described in ***Section 1.8.5***.

There may be some decommissioning activities associated with the tailings emplacement facilities at Cumnock during the reporting period. Ravensworth Operations will apply for a HRA notification in relation to the cessation of tailings emplacement in the Cumnock Void 1/2 TSF. Decommissioning and closure of the TSF will be undertaken in accordance with the HRA notification and the Cumnock Closure Plan.

6.2.3 Domain 3 – Water Management Area

Water management areas will continue to be managed as detailed in **Section 2.2.3**. Remediation works of Bayswater Creek drop structure may be undertaken during this MOP term.

6.2.4 Domain 4 – Overburden Emplacement

Overburden emplacement associated with Ravensworth North will continue to progress further south during the MOP period (western out of pit overburden emplacement area). Overburden emplacement will also be undertaken at Narama in the eastern out of pit emplacement area. With operations continuing at Ravensworth North, Domain 4 will increase in size during the MOP period.

Rehabilitation of overburden emplacement areas will progressively be completed at Ravensworth North and Narama as areas become available during the MOP period.

Decommissioning

No decommissioning activities will be required to rehabilitate overburden emplacement areas of Ravensworth North, Narama and Narama West.

Physical and Chemical Characteristics of Material

The *Biodiversity Management Plan* includes the requirement to complete material and soil characterisation. Material and soil characterisation will be undertaken at an appropriate scale across the site, prior to clearing activities or the re-handling of topsoil that has been stored on site for a period of 2 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 for rehabilitation to be sustainable.

The results from material and soil testing will determine if any ameliorates are required to be added to spoil material and topsoil to achieve sustainable rehabilitation. The *Ravensworth North Topsoil Stripping Management Plan* (*RAVCX-307024981-5670)* outlines the topsoil management procedure implemented at Ravensworth Operations. Ravensworth Operations will endeavour to utilise all available topsoil resources for rehabilitation activities.

Some ameliorates may need to be added to rehabilitated areas, with these possibly including gypsum, lime, fertiliser and biosolids. The use of soil ameliorants is designed to prevent surface crusting, increase moisture and organic content, and buffer surface temperatures to improve germination.

All vegetation which would be destroyed as part of the emplacement of overburden on existing rehabilitation may be removed, with vegetation mulched on site. This mulch will be incorporated into rehabilitation.

Landform Establishment

Landform establishment is outlined in ***Section 2.3.6***. The conceptual final landform for Ravensworth Operations has been designed to blend into the surrounding environment and be consistent with Schedule 3, Condition 40 of PA 09_0176.

Ecosystem Development

Both pasture and woodland species will be used for rehabilitation at Ravensworth Operations. The typical pasture and woodland species mixes used at Ravensworth Operations are outlined in ***Sections 6.2.9*** and ***6.2.10***, respectively.

Landform Profile

Ravensworth Operations have designed overburden emplacement locations at Ravensworth North (northern out of pit overburden emplacement areas) and Narama (eastern out of pit overburden emplacement areas) to comply with PA 09_0176 as modified. The changes related to the final landform are outlined within ***Section 6.3*** of this MOP.

Drainage and Erosion and Sediment Control

Elements such as drainage paths, contour drains, ridgelines, and emplacement areas will be shaped, as much as practical, to undulating profiles in keeping with natural landforms of the surrounding environment. Contour and catch drains are designed to collect surface runoff from revegetation or disturbed areas. Sedimentation dams are incorporated into the final landform to collect runoff from rehabilitated areas and the dam capacities are designed to allow time for suspended sediment to settle out.

Key erosion and sediment controls are outlined in the *Erosion and Sediment Control Plan* which forms part of the *Water Management Plan*. Erosion and sediment controls will need to be completed in accordance with key guidelines including *DECC (2008) Managing Urban Stormwater: Soils and Construction Volume 2E - Mines and Quarries*.

In summary, Ravensworth Operations utilise some of the following erosion and sediment controls to minimise erosion from rehabilitation:

- Sediment dams;
- Drainage lines to manage clean and dirty water runoff; and
- Erosion controls such as sediment fencing, straw bales etc.

Habitat Establishment

One of the rehabilitation objectives at Ravensworth Operations is to re-establish those vegetation communities and fauna habitats currently occurring across Ravensworth Operations and connect as far as reasonably practical, the habitat areas to the north and south of the disturbance areas with a vegetated corridor. Local indigenous species will be used in the revegetation of woodland areas, which will be linked with existing vegetated areas to improve ecological function and provide habitat.

The salvage of hollow bearing trees, hollow logs, fallen timber and boulders will be undertaken, where practical, during the clearing process. The relocation of such habitat resources into post-mining rehabilitation areas and Offset Areas (where deemed to be appropriate) is aimed at increasing habitat complexity in these areas, in order to make them more habitable for native species.

Rehabilitation associated with Ravensworth Operations aims to provide linkage with existing rehabilitation areas, future rehabilitation areas and currently undisturbed areas.

An existing section of Emu Creek (ephemeral) is located within the Project Approval Area and will be mined through during the MOP period in accordance with PA 09_0176 and the EA. The re-establishment of Emu Creek will not be completed until approximately Year 19 of the Ravensworth Operations Project. The *Creek Diversion Management Plan – Bayswater Creek and Emu Creek* has been prepared as an appendix to the *Water Management Plan* and outlines a conceptual design of the Bayswater Creek diversion and Emu Creek diversion at Ravensworth Operations. A more detailed design has been approved for the Bayswater Creek Diversion. This will be completed in accordance with the management plan.

A specific Emu Creek Diversion Management Plan will be completed closer to the re-establishment of Emu Creek to ensure compliance with Schedule 3, Conditions 30 and 31 of PA 09_0176.

Maintenance Activities

Rehabilitation maintenance is to be completed in accordance with the *Ravensworth Complex Biodiversity Management Plan.* Key rehabilitation maintenance requirements include:

- Weed and feral animal control of rehabilitation;
- Erosion control works;
- Re-seeding/planting of rehabilitation areas that may have failed;
- Maintenance fertilising;
- Repair of fence lines, access tracks and other general related land management activities; and
- Implementation of the *Cumnock Rehabilitation Remediation Plan* (as described in ***Section*** *Error! R eference source not found.***)**.

The *Cumnock Rehabilitation Remediation Plan* recommends management measures to ensure that the woodland rehabilitation in the Cumnock area meets the target community (Central Hunter Grey Box – Ironbark Woodland). The recommended management measures include:

- Control of exotic grasses through grazing, slashing and mechanical removal;
- Targeted weed reduction (including removal of undesirable tree species);
- Improving density of canopy species (i.e. Eucalypts); and
- Increase planting of native grasses and shrubs.

6.2.5 Domain 5 – Active Mining Area

Mining associated with Ravensworth North will continue to progress further south during the MOP period. ***MOP Plan 3C*** illustrates the area of Ravensworth North that will be under the different rehabilitation phases at the end of the MOP period.

Some of the active or previous mining areas at Narama, Narama West and Ravensworth North will be rehabilitated during the MOP period. With mining progressing during the reporting period, large areas classified as active mining (Domain 5) will transfer to overburden emplacement (Domain 4).

Management of Cleared Vegetation

Disturbance of native vegetation will be kept to a minimum and clearing will be constrained to the footprint area of the infrastructure and mining areas. The *Biodiversity Management Plan* details the management of cleared vegetation.

Prior to any ground disturbance activities, a GDP is required to be approved by the Environment and Community Coordinator or their delegate, Mine Surveyor and Task Coordinator. The purpose of the GDP is to ensure that the required environmental approvals have been received and appropriate environmental management controls have been implemented prior to the commencement of work. Controls outlined in the GDP are to be implemented before any ground disturbing activities may commence.

A pre-clearing survey procedure has been developed to minimise the impact of clearing on native species (both threatened and non-threatened), as well as significant habitat features. Pre-clearing surveys will be required before areas of woody native vegetation (including shrublands and scattered trees within grassland) are to be cleared. In all cases, a suitably qualified ecologist is required to complete the pre-clearing surveys.

6.2.6 Domain 6 – Offset Area

This domain is active and will continue to be monitored and managed by Ravensworth Operations during the MOP period. The main activities completed within offset areas (including the Ravensworth North offset area) are weed and feral animal management. The *Biodiversity Management Plan* and ***Section 2.2.6*** of this MOP outline the process of weed and feral animal management within offset areas. Key controls include:

- Existing weed management controls at Ravensworth Mine Complex will be used within Offset Areas;
- Emerging threatening weeds, will be targeted by control programs;
- Biannual monitoring of weed species in Offset Areas will be managed by the Environment and Community Manager or his or her delegate;
- Weed control methods will be implemented and undertaken in consultation with suitably qualified experts, as required, and may include hand removal, mechanical removal and application of approved herbicides when favourable conditions prevail; and
- Monitoring and inspections of areas to assess the effectiveness of the weed control program and to ascertain the requirement for further work;

The management strategy for feral animals involves a monitoring and trapping/baiting program. The program is carried out by experienced consultants and adhered to all best practise guidelines set by BCD and the Livestock Health and Pest Authority.

The *Biodiversity Management Plan* outlines strategies to be used if remediation work is required in offset areas. Ravensworth Operations are proposing that only minor remediation work would be required in offset areas during the MOP period. Works may include weed and pest management activities, minor erosion and sediment control activities and seeding of locally endemic species (if required).

6.2.7 Domain A – Final Void

With mining scheduled to 2034, the final void will increase in volume and size as the mine progresses. There will be no rehabilitation associated with the final void at Ravensworth Operations during the MOP period.

The final land use for the final void has not yet been determined, with a decision on the final land use of the final void to be made closer to mine closure. The *Conceptual Void Management Plan* identified a number of potential final land uses. Detailed measures to manage the final void will be outlined in the Detailed RMCP, which is to be prepared at least 5 years prior to mine closure.

6.2.8 Domain B – Water Management Area

Water management areas will continue to be managed as detailed in ***Section 2.2.3*** (also in accordance with Domain 1). This rehabilitation will include temporary mitigation measures to limit erosion of the existing structures and stabilise the creek alignment in line with the Creek Diversion Management Plan.

6.2.9 Domain C – Rehabilitation (Pasture)

The typical pasture species mix used for rehabilitation at Ravensworth Operations includes:

- Japanese Millet;
- Ryecorn/Oats;
- Couch Grass;
- Wimmera Ryegrass;
- White Clover;
- Lucerne;
- Sub Clover;
- Phalaris Sirosa;
- Kikuyu;
- Green Panic;
- Setaria; and
- Sephic Medic.

Approximately 19.7 ha of pasture rehabilitation is scheduled to the completed at Narama during the MOP period. Rehabilitation monitoring will continue to be conducted during the MOP period to assess rehabilitation progress and success.

In order to demonstrate rehabilitation success or succession toward rehabilitation success, specific indicators will be expected to equal or exceed values obtained from the reference site under the same set of conditions or demonstrate a positive trend towards target values.

A pasture mix will be used for temporary rehabilitation of disturbed areas at Ravensworth Operations.

6.2.10 Domain D – Rehabilitation - Woodland

Table 6-2 outlines the typical woodland species mix for Ravensworth Operations.

Table 6-2 – Typical Woodland Species Mix

Overstorey	Middlestorey	Understorey	Riparian
Acacia implexa	*Acacia decurrens*	*Dianella caerulea*	*Juncus usitatus*
Acacia salicina	*Acacia filicifolia*	*Lomandra multiflora subsp. multiflora*	*Lomandra multiflora*
Allocasuarina luehmannii	*Acacia longifolia subsp. multiflora*	*Austrodanthonia linkii*	*Casuarina glauca*
Angophora floribunda	*Acacia parvipinnula*	*Austrostipa scabra*	

Overstorey	Middlestorey	Understorey	Riparian
Brachychiton populneus subsp populneus	*Bursaria spinosa*	*Chloris verticosa*	
Callitris endlicheri	*Notelaea microcarpa var. macrocarpa*	*Cynodon dactylon*	
Eucalyptus crebra	*Acacia decora*	*Dichondra repens*	
Eucalyptus tereticornis	*Acacia paradoxa*	*Themada australis*	
Eucalyptus molucanna	*Dodonaea viscosa*	*Bothriochloa macra*	
		Microlaena stipoides var	

For areas of woodland rehabilitation, the site will be shaped, deep-ripped and then direct-seeded with a mix of native tree and shrub species which is blended where required with an appropriate ameliorant as determined by soil/subsoil characterisation analysis.

Rehabilitation monitoring using analogue sites will continue to be used to assess rehabilitation progress and success. In order to demonstrate rehabilitation success or succession toward rehabilitation success, specific indicators will be expected to equal or exceed values obtained from the reference site under the same set of conditions or demonstrate a positive trend towards target values. The existing rehabilitation monitoring program and analogue sites will be expanded to include riparian areas and offset areas.

It is planned that the following woodland rehabilitation will be completed in the following areas at Ravensworth during the MOP period:

- Narama – 16 hectares of woodland rehabilitation; and
- Ravensworth North – 105 hectares of woodland rehabilitation.

Specific remediation measures will be undertaken in the Cumnock area in accordance with the *Cumnock Rehabilitation Remediation Plan*.

6.2.11 Domain E – Infrastructure

This domain will remain active during the MOP term. A decision will be made closer to mine closure in consultation with the Resources Regulator to determine if any infrastructure associated with Ravensworth Operations is needed for future mining/infrastructure projects in the area.

The EA states that:

"All buildings, fixed plant and other infrastructure that are not required as part of the post-closure land use will be demolished and removed from the site".

MOP Plan 3C illustrates the proposed infrastructure which will still be in use at the end of the MOP period.

6.3 Summary of Operational Activities during the MOP Period

Ravensworth Operations has prepared this MOP to describe the operational changes that will ultimately develop the final landform. The figures below outline these changes, with key aspects including:

- There will be an approximately 5.50Mbcm addition to MOP approved landform;
- 10 degree batters, with a flat top landform at RL 150 for the Western OEA;

- There will be an approximate 2.09 Mbcm cut/fill to achieve the final landform and cover the ROM pad;
- Variable batter angles to tie in with surrounding landform; and
- Prevents any water pooling on ROM compared to current landform.

Figure 1 Combined Interim and Final Landform Surfaces

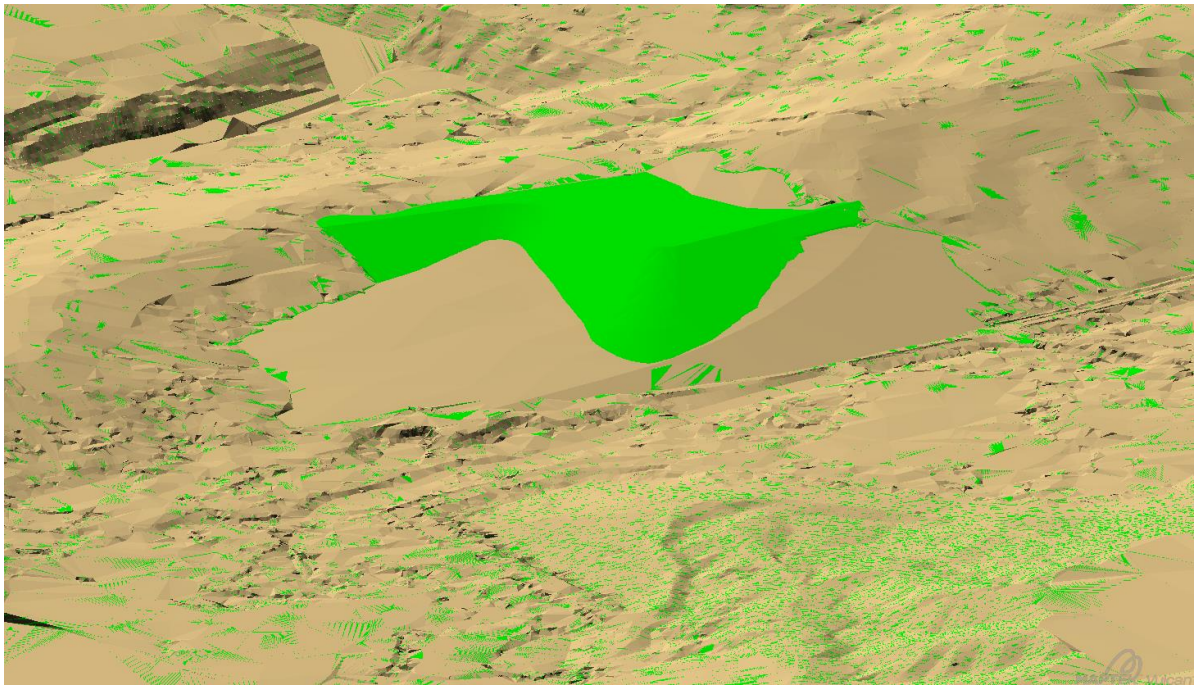


Figure 2 Landform Design including the new dump

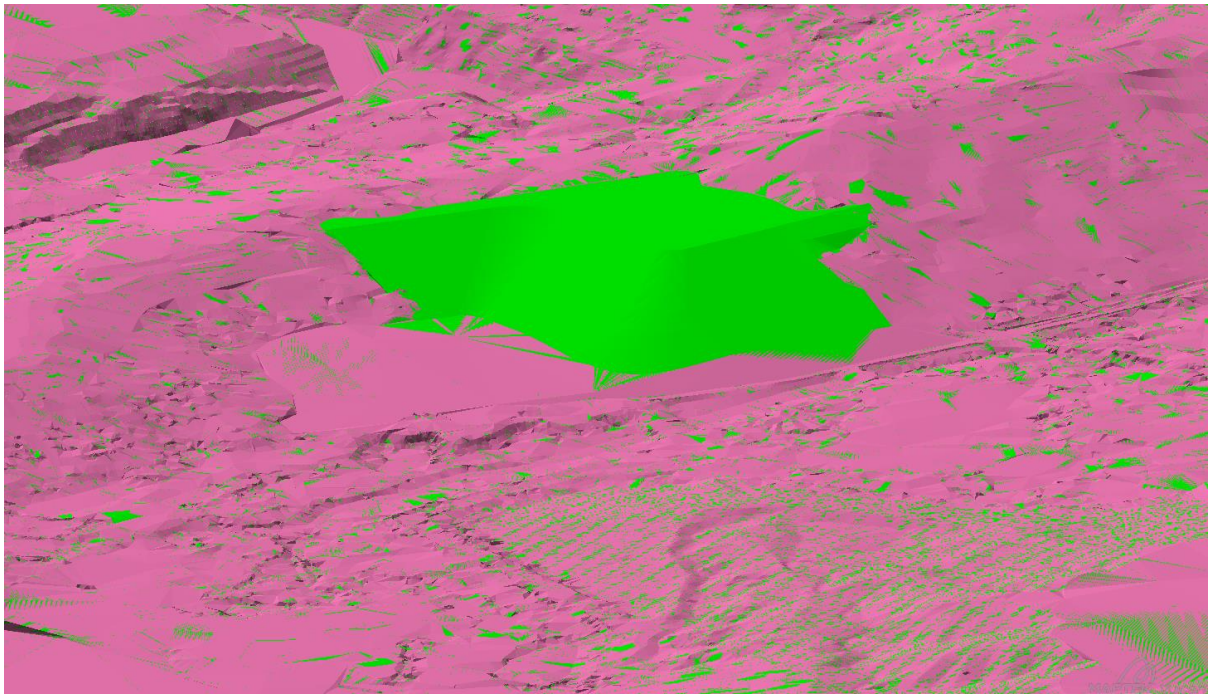
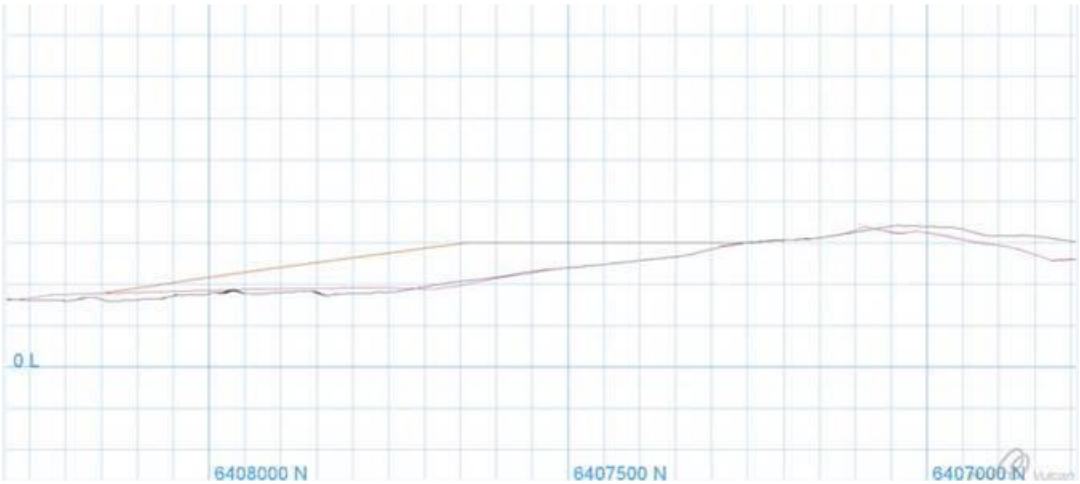


Figure 3 Proposed New Dump

Figure 4 Cross Section of new dump vs existing design



6.4 Summary of Rehabilitation Areas during the MOP Period

Table 6-3 and Table 6-4 outline the proposed rehabilitation of primary and secondary domains. Rehabilitation totals have been broken into rehabilitation phases. A new column has been added to ***Table 6-3*** to outline the total area of greatest disturbance during the MOP period.

Table 6-3 – Summary of Rehabilitation Proposed during the MOP Period - Primary Domains

	Total Area at MOP start (ha)	Total Area in Greatest Year of Disturbance – End of 2021 (ha)	Area Affected / Rehabilitated (ha) Total Area at end of MOP – End of 2023
Domain 1 – Infrastructure (Mining and RCHPP)			
Active	395.8	410.1	367.8
Decommissioning	0	0	42.3
Landform Establishment	N/A during this MOP period		
Growth Medium Development			
Ecosystem and Land use Establishment			
Ecosystem and Land use Sustainability			
Land Relinquishment			
Domain 2 – Tailings Storage Area			
Active	91.5	91.5	91.5
Decommissioning	12.6	0	0
Landform Establishment	N/A in this MOP period		

	Total Area at MOP start (ha)	Total Area in Greatest Year of Disturbance – End of 2021 (ha)	Area Affected / Rehabilitated (ha) Total Area at end of MOP – End of 2023
Growth Medium Development			
Ecosystem and Land use Establishment			
Ecosystem and Land use Sustainability			
Land Relinquishment			
Domain 3 – Water Management			
Active	86.5	67.9	67.9
Decommissioning	0	18.6	18.6
Landform Establishment	N/A in this MOP Period		
Growth Medium Development			
Ecosystem and Land use Establishment			
Ecosystem and Land use Sustainability			
Land Relinquishment			
Domain 4 – Overburden Emplacement			
Active	623.8	629.2	593.9
Decommissioning	N/A in this MOP period	30	141
Landform Establishment		30	141
Growth Medium Development		30	141
Ecosystem and Land use Establishment		30	141
Ecosystem and Land use Sustainability		0	0
Land Relinquishment		0	0
Domain 5 – Active Mining			
Active	283.1	282.2	302.2
Decommissioning	N/A in this MOP period		
Landform Establishment			

	Total Area at MOP start (ha)	Total Area in Greatest Year of Disturbance – End of 2021 (ha)	Area Affected / Rehabilitated (ha) Total Area at end of MOP – End of 2023
Growth Medium Development			
Ecosystem and Land use Establishment			
Ecosystem and Land use Sustainability			
Land Relinquishment			
Domain 6 – Offset Areas			
Active	1958 ha (Ravensworth North Offset Area = 284 ha)	1958 ha (Ravensworth North Offset Area = 284 ha)	1958 ha (Ravensworth North Offset Area = 284 ha)
Decommissioning	0	0	0
Landform Establishment	0	0	0
Growth Medium Development	0	0	0
Ecosystem and Land use Establishment	0	0	0
Ecosystem and Land use Sustainability	0	0	0
Land Relinquishment	0	0	0

Table 6-4 – Summary of Rehabilitation Proposed during the MOP Period – Secondary Domains

	Total Area at MOP start (ha)	Total Area in Greatest Year of Disturbance – End of 2021 (ha)	Area Affected / Rehabilitated (ha) Total Area at end of MOP –End of 2023
Domain A – Final Void			
Active	N/A in this MOP period		
Decommissioning			
Landform Establishment			
Growth Medium Development			
Ecosystem and Land use Establishment			
Ecosystem and Land use Sustainability			

	Total Area at MOP start (ha)	Total Area in Greatest Year of Disturbance – End of 2021 (ha)	Area Affected / Rehabilitated (ha) Total Area at end of MOP –End of 2023
Land Relinquishment			
Domain B – Water Management Area			
Active	N/A in this MOP period		
Decommissioning			
Landform Establishment			
Growth Medium Development			
Ecosystem and Land use Establishment			
Ecosystem and Land use Sustainability			
Land Relinquishment			
Domain C – Rehabilitation Pasture			
Active	282.4	281.6	256.2
Decommissioning	N/A in this MOP period	0.8	45.2
Landform Establishment		0	19.7
Growth Medium Development		0	19.7
Ecosystem and Land use Establishment	282.4	281.6	256.1
Ecosystem and Land use Sustainability	0	0	0
Land Relinquishment	0	0	0
Domain D – Rehabilitation Woodland			
Active	762.2	792.2	878.9
Decommissioning	N/A in this MOP period	0	4.6
Landform Establishment		30	121.3
Growth Medium Development		30	121.3
Ecosystem and Land use Establishment	762.2	792.2	878.9
Ecosystem and Land use Sustainability	0	0	0

	Total Area at MOP start (ha)	Total Area in Greatest Year of Disturbance – End of 2021 (ha)	Area Affected / Rehabilitated (ha) Total Area at end of MOP –End of 2023
Land Relinquishment	0	0	0
Domain E - Infrastructure			
Active	0	0	0
Decommissioning	N/A in this MOP period		
Landform Establishment			
Growth Medium Development			
Ecosystem and Land use Establishment			
Ecosystem and Land use Sustainability			
Land Relinquishment			

The mining process at Ravensworth Operations does not allow for areas of landform establishment at the year end or at the end of the MOP period, as all areas go from active mining, overburden emplacement, landform establishment, to growth medium establishment through the year. This process is completed in accordance with the OMCP and is best rehabilitation practice. Data will therefore not be recorded as the landform establishment phase in ***MOP Plans (3A – 3C)*** or in ***Table 6-4*** above.

6.5 Relinquishment Phase Achieved during the MOP Period

As mining activities at Ravensworth Operations are planned to continue beyond the current MOP period, no areas are anticipated to meet the required rehabilitation obligations for lease relinquishment.

7. Rehabilitation Monitoring, Research and Reporting

7.1 Rehabilitation Monitoring

Ravensworth Operations has an extensive rehabilitation monitoring program which is undertaken in accordance with the *Completion Criteria Development and Rehabilitation Monitoring Procedure*.

Ravensworth Operations will record the details of each rehabilitation and revegetation campaign so that they are available for later interpretation of rehabilitation monitoring results. This will allow the continual improvement of rehabilitation and revegetation standards on site.

Ravensworth's rehabilitation monitoring program consists of two components: Initial Establishment Monitoring (IEM) and Long Term Monitoring (LTM). IEM is a rapid assessment of young (≤3 years old) rehabilitated areas, principally to determine germination success and landform stability, whilst LTM is conducted in older rehabilitation areas (≥ 4 years old) to evaluate their progress towards fulfilling agreed completion criteria and the targeted post mining land use.

Annual rehabilitation monitoring programs are implemented by a suitably qualified and experienced consultant utilising the current NSW Biodiversity Assessment Methodology (BAM). Further detail on monitoring methodologies and deliverables is outlined in the *GCAA Rehabilitation Monitoring Scope for NSW Operations*. In addition to IEM and LTM, an Annual Rehabilitation Inspection is undertaken to further inform the overall condition of rehabilitated areas and focus on identifying any issues requiring maintenance. The inspection includes but is not limited to the identification of:

- Erosion (rill, gully, tunnel etc);
- Stability and function of erosion and sediment control and water management structures;
- Presence of habitat features;
- Visual assessment of vegetation cover, species diversity, vegetation health and growth rates;
- Presence of weeds and pests; and
- Disturbance factors.

In accordance with the *Completion Criteria Development and Rehabilitation Monitoring Procedure*, the long term rehabilitation monitoring program reports should:

- Compare results against rehabilitation objectives, nominated completion criteria and site specific TARP (***Section 8.2***);
- Classify and map rehabilitation areas using the following performance categories;
    - Rework – Does not meet completion criteria. Extensive rework required that would not typically form part of a rehabilitation maintenance program;
    - Maintenance - Does not meet completion criteria. Routine rehabilitation maintenance works required;
    - Monitor – Trajecting towards completion criteria but does not meet all criteria. No intervention required but continue to monitor; or
    - Acceptable - Meets all completion (success) criteria and ready for sign off by stakeholders.

- Report key trends in monitoring results and progression towards achievement of rehabilitation objectives and completion criteria using performance categories;
- Identify any required rehabilitation repairs and other rehabilitation care and maintenance requirements;
- Assess effectiveness of environmental controls implemented;
- Identify opportunities for continual improvement in rehabilitation practices or additional trials or research; and
- Identify opportunities for continual improvement of the monitoring program.

To assess the success of the remediation works of the Bayswater Creek drop structure, an annual walk over and photographic record will be kept of the works. This inspection will include records of recent weather, the stability, vegetation cover and the absence/ presence of erosion. These records will then be incorporated into the works undertaken as part of the Bayswater Creek diversion remediation consistent with the *Creek Diversion Management Plan – Bayswater Creek and Emu Creek*.

Purpose of Rehabilitation Monitoring

The objectives of undertaking rehabilitation monitoring include:

- Fulfil commitments made by Ravensworth Operations in regards to rehabilitation monitoring within management plans (*Biodiversity Management Plan, OMCP)*;
- Fulfil Glencore requirements;
- Enable assessment and management of impacts on biodiversity and rare species;
- Provide feedback for continuous improvement in rehabilitation. Rehabilitation results are reviewed with rehabilitation practices amended as required;
- Assess the effectiveness of erosion control measures (soils, vegetation, water quality);
- Identify any rehabilitation performance issues which require management;
- Identify research needs for specific problems, and provide relevant data;
- Provide information for stakeholders and public relations;
- Assess when rehabilitation goals have been attained, leading towards mine closure; and
- Assess rehabilitation phases.

Timing

The *Biodiversity Management Plan* provides details of ecological and rehabilitation monitoring completed at Ravensworth Operations. In summary, the following is completed:

Table 7-1 - Rehabilitation Monitoring Timing and Frequency

Monitoring	Frequency/Timing
Initial Establishment Monitoring – Rehabilitation Sites	• Rehabilitation ≤ 1 year old (Inspection only) • Rehabilitation ≥ 2 and ≤ 3 years old • Monitoring undertaken annually and consistently in the same season
Long Term Monitoring - Rehabilitation Sites	• Commencing for rehabilitation ≥ 4 years old • Biennial for six years and triennial for the remainder of the project • Monitoring undertaken annually and consistently in the same season
Long Term Monitoring - Analogue Reference Sites	• Biennial and staggered (half monitored one year, followed by the other half the next year)
Soil Sampling	• Prior to rehabilitation to inform amelioration requirements • Sampling as required on recalcitrant bare areas (>400m2) as determined by inspections and monitoring
Rehabilitation Inspections (Rapid assessment)	• Annually across polygons subject to IEM or LTM
Fauna Monitoring	• At least once every three years

Monitoring and Measurement Following Closure

Following closure of the operation, the existing environmental monitoring program as per the requirements of PA 09_0176 and EPL 2652 will be maintained until all decommissioning and rehabilitation works have been completed. Notwithstanding this, there may be the need to establish some additional monitoring sites depending on the nature of the decommissioning works and also in response to finding possible sources of pollutants to the environment.

The post closure monitoring and measurement program will be similar to that undertaken during operation of Ravensworth Operations, but will be scaled back to focus on those aspects of the site that have the potential to cause pollution or is being used as an indicator to verify the success or failure of the rehabilitation works.

Post closure monitoring will be conducted for up to five years after decommissioning and final rehabilitation has been completed, or until such time as monitoring records demonstrate that the site is no longer contributing, nor has the potential to contribute, pollutants to the surrounding environment, and that rehabilitation has achieved a satisfactory stage of maturity and ground cover.

7.2 Research and Rehabilitation Trials and Use of Analogue Sites

Ravensworth Operations have undertaken numerous rehabilitation trials in the past, with excellent rehabilitation results achieved from some of these trials. Many of these trials, which have been

completed at Narama, Ravensworth West and Cumnock, have involved innovative practices for habitat augmentation. Soil ameliorates such as biosolids, gypsum and lime have successfully been used at Ravensworth Operations to improve rehabilitation results. These have included trials for pasture and woodland rehabilitation. Each year the rehabilitation trials are reviewed with key findings presented in the Annual Review.

All disturbed areas will be progressively rehabilitated throughout the life of the mine to achieve a suitable final landform. Progressive rehabilitation has the advantage of allowing for practical trials of rehabilitation techniques that may require refining or the commencement of detailed research before their more widespread use.

Analogue Sites

Analogue sites are outlined in the 2019 Rehabilitation Monitoring Report prepared by Koru Environmental. Analogue sites indicate the condition of the native communities in the vicinity of the mining area. Four analogue sites were established in areas of remnant woodland within the Ravensworth Operations mining authorities. Similar to other woodland monitoring sites, the analogue sites exist in the form of 20 x 20m quadrats and are surveyed for species diversity and cover abundances.

The 2019 rehabilitation monitoring program found that the vegetation composition, structure and function values at the analogue sites were consistently lower than the published OEH benchmarks. These lower values were attributed to the prolonged dry conditions experienced in the region. The results of the 2019 monitoring program indicate that the analogue sites provide a more realistic benchmark for the assessment of rehabilitation condition than the OEH benchmark values.

7.3 Rehabilitation Trials and Research

The Hunter Ironbark Research Program was conducted in accordance with Schedule 3, Condition 36 of PA 09_0176. The research program was funded by Ravensworth Operations and undertaken by the University of Newcastle's Centre for Sustainable Ecosystem Restoration from 2013 to 2016. The final report on this research program is published on the Ravensworth Operations website:

https://www.ravensworthoperations.com.au/en/publications/Pages/research-plans-programs.aspx

The findings of this research program inform rehabilitation programs across the site.

7.4 Proposed Remediation Actions

7.4.1 Cumnock Rehabilitation Remediation

Weed Management

The *Cumnock Rehabilitation Remediation Plan* (Koru Environmental, 2020) was prepared to address regulatory concerns that the woodland rehabilitation at the former Cumnock Mine was not meeting the desired vegetation community (Central Hunter Grey Box – Ironbark Woodland). Koru Environmental identified that weed infestation (particularly exotic grasses) was a key risk to the successful establishment of the target community.

The exotic grasses prevalent within the Cumnock area include *Cenchrus clandestinus*, *Chloris gayana*, *Hyparrhenia hirta*, *Megathyrsus maximus* and *Setaria sphacelata*. Most of these species are listed as 'high threat exotics' under the *Biobanking Assessment Method* (OEH, 2017). The Plan recommends several management strategies for exotic grasses, of which the following are most suitable:

- Chemical (herbicide) application;

- Mechanical removal;
- Slashing or mowing; and
- Cattle grazing.

Targeted weed reduction works will be undertaken for two shrub species (*Galenia pubescens* and *Acacia saligna*). Herbicide application has been identified as the most appropriate controls for these species. The establishment of a dense canopy and the resultant reduction in light access will also assist in suppression of *Acacia saligna*. Land that has been infested by *Acacia saligna* may exhibit elevated soil nitrogen. Soil sampling of such areas will be undertaken prior to revegetation with native species. If required, elevated nitrogen levels can be treated through use of nitrophilous cover crops or application of mulch/sawdust (which decompose using nitrogen-consuming microbes).

Eucalyptus cladocalyx is a woodland tree species that is native to South Australia but has historically been included in seed mixes for Hunter Valley mines. Although it is a native species, *Eucalyptus cladocalyx* may inhibit the establishment of native shrubs and groundcover species. The most suitable management strategy for this species is a combination of felling and herbicide application (i.e. 'cut and paint'). Larger trees may require injection techniques.

Vegetation Improvements

The *Cumnock Rehabilitation Remediation Plan* identified areas with insufficient canopy tree densities. In such areas, revegetation will be undertaken through direct seeding using a seed mix commensurate with the target vegetation community. The preferred canopy tree species are *Eucalyptus crebra* and *Eucalyptus moluccana*. The seeding rate for Eucalypt species is generally 3 to 4 kg/ha. The desired canopy tree density is in the order of 300 to 400 stems/ha.

There are some areas where the existing canopy will need to be thinned to allow mid and understorey species to persist. Selective thinning of the canopy will also target a tree density of 300 to 400 stems/ha.

Planting of native shrubs and grasses will be undertaken in conjunction with the aforementioned canopy improvements. The species to be used for revegetation are listed in the *Cumnock Rehabilitation Remediation Plan*.

Autumn is generally the most suitable season for revegetation efforts, although favourable conditions may also arise in early to mid Spring.

The proposed remediation works are described in detail in the *Cumnock Rehabilitation Remediation Plan*.

Monitoring

The proposed remediation program will be implemented over a five year period (2020 to 2024). Inspections will be conducted annually during this period. The objectives of monitoring are to:

- Assess and document the success of completed remediation works;
- Ensure that cattle are excluded from restored areas;
- Identify key weed incursion and erosion issues (particularly in reworked areas) to inform the maintenance action plan for the following year; and
- Determine the need for further improvement works or adjustments to management strategies.

The results of the annual rehabilitation monitoring program will be reported in the annual review

7.5 Reporting

An Annual Rehabilitation and Closure Plan (ARCP) is developed each year based on the mining plan, results from the annual rehabilitation inspections and rehabilitation monitoring reports. As part of the ARCP, an annual rehabilitation maintenance plan is prepared to identify and address non performing areas of rehabilitation.

A summary of rehabilitation and offset monitoring is included in the Ravensworth Complex Annual Review. The Annual Review is sent to Resources Regulator, DPIE, BCD and other relevant stakeholders.

Under its EPBC approval, Ravensworth Operations is required to report on its rehabilitation and offsets after year 3, 5 and 10 of operations at Ravensworth Operations. Ravensworth Operations prepares an annual compliance report based on the approval conditions in the EPBC approval (2010/5389). These conditions refer to offset requirements, ecological management and threatened species management. A copy of the report can be found on the Ravensworth Complex website.

Internal Glencore rehabilitation reporting requirements include reporting rehabilitation progress against annual site rehabilitation targets, and reporting key monitoring results and trending against completion criteria in the sites Annual Rehabilitation and Closure Plan.

External reporting includes preparation of annual reports assessing rehabilitation progress against the rehabilitation schedule included in the MOP as part of the submission of the Annual Review to the relevant regulatory authorities, as well as other rehabilitation monitoring reports that may be required by other approvals.

8. Intervention and Adaptive Management

8.1 Risks to Rehabilitation

Risks associated with rehabilitation at Ravensworth Operations are outlined in the ECBBRA and the Trigger Action Response Plan (TARP) in ***Table 8-1*** .

8.2 Trigger Action Response Plan

The following TARP has been developed to identify the 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. Ravensworth Operations will notify the Resources Regulator and other relevant stakeholders of any incident resulting in major impacts to rehabilitation. The TARP has been developed based on the rehabilitation and closure risks identified in the ECBBRA. The TARP includes:

- Identification of the principal contributing factors and impacts for each major risk to rehabilitation;
- Identification of upper limits (trigger values) for causes and impacts that are considered to represent an unacceptable level of risk; and
- Identification of appropriate responses to mitigate or remediate the causes and impacts, including a notification protocol.

The TARP provides management responses for lower (first tier) and upper (second tier) trigger values. First tier trigger values identify opportunities for closer monitoring or early intervention that may mitigate potential impacts before notable impact to rehabilitation occurs. Second tier trigger values identify when indicators have reached a threshold that requires more substantive or widespread remedial actions to remediate or mitigate rehabilitation failure.

The TARP is provided as ***Table 8-1*** below, and will be reviewed and may be revised as conditions at Ravensworth Operations change or new risks to rehabilitation are identified.

Table 8-1 – Trigger Action Response Plan – Rehabilitation and Closure

Aspect/Category	Key Element	Trigger Response	1st Level Trigger	2nd Level Trigger
Landform Stability	Erosion control	Trigger	Minor gully or tunnel erosion present and/or minor rilling (rilling up to 200 mm).	Slumping and /or significant gully or tunnel erosion present and/or significant rilling (where required)
		Response	An inspection of site will be undertaken by a suitably trained person. Investigate opportunities to install water management structures to address erosion. Remediate as appropriate.	Engage a consultant to assist with the management of erosion and sedimentation at the site and provide recommendations to appropriately remediate the erosion. Remediate as soon as practicable. Review, and update where required, the *Erosion and Sediment Control Plan*.
	Free Draining Landforms	Trigger	Landforms exhibiting minor ponding.	Landforms exhibiting significant drainage issues, threatening or causing material harm to the environment.
		Response	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 landform design, including survey if required. Undertake re-grading and re-vegetation of the area.
	Water Management Structures	Trigger	Water management structures (sediment dams, channels, contour banks) minor erosion and/or scouring.	Water management structures fail or display significant scouring / erosion (where required
		Response	An inspection of the site will be undertaken by a suitably trained person. Identify remedial actions such as amelioration, re-vegetation or alternative scour protection.	Engage specialist consultant to develop a site specific remediation plan and review water management structure design criteria.
	Ground cover percent	Trigger	Bare surfaces >20m^2 in area or >10m in length downslope are present.	During Ecosystem Establishment, vegetative cover is 50% or less. Bare surface > 30m^2 in area or >20m in length downslope are present.

Aspect/Category	Key Element	Trigger Response	1st Level Trigger	2nd Level Trigger
		Response	Undertake a field survey to identify likely causes of unsatisfactory germination rates. Re-seed areas with unsatisfactory cover. Review seeding procedures incl. seasonal mixes, timing and seed rate per hectare. Undertake soil testing	Engage a suitably qualified specialist to investigate causes for germination failure and recommend remedial actions. Implement appropriate management actions including revising rehabilitation procedures if required. Undertake soil testing
Biodiversity (native vegetation areas)	Rehabilitation success	Trigger	<75% but >55%of shrubs and/or trees are healthy when ranked healthy, sick or dead in during rehabilitation inspections in the Ecosystem Establishment phase.	<55% of shrubs and/or trees are healthy when ranked healthy, sick or dead in during rehabilitation inspections in the Ecosystem Establishment phase.
		Response	Undertake a field survey to identify likely causes of vegetation sickness and/or death rates. Re-seed or re-plant areas with high sickness or death rates. Review seeding and/or planting procedures.	Engage a suitably qualified specialist to investigate causes for vegetation sickness and death. Implement appropriate management actions including revising rehabilitation procedures if required.
	Weed Presence	Trigger	> 10% but <25% cover of undesirable species present in Ecosystem Establishment phase.	>25% cover of undesirable species present in Ecosystem Establishment phase.
		Response	Engage weed management contractor to remove / spray introduced weed species. Treatment of infestations as appropriate to the species.	Engage weed management contractor to remove introduced weed species. Investigate management measures to reduce weeds including additional soil amelioration, establishment and retention of cover crops until weed presence is at acceptable levels. Implement recommendations as appropriate.
	Pasture Seed Mix	Trigger	Palatable, nutritious pasture grass species cover <75% but >55% during the Growth Medium Development phase.	Palatable, nutritious pasture grass species cover <55% Growth Medium Development phase.

Aspect/Category	Key Element	Trigger Response	1st Level Trigger	2nd Level Trigger
		Response	Undertake a field survey to identify likely causes of unsatisfactory germination and/or growth rates. Re-seed areas with unsatisfactory cover. Review seeding procedures incl. seasonal mixes, timing and seed rate per hectare.	Engage a suitably qualified specialist to investigate causes for germination failure and/or reduced growth rates and recommend remedial actions. Implement appropriate management actions including revising rehabilitation procedures if required.
	Temporary Rehabilitation	Trigger	<75% but >55% of vegetation cover is present on areas where hydromulching has been applied within 6 months.	<55% of vegetation cover is present on areas where hydromulching has been applied within 6 months.
		Response	Review RMCP. An inspection of the site will be undertaken by a suitably trained person. Investigate opportunities to address issues. Revegetate as appropriate.	Engage specialist consultant to develop a site specific remediation plan. Revegetate as appropriate.
	Pest animal species presence	Trigger	Pest animal species presence and density increased in annual monitoring events.	Significant numbers of pest animals causing widespread damage to rehabilitation.
		Response	Consult with relevant government agencies (including OEH) to recommend and implement appropriate pest animal control campaign.	Consult with relevant government agencies (including OEH) to recommend and implement appropriate pest animal control campaign. Update to *Biodiversity Management Plan.*
	Native Fauna Presence	Trigger	Decrease in the number of vertebrate species over successive seasons prior to mine closure.	Continued decline in trend in recorded vertebrate species numbers and/or presence and abundance (allow for natural variation occurring in analogue sites).
		Response	Engage ecologist to undertake investigation to determine the cause of change.	Engage ecologist to undertake investigation to determine the cause of change. Liaise with relevant government agencies.

Aspect/Category	Key Element	Trigger Response	1st Level Trigger	2nd Level Trigger
	Native Fauna Presence	Trigger	Loss or deterioration of nest boxes, or pest animal species usage of nest boxes.	Decline in trend in recorded fauna numbers and/or presence and abundance (allow for natural variation occurring in analogue sites).
		Response	Replace damaged / lost nest boxes. Relocate and replace boxes adopted by pests.	Engage ecologist to undertake investigation to determine the cause of change. A site specific management report may be prepared and implemented where necessary that aligns with the *OMCP*.
	Native Animal Control	Trigger	Damage to rehabilitation from native fauna.	Continued damage to rehabilitation from native fauna after tree guards and fencing has been installed.
		Response	Options will be incorporated to maintain survival rates.	Liaise with government agencies and consider a culling program in accordance with National Parks and Wildlife Service regulations.

9. Plans

Ravensworth Operations is classified as a Level 1 Mine, and therefore the following Plans have been prepared:

- ***Plans 1A – 1D*** show the location and pre mining natural and physical environment of Ravensworth Operations;
- ***Plan 2*** shows the mine domains and mining features at commencement the MOP;
- ***Plans 3A – 3C*** are a series of Plans which show the annual sequence of mining and rehabilitation activities over the MOP period;
- ***Plan 4*** shows the proposed post mining land use and landform at the end of mine life; and
- ***Plan 5A and B*** shows vertical and longitudinal cross sections.

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

10. Review and Implementation of the MOP

10.1 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 MOP. The MOP may be reviewed, and if necessary revised, following the submission of the following:

- Annual Review;
- Incident report;
- Audit; or
- Any modification to the conditions of the Project Approval.

This MOP may also be revised due to:

- Deficiencies being identified;
- Results from the monitoring and review program;
- Recommendations resulting from the monitoring and review program;
- Changing environmental requirements;
- Improvements in knowledge or technology become available;
- Change in legislation;
- Where a risk assessment identifies the requirement to alter the MOP; and
- Change in the activities or operations associated with Ravensworth Operations.

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

10.2 Implementation

Table 10-1 defines personnel who are responsible for the monitoring, review and implementation of this MOP.

Table 10-1– Responsibilities for Implementation of the MOP

Title	Responsibility
Mine Manager	Implement the procedures referenced in this MOP; Undertake training in relevant Management Plans and procedures as required; Provide resources required and support to implement these procedures; Construct landforms in accordance with this MOP; and Develop dumping strategies to allow for progressive rehabilitation of mined land.
Technical Services Manager	Implement the procedures referenced in this MOP; Undertake training in relevant Management Plans and procedures as required;

Title	Responsibility
	Provide resources required to implement these procedures; and Develop mine plans to allow for progressive rehabilitation of mined land.
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; and Report the progress of any rehabilitation and monitoring of biodiversity in the Annual Review.
Survey	Prepare MOP Plans in accordance with the MOP Guidelines.

11. Document Information

Relevant legislation, standards and other reference information are regularly reviewed and monitored for updates and should be included in the site management system. Related documents and reference information are described below.

11.1 Related Documents

Related documents, listed in ***Table 11-1*** below, are *documents* directly related to or referenced from within this document.

Table 11-1 – Related documents

Number	Title
GCAA-625378177-15244	*Stakeholder Engagement Strategy*
RAVOC-258458278-15426	*Operational Mine Closure Plan*
RAVCX-307024981-4592	*Ravensworth Complex Water Management Plan*
	Sustainable Development Guideline Risk and Change Management Procedure
GCAA-625378177-2844	*Glencore Coal Assets Australia Risk Management Standard*
GCAA-625378177-16367	*Glencore Coal Assets Australia Closure and Residual Risk Guideline*
RAV SD PLN 0067	*Ravensworth Complex Air Quality and Greenhouse Gas Management Plan*
RAVOC-1007099517-20	*Ravensworth Complex Biodiversity Management Plan*
RAVCX-307024981-4092	*Ravensworth Complex Blast Management Plan*
RAVCX-307024981-4092	*Ravensworth Complex Noise Management Plan*
RAVSD PLN 0063	*Ravensworth Complex Aboriginal Cultural Heritage Management Plan*
RAV SD PLN 0030	*Ravensworth Complex Heritage Management Plan*
RAVOC-258458278-748	*Spontaneous Combustion Principal Mining Hazard Management Plan*
RAVCX-307024981-5670	*Ravensworth North Topsoil Stripping Management Plan*
GCAA-625378177-15551	*Tailings Storage Facilities Protocol*
GCAA-625378177-10325	*Mine Closure Planning Protocol*
GCAA-625378177-16642	*Rehabilitation Monitoring Scope for NSW Operations*

11.2 Reference Information

Reference information, listed in ***Table 11-2*** below, is *information* that is directly referred to for the development of this document.

Table 11-2 – Reference information

Reference	Title
DRE (2013)	*ESG3: Mining Operations Plan (MOP) Guidelines*
DRG (2017)	*Exploration Code of Practice: Rehabilitation*
DRE (2015)	*Exploration Code of Practice: Environmental Management*
EPA (2016)	*Environmental Guidelines: Solid Waste Landfill*
ATC Williams (2012)	*ROC Life of Mine Tailings Storage Strategy*
DECC (2008)	*Managing Urban Stormwater: Soils and Construction Volume 2E - Mines and Quarries*

11.3 Change Information

Full details of the document history are recorded in the document control register, by version. A summary of the current change is provided in ***Table 11-3*** below. Refer to **Figure 5** for MOP approval correspondence.

Table 11-3 – Change information

Version	Date	Change Details
1.0	28 July 2015	New document based on previous versions of the MOP
1.1	4 July 2017	New MOP period
1.2	July 2018	MOP Amendment A
1.3	May 2019	MOP Amendment B
1.4	September 2019	MOP Amendment C
1.5	September 2020	New MOP period

Figure 5 - 2021 - 2023 MOP approval correspondence

NSW GOVERNMENT

Resources Regulator

FORM FRM-222-5 MOP Approval v1.9

Our ref: MAAG0008415
LETT0005205

Anthony Israel
PO Box 294
Muswellbrook NSW 2333
Attn: Anthony Israel

Dear Anthony Israel

ML 1506 (1992), CCL 739 (1973), ML 1576 (1992), ML 1348 (1992), ML 1580 (1992), ML 1398 (1992), ML 1495 (1992), ML 1625 (1992), ML 1669 (1992), ML 1581 (1992), ML 1349 (1992), ML 1477 (1992), ML 1667 (1992), ML 1591 (1992), CCL 723 (1973), ML 1683 (1992), ML 1668 (1992), CL 580 (1973), ML 1485 (1992), ML 1416 (1992), ML 1393 (1992), ML 1595 (1992), ML 1357 (1992), CL 380 (1973), CL 378 (1973), ML 1325 (1992), ML 1502 (1992), Anthony Israel
Approval of Mining Operations Plan and Assessment of Security Deposit

NOTICE OF APPROVAL

Pursuant to the relevant Condition of ML 1506 (1992), CCL 739 (1973), ML 1576 (1992), ML 1348 (1992), ML 1580 (1992), ML 1398 (1992), ML 1495 (1992), ML 1625 (1992), ML 1669 (1992), ML 1581 (1992), ML 1349 (1992), ML 1477 (1992), ML 1667 (1992), ML 1591 (1992), CCL 723 (1973), ML 1683 (1992), ML 1668 (1992), CL 580 (1973), ML 1485 (1992), ML 1416 (1992), ML 1393 (1992), ML 1595 (1992), ML 1357 (1992), CL 380 (1973), CL 378 (1973), ML 1325 (1992), ML 1502 (1992), the Mining Operations Plan (MOP) that was submitted to the Resources Regulator on 7 September 2020 (Department Reference: MAAG0008415) is approved for the period from the date of this approval until 31 December 2023.

It is the responsibility of the Authorisation Holder to ensure that all mining and mining related operations described in this MOP are as approved within the relevant Project Approval or Development Consent and all necessary approvals, consents or permits required under the relevant NSW or Commonwealth regulations have been obtained prior to carrying out the operations.

It is the responsibility of the Authorisation Holder to fulfil their obligations and commitments to the rehabilitation outcomes and performance standards as approved by the relevant consent authority to ensure the rehabilitation outcomes identified are achieved.

ASSESSED DEPOSIT

Approval of this MOP has triggered a review of the assessment of the security deposit required to secure funding for the fulfilment of rehabilitation obligations under the listed Mining Authorisation Number(s).

Notice of any change in the security deposit condition related to this MOP approval will be provided separately.

Resources Regulator
516 High Street MAITLAND NSW 2320 Australia I PO Box 344 HRMC NSW 2310 Australia
Tel: 1300 814 609

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DEFINITIONS

In this letter, words have the meaning given to those terms in the *Mining Act 1992*, unless otherwise specified below.

Assessed Deposit has the meaning given by section 261BC of the *Mining Act 1992*.

Authorisation Holder means the holder of the relevant authorisation(s).

Mining Operations Plan means the project, mining and mining related operations described in the Mining Operations Plan, Ravensworth Open Cut, 1 Jan 2021 - 31 Dec 2023 – September 2020 prepared by Ravensworth Operations Pty Limited .

As amended by Mining Operations Plan, Ravensworth Open Cut, 1 Jan 2021 - 31 Dec 2023 received 26 Oct 2020

If you require additional information, please contact the Resources Regulator on 1300 814 609 (Option 2, then 5), or via email at nswresourcesregulator@service-now.com.

Yours sincerely,

Peter Ainsworth
Manager Environmental Operations
Mining Act Inspectorate
Resources Regulator

4 November 2020

Other copies provided by email to: Klay Marchant

Signed under delegation from the

Appendix A - Project Approval

Appendix B - MOP Rehabilitation Risk Assessment

Appendix C - MOP Plans

Appendix D - Cumnock Void 1/2 TSF Closure Plan

Appendix E - Cumnock Rehabilitation Plan