Mining Operations Plan

Tarrawonga Coal Mine

1 November 2015 to ~~31 December 2020~~30 November 2020

~~Report Number 630.11207~~

~~30 June 2017~~~~01 January 2018~~

March 2019

Tarrawonga Coal Pty Ltd

Boggabri NSW

Version: Amendment ~~B~~ ~~C~~ D

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Tarrawonga Coal Mine

1 November 2015 to 31 December 2020

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Tarrawonga Coal Mine	
Mining Operations Plan	
Name of Mine	Tarrawonga Coal Mine
MOP Commencement Date	1st November 2015
MOP Completion Date	~~31st December~~30th November 2020
Mining Authorisations (Lease / Licence No.)	ML 1579, ML 1693~~ and~~, ML1685 and ML 1749
Name of Authorisation / Authorisations Holder(s)	Whitehaven Coal Mining Limited and Idemitsu Boggabri Coal Pty Ltd
Name of Mine Operator (if different)	Whitehaven Coal Mining Limited
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Title of Representative(s) of Authorisation Holder(s)	GM – Open Cut Operations
Signature of Representative(s) of Authorisation Holder(s)	
Date	~~9/03/2018~~ 15/03/2019
Version	~~Amendment B C D~~

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TABLES

APPENDICES

1 INTRODUCTION

This Mining Operations Plan (MOP) has been prepared by SLR Consulting Australia Pty Ltd (SLR) in conjunction with Tarrawonga Coal Pty Ltd (TCPL), which is a joint venture between Whitehaven Coal Mining Pty Ltd (Whitehaven) and Boggabri Coal Pty Limited (BCPL), for the Tarrawonga Coal Mine (Tarrawonga) in the Gunnedah Basin of northern New South Wales (NSW). This MOP has been prepared to satisfy Condition 2 of Mining Lease (ML) 1579, and Condition 3 of MLs 1685, and 1693 and 1749, and in accordance with the relevant provisions of Project Approval PA 11_0047, as modified. Modification (MOD) 1 issued by the Minister for Planning and Environment (DP&E) on the 6 November 2014 under Section 75W of the *NSW Environmental Planning and Assessment Act 1979* (EP&A Act) for the Tarrawonga Coal Project.

The Tarrawonga Coal Project provides for the continuation and extension of Tarrawonga, as described in the *Tarrawonga Coal Project Environmental Assessment* (Project EA) (Resource Strategies 2012). PA 11_0047 MOD 1 also permits the integration of coal processing and transport from Tarrawonga with the neighbouring Boggabri Coal Mine (Boggabri), which has been approved under Project Approval PA 09_0182.

This MOP has been prepared in accordance with the *Mining Operations Plan (MOP) Guidelines* (DTIRIS 2013) and meets the relevant requirements of PA 11_0047 MOD 1, including the appended Statement of Commitments, and the relevant mineral authorities (refer to **Section 1.5**).

1.1 History of Operations

Tarrawonga (formerly known as East Boggabri Coal Mine) is an open cut coal mine located approximately 15 kilometres (km) north-east of Boggabri and 42 km north-northwest of Gunnedah NSW.

Tarrawonga was originally approved by the Minister for Planning under Development Consent DA 88-4-2005 in November 2005 under Part 4 of the EP&A Act. The Mining Lease ML 1579 was issued for Tarrawonga in April 2006 and coal production subsequently commenced in late 2006. Under the provisions of Development Consent DA 88-4-2005 TCPL was permitted to extract approximately 12.4 million tonnes (Mt) of coal from the open cut pit at Tarrawonga at a maximum rate of 2 million tonnes per annum (Mtpa) using truck and excavator method. This consent also permits road transport of the coal to the Whitehaven Coal Handling and Preparation Plant (CHPP) on the outskirts of Gunnedah for selective washing and subsequent rail transport to the Port of Newcastle. A proportion of coal produced at Tarrawonga is also permitted to be collected at the mine site by domestic customers.

On 15 October 2010, the Minister issued an approval under Section 75W of the EP&A Act to modify Development Consent DA 88-4-2005 (MOD 1). This modification permitted TCPL to extend the open cut pit boundary, increase the total coal production by some 4 Mt, and increase mine waste rock production, as well as associated alterations to the waste rock emplacements. The modification also included the provision of a mobile crusher for domestic coal production and various changes to site water management, soil stockpiles and supporting infrastructure.

In 2013, TCPL received PA 11_0047 from the Planning Assessment Commission (as delegate of the Minister for Planning and Infrastructure) under Part 3A of the EP&A Act for the Tarrawonga Coal Project, which provides for the continuation and extension of the mine. Modification 1 was approved by the Minister for Planning and Environment on 6 November 2014. Modification 2 was approved on 3 November 2016. Modifications 3, 4, and 5 and 6 were approved in February, May, and August of 2017 and November 2018, respectively. The main activities approved are listed in **Section 2.1**.

1.2 Future Operations

Future Integration with Boggabri Coal Mine

PA 11_0047 ~~MOD 1~~ approves integration with the adjoining Boggabri operation, namely:

- Continued development of mining operations in the Maules Creek Formation, including to the north within ML 1685 which adjoins ML 1579;
- Use of upgraded Boggabri Infrastructure Facilities for the handling and processing of up to 3Mtpa ROM coal from Tarrawonga, and the loading of product coal to trains for transport on the Boggabri private rail spur to the Werris Creek - Mungindi Railway; and
- Expanded emplacement of waste rock in the Northern Emplacement as mining develops, ultimately integrating with the southern extent of the Boggabri emplacement.

Coal Processing and Transportation

Subject to commercial agreement, TCPL and BCPL will handle and process Tarrawonga's ROM coal at the upgraded Boggabri Infrastructure Facilities and private rail spur. Tarrawonga product coal would also be separately loaded into trains for transport to the Port of Newcastle via the Boggabri private rail spur and Werris Creek - Mungindi Railway.

If this option proceeds an internal services corridor will be constructed to haul ROM coal to the Boggabri facilities.

Boggabri – Tarrawonga Overburden Emplacement Integration Management Plan

Integration of the Tarrawonga Northern Emplacement and the southern extent of the Boggabri waste rock emplacement presents an opportunity to enhance connectivity between the post mining landforms of both mines. Detailed planning to optimise integration of the final rehabilitated landform will be developed during this MOP term and documented in a Boggabri – Tarrawonga Overburden Emplacement Integration Management Plan.

Overburden Emplacement Integration – Timing

BCPL agreed to a partial lease transfer which culminated in the grant of ML 1685 to enable Tarrawonga to commence open cut pit and overburden emplacement area development in the northern extension area. This partial lease transfer is south of an existing haul road currently in use by Boggabri Coal.

It is intended that an application will be made for transfer of the remaining portion of Boggabri Coal's Lease (CL 368) within the approved Tarrawonga development area within this MOP period. Upon transfer, TCPL will assume responsibility for subsequent rehabilitation of the area.

Until the partial lease transfer occurs, Boggabri Coal will continue to progress their overburden emplacement area development in accordance with their MOP. This will facilitate the extension of the Tarrawonga overburden emplacement to integrate with and blend into the Boggabri overburden emplacement.

Overburden Emplacement Integration – Rehabilitation

The lease boundary will define the area of responsibility between Boggabri Coal and Tarrawonga. The Overburden Emplacement Integration Management Plan, which will be signed-off by both parties, will define the rehabilitation goals for that area. It is intended that the rehabilitation standard currently in place within the Leard State Forest area, as demonstrated by Boggabri Coal, be adopted for the lease

transfer area to ensure the landform and rehabilitation of both operations are consistently applied to ensure an integrated landform is achieved.

To ensure adequate planning for integration of the emplacement areas, TCPL, in consultation with BCPL, has developed the following actions:

- The Overburden Emplacement Integration Management Plan will be prepared in consultation with DRE and will be formally endorsed/signed-off by both BCPL and TCPL.

- The Overburden Emplacement Integration Management Plan will include definition of working areas and responsibilities, scheduling of emplacement area development and progressive rehabilitation activities, nominal point of emplacement area integration and a conceptual final landform plan illustrating the integrated emplacement areas.

- The Overburden Emplacement Integration Management Plan will include details on the integrated water management strategies for both the development and rehabilitation phases of the emplacement area integration, location of water management structures and responsibilities for water management (including on-going maintenance).

- The Overburden Emplacement Integration Management Plan will identify topsoil resources required by each operation for replacement on the final shaped emplacement area. Boggabri Coal will strip required topsoil resources in advance of their required emplacement area footprint within its lease, and Tarrawonga will strip required topsoil resources within its emplacement area footprint within the partial lease transfer area. Tarrawonga and BCPL will liaise on topsoil stripping depths and topsoil replacement methodologies based on the relevant soil resource assessments completed for each project in that specific area, and coordinate soil replacement and rehabilitation activities at emplacement area integration points (as appropriate).

1.3 Rehabilitation Progression – Action Plan

Following consultation with the Department of Planning and Environment and Division of Resources and Geosciences on MOP Amendment C it was agreed that an action plan would be included in the MOP to describe how the site intended to address identified inconsistencies between the areas subject to existing and proposed rehabilitation during the MOP term, in the context of the approved development consent.

The three main reasons for the identified inconsistencies, and proposed actions to address, are outlined in the following **sections 1.3.1, 1.3.2 and 1.3.3**.

1.3.1 Mine Schedule

The TCM EA mining and rehabilitation progressions were based on an indicative mine schedule of 29.2 Mbcm (annual average) of waste rock and 3.0 Mtpa of ROM coal. Actual TCM production has been 18.7 Mbcm (annual average) of waste rock and 2.2 Mtpa (average) of ROM coal. This reduced material production has materially affected the ability to advance emplacement areas with approximately 59ha of potential emplacement rehabilitation affected.

TCPL has developed the following actions to address the historic mine schedule impact on rehabilitation progression:-

1. Develop a 3.0 Mtpa ROM coal schedule and if acceptable reflect outcomes in revised approval documentation – develop 3.0 Mtpa ROM coal schedule by 31/03/2018,

2. Review current emplacements to identify inactive areas and either rehabilitate or temporarily stabilise these areas within set timeframes in agreement with DP&E/DRG – review to be completed by 30th April 2018.

Action 1 above was completed by the 31/03/2018 due date and the ROM coal schedule produced will be utilised to support the Tarrawonga Coal Mine (TCM) Life of Mine Modification under s4.5.5 of the EP&A Act.

The Modification, scheduled for submission by mid 2019, will include the following:

- Run-of-Mine (ROM) coal production rate increase from 3.0 to 3.5 Million tonnes per annum (Mtpa).
- Increase to ROM coal transported along Northern Section of the haul road from 3.0 to 3.5 Mtpa.
- Reduction of the extent of the open cut to avoid mining the:
    - alluvium; and
    - Goonbri Creek.
- Consequently, the low permeability barrier and Goonbri Creek diversion are no longer proposed.
- Construction of a revision of the post-mining landform and land use.
- Construction of a new ROM coal stockpile and access road.
- Construction and use of a water supply pipeline between the Tarrawonga Mine and the proposed Vickery Extension Project borefield (which is the subject of a separate Development Application for State Significant Development [SSD] 7480).

The identification of inactive areas of current emplacements component of Action 2 was completed in February 2018. Approximately 176,000 square metres of shaping and drainage works were completed on the inactive dump area by February 2019. The works were undertaken on the western dump face of the Tarrawonga north dump where it blends into the Boggabri Coal Mine rehabilitated waste emplacement.

1.3.2 Integration with Boggabri Coal Mine

The TCM EA rehabilitation progressions were based on the assumption that ROM coal haulage to Boggabri Coal Mine, and the associated removal of existing TCM ROM infrastructure, would occur within Year 1 of the Project. ROM coal haulage to Boggabri Coal Mine is now considered unlikely preventing the rehabilitation of approximately 60 ha of the northern emplacement.

The TCM EA rehabilitation progressions were based on the assumption that lease transfers with Boggabri Coal Mine would occur early in the Project life. Completion of all required lease transfers is yet to be achieved delaying integration, and partial rehabilitation, of the northern TCM emplacement with Boggabri Coal Mines emplacement.

TCPL has developed the following actions to address the integration with Boggabri Coal Mine impact on rehabilitation progression:-

1. Relocation of domestic crusher from toe of emplacement - November 2018,

2. Relocation of existing ROM haul road further to south – December 2018,

3. Identify and schedule potential areas of rehabilitation given completion of items 1 and 2 – identify and schedule areas by 30th April 2018,

Action 1 above was completed by November 2018.

Action 2 above was completed by October 2018.

Action 3 above was completed by 30th April 2018 and included within the TCM LOM modification mine schedule.

1.3.3 Relocation of Mine Infrastructure Area (MIA)

The TCM EA rehabilitation progressions were based on the assumption that the existing MIA area would be relocated to the southern extent of the Project Area, and Goonbri Road realigned to allow the MIA relocation, within Year 1 of the Project allowing the rehabilitation of the southern face of the southern emplacement area and some ancillary areas. The existing MIA is not intended to be relocated nor Goonbri Road realigned as assumed by the EA affecting the ability to rehabilitate approximately 90.3ha of waste emplacement.

TCPL has developed the following actions to address the non-relocation of the MIA impact on rehabilitation progression:-

1. Relocate water management infrastructure south of Goonbri Road pending approvals – June 2019,

2. Identify and schedule potential areas of rehabilitation given completion of item 1 – identify and schedule areas by June 2018.

Action 1 was started in early 2018. AECOM was engaged to propose options to the new water management system. They developed feasibility options and detailed designs. At this stage the preferred options do not consider a water management infrastructure south of Goonbri road.

Action 2 was completed by June 2018 with rehabilitation progressions included within the TCM LOM modification mine schedule.

1.4 ~~Relevant~~ Current Consents, Authorisations and Licences

Table 1 lists the approvals, leases and licences held for Tarrawonga at the time of MOP preparation.

Table 1 - Approvals, Leases and Licences

Issuing / Responsible Authority	Type of Lease, Licence, Approval	Date of Issue	Expiry	Comments
Department of Primary Industries (DPI)*1	Exploration Licence (EL 5967)	24/07/2002	~~23/07/2015~~24/07/2021	~~Renewal pending~~
~~DA originally issued by Minister for Infrastructure and Planning*2~~	~~Development Application (DA) 88-4-2005~~	~~09/11/2005~~	~~09/11/2017~~	~~Original consent. To be surrender late 2015~~
Department of Primary Industries - Mineral Resources*1	Mining Lease (ML) 1579	03/04/2006	02/04/2027	~~Expires 21 years from commencement~~

Issuing / Responsible Authority	Type of Lease, Licence, Approval	Date of Issue	Expiry	Comments
~~Department of Primary Industries - Mineral Resources~~[*1]	~~Mining Operations Plan (MOP)~~	~~09/05/2006~~28/0~~7/2017~~	~~28/02/2012~~31/12/~~2020~~	~~Replaced by MOP Amendment approved in 2010~~MOP ~~Amendment B~~
Department of Environment, Climate Change and Water (DECCW)[*3]	Environment Protection Licence (EPL) No. 12365	09/01/2006	Anniversary date: 9 January	~~Variations to EPL made in Dec 07, Sep 08, May 09 Dec 11, Mar 13, Nov 14.~~
Department of Water and Energy (DWE)[*4]	90BL253276 90BL253278 90BL253279 90BL253280 90BL254253 90BL254254 90BL254255 90BL254221 90BL254214 90BL255766 ~~90BL255084~~WAL 31084	18/05/2006 18/05/2006 18/05/2006 18/05/2006 18/05/2006 18/05/2006 24/04/2007 05/04/2007 04/04/2007 19/08/2012 26/06/2012	Perpetuity Perpetuity Perpetuity Perpetuity Perpetuity Perpetuity Perpetuity Perpetuity Perpetuity Perpetuity ~~25/06/2017~~ Perpetuity	Monitoring bores 250ML Mining
~~Director, Mining and Industry Projects for Department of Planning~~[*2]	~~Notice of Modification (DA) 88-4-2005 MOD 1~~	~~15/10/2010~~	~~09/11/2017~~	~~Modification to original consent~~
~~Industry & Investment NSW~~[*1]	~~Mining Operations Plan (MOP) Amendment~~	~~01/07/2010~~	~~30/06/2013. Extension granted to 30/10/2013.~~	~~Superseded by 2013 MOP~~
Department of Planning and Infrastructure (DoPI) [*2]	Project Approval PA 11_0047	22/01/2013	31/12/2030	Project Approval for LOM Extension Project. ~~Expires December 2030~~
Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) [*5]	EPBC 2011/5923	11/03/2013	31/12/2053	Conditional Federal Project Approval for LOM Project
Department of Trade & Investment – Regional Infrastructure and Services[1]	Mining Lease (ML) 1685	18/07/2013	14/11/2032	
Department of Trade & Investment – Regional Infrastructure and Services[1]	Mining Lease (ML) 1693	14/10/2013	14/10/2034	~~Expires 21 years from commencement~~

Issuing / Responsible Authority	Type of Lease, Licence, Approval	Date of Issue	Expiry	Comments
~~Division of Resources and Energy (DRE)~~	~~Mining Operations Plan (MOP)~~	~~23/10/2013~~	~~31/10/2015~~	~~MOP prepared under the new ESG3 Guidelines for LOM Project~~
~~Division of Resources and Energy (DRE)~~	~~Mining Operations Plan Amendment A (MOP)~~	~~6/12/2013~~	~~31/10/2015~~	~~Amendment A to MOP~~
~~Department of Planning & Environment~~	~~Notice of Modification of Project Approval PA 11_0047~~	~~6/11/2014~~	~~31/12/2030~~	~~Modification to allow coal haulage to continue to the Gunnedah CHPP.~~
~~Division of Resources and Energy (DRE)~~	~~Mining Operations Plan Amendment B (MOP)~~	~~13/11/2013~~	~~31/10/2015~~	~~Amendment B to MOP~~
Division of Resources and ~~Energy~~ Geoscience (~~DRE~~DRG)	Tarrawonga Coal Mine MOP	1/11/2015	~~31/12~~30/11/2020	This document
~~Department of Planning & Environment~~	~~Notice of Modification of Project Approval PA 11_0047~~	~~3/11/2016~~	~~31/12/2030~~	~~Modification to allow changes to receipt of coal reject.~~
Division of Resources and Geoscience	Mining Lease (ML) 1749	17/11/2017	14/11/2032	

*[1] Now, Department of Industry, Division of Resources and ~~Energy~~ Geoscience (DRG~~E~~)
*[2] Now, Department of Planning and Environment (DP&E)
*[3] Now, Environment Protection Authority (EPA)
*[4] Now, ~~NSW Office of Water (NOW)~~ Department of Primary Industries – Water (DPI – Water)
*[5] Now, Department of the Environment and Energy (DoE~~E~~)

1.5 Land Ownership and Land Use

~~1.5.1 Land Ownership~~

The Tarrawonga Coal Project covers an area of approximately 1231 hectares (ha) within the Parish of Leard, County of Nandewar and Local Government Area of Narrabri (see **Plan 1c**). Tarrawonga comprises a number of land parcels, including land owned by the Crown (including part of the Leard State Forest under the care and control of Forests NSW), Narrabri Shire Council, Whitehaven Coal Mining ~~-~~and Boggabri Coal. The entire area of ML 1685 is under compensation agreement with NSW Forestry, which was executed March 2014

Land ownership within and surrounding Tarrawonga is shown on **Plan 1c**. As evident, all freehold land within ML 1579, and ML 1693 is owned by Whitehaven and Boggabri. ~~The mine expansion~~ ML 1685 and ML 1749 ~~will extend in to~~ include the Leard State Forest. **Appendix B** details land ownership and property descriptions within and surrounding Tarrawonga.

~~1.5.2 Land Use~~

Tarrawonga is located in an area that is removed from any urban areas and has a relatively low density of surrounding residences. Surrounding land uses include mining (Boggabri and the Maules Creek Coal Project), commercial forestry and biodiversity conservation (within Leard State Forest), and traditional agriculture (cropping and grazing) on privately held freehold land. Land use is shown on **Plan 1b.**

1.6 Stakeholder Consultation

1.6.1 Stakeholders and the Consultative Process

TCPL has developed a number of mechanisms to facilitate on-going consultation with local, State and Commonwealth government agencies, surrounding residents, the wider community and other relevant stakeholders. These mechanisms were the foundation of the consultation process undertaken throughout all stages of the Tarrawonga Coal Project assessment and approval process. The EA (Resource Strategies 2012) prepared for the Project addressed the mine plan on which this MOP is based, along with the proposed mining and rehabilitation activities, and proposed environmental management.

Stakeholders engaged in this consultative process include:

- Commonwealth Department of Sustainability, Environment, Water, Population and Community (SEWPaC) (~~now Department of the Environment – DotE~~ DoEE);
- NSW Department of Planning and Environment (DP&E)
- NSW Office of Environment and Heritage (OEH);
- NSW Office of Water (NOW) (now DPI – Water);
- NSW Department of Trade and Investment, Regional Infrastructure and Services (DTIRIS) (now Department of Industry);
- NSW Roads and Maritime Service (RMS);
- Namoi Catchment Management Authority (CMA) (now North West Local Land Services – LLS);
- Forestry Corporation of NSW (now Forests NSW);
- Narrabri Shire Council;
- Gunnedah Shire Council;
- Association of Mining Related Councils.
- Namoi Catchment Water Study;
- Essential Energy;
- Aboriginal stakeholder groups;
- Local community and affected landowners;
- Community groups; and

- Staff, contractors and unions.

1.6.2 MOP Consultation with the DRE

Prior to submitting this MOP, consultation was undertaken with the ~~DRE~~ DRG in terms of the requirements for MOP development.

These discussions confirmed that the proposed development activities during the term of the MOP period were all within the project approval boundaries and generally in accordance with activities approved under PA 11_0047 ~~MOD 1~~.

~~DRE were advised of pending submission of this MOP Amendment A, following approval of PA 11_0047 MOD 2.~~

1.6.3 Stakeholder Consultation

TCPL engaged with the local communities and stakeholder groups regarding issues addressed in this MOP including final land use options and rehabilitation expectations.

Key issues associated with final land use and rehabilitation addressed in the Tarrawonga Coal Project EA consultation process included:

- Design criteria for the proposed low permeability barrier and permanent Goonbri Creek alignment, including geomorphic integrity of the constructed alignment, rehabilitation of riparian vegetation communities and long term impacts to ground water recharge and surface water flows to downstream users;

- Requirement for the Project to be conditioned to produce a final void and mine closure plan that addresses long term impacts of the proposed final void on groundwater resources;

- Agricultural Resource Assessment methodologies to identify suitable soil resources for woodland and agricultural post mining land uses, and reinstate agricultural cropping land with no net loss of Class 3 agricultural land; and

- Landform design including emplacement heights and slopes, and final void design to minimise ground water impacts.

All issues raised in the consultation process for the Project EA were comprehensively addressed in the approval process and are reflected in the commitments in the Project EA Statement of Commitments and PA 11_0047 ~~MOD 1~~ conditions.

2 PROPOSED MINING ACTIVITIES

2.1 Project Description

Operations at Tarrawonga over the MOP term include:

- Continued development of mining operations in the Maules Creek Formation to facilitate a Run of Mine (ROM) coal production rate of up to 3 Mtpa, including open cut extensions:
    - to the east within Mining Lease 1579 and Mining Lease 1693; and
    - to the north within Mining Lease 1685;
- Ongoing exploration activities;
- Continuation of transport of ROM coal via the approved haulage route to the Whitehaven CHPP, or to the Boggabri CHPP via internal haul roads, subject to a suitable commercial agreement between Boggabri and Tarrawonga Mines.
- Use of an existing on-site mobile crusher for coal crushing and screening of up to 150,000 tonnes (t) of domestic specification coal per annum for direct collection by customers at the mine site for transport offsite;
- Use an existing on-site mobile crusher to produce up to approximately 90,000 m^3 of gravel materials per annum for direct collection by customers at the mine site;
- Progressive backfilling of the mine void behind the advancing open cut mining operation with waste rock and reject material from the Gunnedah CHPP;
- Continued and expanded placement of waste rock in the Northern Emplacement (including integration with the Boggabri Coal Mine emplacement) and Southern Emplacement, as mining develops;
- Progressive development of new haul roads and internal roads, as mining develops;
- Progressive development of sediment basins and storage dams, pumps, pipelines and other water management equipment and structures;
- Continued development of soil stockpiles, laydown areas and gravel/borrow areas;
- Ongoing monitoring and rehabilitation; and
- Other associated minor infrastructure, plant, equipment and activities.

2.2 Asset Register

The asset register (**Table 2**) provides a summary of the key features of each primary domain (see **Section 5**), and principal activities required for decommissioning and rehabilitation.

The areas for each domain represent the current footprint for each domain~~, as depicted on **Plan 2**~~.

Table 2 - Asset Register

Domain	Area (ha)	Major Assets
Domain ~~16~~ – ~~Final Void / Active Mining~~Void (Open Cut Void)	~~132.31~~102.6	Footprint of the open cut mining pits.
Domain ~~23~~ – Water Management Area	~~58.85~~21.8	Network of dams, channels and associated water management infrastructure. ~~Includes disturbance footprint for works for the permanent Goonbri Creek re-alignment.~~
Domain ~~31~~ – Infrastructure Area	~~53.28~~51.8	Existing Infrastructure and facilities to be constructed during the MOP term, including administration areas, workshops, and coal handling and preparation facilities.
Domain ~~45~~ – ~~Topsoil Stockpile Area~~Stockpiled Material[1]	65.9~~4~~	Areas disturbed to stockpile topsoil and vegetation for reuse in rehabilitation.
Domain ~~54~~ – Overburden Emplacement Area	~~202.95~~342.0	Footprint of out of pit (Northern Emplacement and Southern Emplacement and environmental bunds) and in-pit waste rock dump areas.
~~Domain 6 – Temporary Rehabilitation~~	~~18.67~~	~~Area of Overburden Emplacement subject to temporary rehabilitation.~~
Domain 7 – Rehabilitation Area	~~50.38~~75.9	Footprint of existing rehabilitation area

[1] Area of Stockpiled Material included within other Domains.

This asset register is intended to provide a suitable level of context for the Rehabilitation Cost Estimate (RCE). The RCE provides for third party rates to undertake the following:

- Decommissioning and demolition of all surface infrastructure;
- Rehabilitation of all areas disturbed by mining as depicted in **Plan 3f** (the year of maximum disturbance), with the exception of some dams that will be retained for post mining use; and
- Mobilisation costs, project management and contingencies.

A copy of the RCE ~~will be submitted to DRE on finalisation of this MOP~~ was submitted to DRE at the time of MOP submission in 2015 and was subsequently accepted. ~~No change to the RCE is required as a result of this MOP Amendment A as the disturbance remains the same. A revised RCE will be submitted with this MOP.~~ A revised RCE was submitted, accepted and lodged for MOP Amendment C. A revised RCE is not intended to be submitted with this MOP amendment.

2.3 Activities over the MOP Term

The following section outlines the activities planned at Tarrawonga throughout the MOP term.

2.3.1 Exploration

~~During the MOP term, exploration activities will be undertaken within ML 1579, ML 1685 and ML1693. It is anticipated that approximately 80 open holes and approximately eight core holes will be drilled in front of the current open cut during the next five years of operation at Tarrawonga. The drill spacing will be on a 120 by 120 metre (m) pattern to confirm stratigraphic thickness, coal quality and structure. Some of the core holes will be continued to the Tarrawonga Seam to further investigate the underground potential of the Tarrawonga Mine once open cut operations are concluded.~~

~~Four HQ core holes will be drilled to the Templemore Seam in the Tarrawonga South deposit to confirm stratigraphic thickness, coal quality and structure.~~

Resource definition drilling will continue to be undertaken at the Tarrawonga Coal Mine to further define the coal resources within the mining authorisations ML 1579, ML 1685, ML1693 and ML 1749 to support the mining proposed as part of the MOP. The focus of this work is likely to involve the drilling of between 20 and 50 holes over the MOP period. The drilling will include a combination of open hole hammer (125 mm) and core drilling (99 mm) to a maximum depth of 350 metres. This ancillary mining activity would occur within the Project Disturbance Boundary area shown on **Plan 2** and would not involve additional disturbance.

2.3.2 Construction

Mining operations in this MOP term will continue to utilise existing infrastructure and facilities.

Realignment of the existing coal haul road and additional water management structures as depicted on **Plans 3a** to **3f** will be constructed during the MOP term. Construction of water management structures will be based on detailed design works as provided by relevant engineering specialists. The design criteria will include consideration of in-situ soil materials and suitability for dam construction, storage capacities based on the reporting catchment area, and sediment storage capacity to maintain the 90%ile 5 day event design criteria as specified in the *Managing Urban Stormwater Volume 1: Soils and Construction* (Landcom 2004) and *Managing Urban Stormwater Volume 2E: Mines and Quarries* (DECC 2008a).

2.3.3 ~~Land Preparation~~ Mining Operations

Plans 3a to **3f** show the intended annual sequencing of mine development over the MOP period. This sequencing has been developed in order to ensure the efficient mining of coal, minimisation of haul lengths and permit effective overburden emplacement (both out-of-pit and in-pit) to enable the progressive formation of the post mining landform, and reduce the amount of disturbed land at any one time.

The ongoing development of Tarrawonga will involve the sequential clearing of vegetation and removal of soil (land preparation) prior to the removal of overburden and interburden, mining of the identified coal resource and progressive backfilling and rehabilitation of mined-out areas.

During the MOP term, it is anticipated that approximately 709~~.85~~ ha will be cleared for mining related activities. Vegetation clearing will generally be undertaken in the following manner, in accordance with the *Stage 1 Biodiversity Management Plan (*Whitehaven 2015b), as modified.

- Clearing of remnant tree and shrub vegetation will be carried out in campaigns ahead of mining (refer to **Plans 3a** to **3f**). In accordance with the approved *Stage 1 Biodiversity Management Plan*, removal of vegetation will be restricted to a clearing window of 15 February to 30 April each year for all contiguous vegetation within the Project boundary, inside and outside of the Leard State Forest Clearing will be subject to a pre-clearance survey by an appropriately qualified ecologist to ensure clearing activities are managed to minimise impacts on fauna.

- The area cleared in each campaign will generally be no greater than that required to accommodate the mine's needs for the following 12 months. This will ensure that excessive areas of timber cover are not cleared at any time.

- The limits of each planned clearing campaign will be clearly delineated on the ground to avoid excessive clearing.

- On areas devoid of tree and large shrub vegetation, vegetation will be stripped and collected with the topsoil in a simultaneous operation.

- In areas of dense vegetation cover, timber not retained for habitat augmentation will be mulched and co-mixed with the soil during stripping to improve the topsoil resource.

In areas requiring vegetation clearance within ML 1685 and 1749 (i.e. the Leard State Forest), clearing activities will be undertaken in accordance with requirements established under agreement with Forestry NSW. This agreement defines requirements for access, clearance procedures and appropriate compensation arrangements.

During this MOP term, approximately 127,460 m^3 of topsoil will be stripped within the pit extension and out-of-pit emplacement areas, following vegetation clearing. Preferably, stripped soils will be directly ~~re-emplaced~~placed on rehabilitation areas (subject to the availability of shaped rehabilitation areas). If no suitable rehabilitation areas are available for direct ~~em~~placement then soils will be temporarily stockpiled~~until shaped areas with the appropriate intended final land use for the soil type is available~~.

During the MOP term Tarrawonga will construct and operate additional topsoil stockpiles. These stockpiles will be located on already disturbed land ~~on the northern emplacement~~.

Soil resources appropriate for agricultural and native vegetation rehabilitation outcomes, including suggested stripping depths and reinstatement depths, have been assessed and documented in the Agricultural Resources Assessment: "Tarrawonga Coal Project", Boggabri NSW) (Agricultural Resources Assessment) (McKenzie Soil Management, 2011) prepared for the Project EA .

Soils stripped and ~~re-em~~placed during this MOP term will be associated with rehabilitation of woodland native vegetation communities. No soil resources identified for Class 3 Agricultural Suitability rehabilitation areas will be stripped during this MOP term.

The Agricultural Resource Assessment (McKenzie Soil Management, 2011) recommends that subsoils located in the areas of activity over this MOP term are generally not suitable for re-application due to major constraints (strongly acidic and highly dispersive) (McKenzie Soil Management, 2011). Subsoils will be assessed prior to stripping to determine their suitability for rehabilitation, in accordance with the site's ~~*Land Disturbance Protocol*~~ *Stage 1 Biodiversity Management Plan (*Whitehaven 2015b), as modified.

~~Soil Stripping and Stockpiling Procedures~~

~~The soil stripping and stockpiling techniques are described in the site Land Disturbance Protocol included as Appendix B of the *Stage 1 Biodiversity Management Plan (*Whitehaven 2015b).~~

~~Soil Re-Spreading and Seedbed Preparation~~

~~Suitable soil resources have been identified to meet the rehabilitation objective of (on average) a soil re-application targeting EA approximate depths of 1.5 m on agricultural rehabilitation areas and 0.2 m in native vegetation rehabilitation areas. Prior to soil stripping activities, additional investigations will be conducted to confirm the appropriate soil stripping and re-application depths for each soil type identified for salvage.~~

~~Where possible, soils will be re-spread directly onto re-shaped landforms. Subsoils and topsoils will be characterised prior to re-spreading to determine the type and application rates for any required soil ameliorants (e.g. lime, gypsum, fertiliser and organics). The use of soil ameliorants improves germination and vegetation establishment by minimising surface crusting, increasing moisture retention and organic content, and buffering surface temperatures. Further details regarding reinstatement of soils to establish the desired vegetation community are included in **Section 7.3.3**.~~

2.3.4 Mining Operations

During the MOP term, open cut mining will continue eastward within ML 1579, ML 1693, and ML1685 and ML1749. Mine sequencing and overburden emplacement development is displayed on **Plans 3a** to **3f**.

The current truck and shovel mining methods will be utilised for pre-stripping and coal recovery. Excavators will be used to load haul trucks to remove overburden and interburden. Coal will also be loaded into haul trucks with excavators. Additionally, a mobile crusher will operate in a gravel stockpiling area where select overburden will be crushed and screened for subsequent dispatch from site.

The typical equipment fleet and ancillary equipment used at the operation is listed in **Table 3.**

Table 3 - Typical Equipment Fleet

Item	Number	Level/Function
O & K RH170 Excavator	3	Overburden excavation / loading
Hitachi EX1900 Excavator	1	Overburden / interburden / coal mining
CAT 785C Haul Truck	16	Overburden / interburden
CAT D11R Dozer	6	Clearing / interburden / coal ripping / pushing / dump maintenance
CAT D10R Dozer	3	Clearing / interburden / coal ripping / pushing / dump maintenance
988H Loader	3	Load the mobile crusher
CAT 16M Graders	2	Road maintenance
Cubex QXR 1320 Drill	1	Waste rock drilling
SKF Drill	1	Waste rock blasting
CAT 6420 Drill	1	Waste rock blasting
Road Water Carts	1	Dust suppression
Water truck 773	2	Dust suppression
Mobile Crusher	1	Coal size reduction / domestic product
Volvo Water Truck	1	Dust suppression
Service Truck	2	Machinery servicing
Cummins Gen set	2	Power for site offices, workshop and coal loader
Lighting Plant	15	Lighting for work after nightfall
IT38G Loader	2	Loading
962 Loader	1	Road Maintenance

The mine development and sequence presented in this MOP varies from the concept plan presented in the Project EA. This is primarily due to:

- Adjustments to the progression of the open cuts to optimise operating costs by delaying the mining of higher strip ratio areas located toward the eastern extent of ML 1579;
- Commencement of mining within ML 1685 being delayed due to timeframes to achieve formal approval of ML 1685; and

- BCPL requiring continued access to an existing haul road in the Tarrawonga northern extension.

The main variations between the concept plan in the Project EA (Tarrawonga Coal Project EA Figure 2.4) and the mine sequencing in this MOP depicted on **Plans 3a** to **3f** are:

- The run-of-mine coal production rate is forecast to be 2 Mtpa rather than 3 Mtpa resulting in less overburden being generated during the MOP term than anticipated in the Tarrawonga Coal Project EA for Year 2.

- The integration with the Boggabri Coal Mine overburden dump to the north-west will not commence until start of 2017 and the Southern Emplacement will not be extended as far to the south and south-east. This is possible because of the smaller quantity of waste that will be generated during the term of the MOP.

- The planned construction of the new Mine Infrastructure Area (MIA) at the southern extent of the lease will not occur during the term of this MOP.

Gravel Production

In addition to coal production, Tarrawonga have approval to produce up to 90,000 m^3 per annum of gravel from the site for on-site collection by customers. Gravel would may be processed through an on-site mobile crusher on a campaign basis. PA 11_0047 MOD 1 approves gravel crushing using a mobile gravel crusher on a campaign basis determined by product availability and customer demand.

Blasting

Conventional drill and blast techniques are used for the removal of competent overburden and interburden material. Blast designs and sizes will vary over the life of the mine and will depend on factors such as the depth of coal seams and the design of benches. As the open cut mining operations advance to the south-east, some sections of Goonbri Road will be temporarily closed during blast events that are within 500 m of the public road.

Blast design and implementation is undertaken by a suitably qualified blasting engineer and/or experienced and appropriately certified shot-firer. Blast design will ensure that burden distances and stemming lengths are such that explosion gases are almost completely without energy by the time they emerge into the atmosphere and charges consistently detonate in carefully designed sequences. Each blast will be designed to provide an adequate level of fragmentation with acceptable environmental impact is achieved.

In accordance with condition 16 of Schedule 3 of PA 11_0047 MOD 1 blasting will be limited to one blast per day; unless an additional blast is required for safety reasonsfollowing a misfire. The total number of blasts per week will not exceed four, averaged over a calendar year. PA 11_0047 MOD 1 does allow additional blasts provided that such blasts do not generate ground vibration of more than 0.5 millimetres per second (mm/s) at any residence on privately-owned land. Additional blasts required to ensure the safety of the mine or its workers are also permitted.

Blasting shall generally occur between 9:00 am and 5:00 pm Monday to Saturday (inclusive). No blasting shall occur on Sundays or public holidays.

2.3.5 Overburden Emplacement

Overburden and interburden mined during the MOP period will continue to be used to in-fill the mine void behind the advancing open cut, as well as being placed in the two adjoining out-of-pit mine waste rock emplacements (Northern Emplacement and Southern Emplacement) (**Plans 3a** to **3f**).

The waste rock emplacements at Tarrawonga will be progressively shaped ~~by bulldozers~~ for rehabilitation activities, including final re-contouring, topsoiling and revegetation.

~~Approximately 104 million bank cubic metres (Mbcm) of waste rock will be mined over the MOP period. Coal seams are exposed with multiple bench pre-stripping. The majority of waste rock at Tarrawonga is blasted and removed by conventional haul-back methods utilising excavators to load haul trucks. Dozers are also used to remove thin layers of interburden to reduce damage to the underlying coal seam.~~

~~Generally, the process for removal of overburden and interburden is as follows:~~

~~1. Holes are drilled into the overburden rock (generally stopping short of the coal seam), packed with explosive and blasted to fracture the rock such that it can be removed from the open cut area to expose the coal seams; and~~

~~2. Following blasting, the bulk overburden will be loaded by excavator into haul trucks and transported to the overburden emplacement or mined out section of the void;~~

2.3.6 Coal Processing and Transport

During the MOP term, the majority of ROM coal will be trucked to the ROM pad and ROM stockpiles where it will be transferred to a 40 t hopper and conveyed to the on-site coal crushing and screening facility. ROM coal will then be sized and conveyed to the coal load-out bin for loading in to on-highway haul trucks for transport to the Whitehaven CHPP or Boggabri CHPP for further processing prior to being railed to the Port of Newcastle via the Werris Creek Mungindi Railway for export customers.

Tarrawonga will continue to use an on-site mobile crusher to selectively process domestic specification ~~(15-35 mm)~~ coal per annum. Sized coal will then be transported via road to domestic customers.

Mining operations are permitted to occur 24 hours a day, seven days per week. Coal transport to the Whitehaven CHPP is permitted between 6:00 am and 9:15 pm Monday to Friday, and between 7:00 am and 5:15 pm on Saturdays. No road transport is permitted Sundays or public holidays.

Transport of gravel by truck from Tarrawonga is permitted between 7:00 am and 6:00 pm Monday to Saturday. No road transport is permitted Sundays or public holidays.

PA 11-0047 ~~MOD 1~~ permits 3 Mtpa of ROM coal to be transported offsite from Tarrawonga, via approved haulage routes to the Whitehaven CHPP or domestic markets. ~~Cumulatively, a combined total of 3.5Mtpa of coal is permitted to be transported by road each year from Tarrawonga, Rocglen and the (recently approved) Vickery Coal Mine to the Gunnedah CHPP, or 4.5Mtpa with the addition of the Kamilaroi Road overpass.~~ Cumulative limits apply to Tarrawonga, Rocglen and the Vickery Coal Project.

Subject to commercial agreement, TCPL and BCPL will handle and process Tarrawonga's ROM coal at the upgraded Boggabri Infrastructure Facilities and private rail spur. Tarrawonga product coal would also be separately loaded into trains for transport to the Port of Newcastle via the Boggabri private rail spur and Werris Creek - Mungindi Railway.

Coal Stockpiles

~~Prior to the operation of the Boggabri Infrastructure Facilities,~~ ROM coal will be loaded by excavator into haul trucks and transported to the ROM pad and/or temporary in pit ROM coal stockpile areas. At the Whitehaven CHPP, sized ROM coal received from Tarrawonga will be stockpiled in either ROM coal stockpiles for processing in the CHPP or in product stockpiles for bypass loading at the rail loadout facility.

2.3.7 Coarse Rejects and Tailings

Reject material from the Whitehaven CHPP is currently transported to Whitehaven pits for disposal.

~~Until the Boggabri Infrastructure Facilities option is available,~~ pProcessing of ROM coal from Tarrawonga will continue to generate reject material at the Whitehaven CHPP. Reject material from the Whitehaven CHPP (comprising reject generated by processing coal from Tarrawonga and other Whitehaven sites) will be returned via truck to nearby Whitehaven pits including Tarrawonga for disposal. All reject material will be co-disposed ~~in the pit void~~ within the footprint of the void with waste rock material.

All reject material is required to be placed at least 30m inside the pit boundary, at least 5m below the final landform surface and at a setback angle of 30 degrees for any dumping of rejects above the pre-mined surface. As an additional control, a survey marker and a sign stating “Chitter Boundary”, will be in place to represent the limit boundary, all rejects will then be placed inside these markers.

Reject material will be “mixed” with the waste overburden and interburden. This will primarily be achieved through the loading of the reject material over the dump face and the alternating of reject and mine waste dumping at the reject disposal areas. Generally this material will be layered within the overburden material evenly to minimise any stability impacts. To achieve this, once reject material has rilled to the overburden dump toe, a minimum gap of 2 loader widths will be left along the tip head before loading over the face again.

Management measures relating to reject are discussed in **Section 3**.

2.3.8 Temporary Stabilisation

Temporary stabilisation, being aerial seeding of a cover crop, of the southern face of the southern waste emplacement was undertaken in July 2015. Visual monitoring of the area treated will be undertaken to determine whether any follow up work is required to achieve stability.

Temporary stabilisation will occur at the site as and when required.

2.3.9 Progressive Rehabilitation and Completion

Progressive rehabilitation will continue at the overburden emplacement areas in this MOP period, as shown on **Plans 3a** to **3f**. ~~Rehabilitation activities will be undertaken on 71.85 ha of the Northern Emplacement Area and 7.07 ha the Southern Emplacement during this MOP period.~~

Further details of rehabilitation procedures to be undertaken are included in **Section 7**.

2.3.10 Material Production Schedule

The material production schedule for the duration of the MOP period is listed in **Table 4**3.

Table ~~43~~ – Material Production Schedule during the MOP Term

Material	Unit	Year 1[1] (Jan 2015 – Dec 2015)	Year 2 (Jan 2016 – Dec 2016)	Year 3 (Jan 2017 – Dec 2017)	Year 4 (Jan 2018 – Dec 2018)	Year 5 (Jan 2019 – Dec 2019)	Year 6 (Jan 2020 – Dec 2020)
Stripped topsoil	m^3	28,000	47,000	88,000	~~24000~~126,200	~~33000~~39,600	~~17000~~35,000
Rock/Overburden	Mbcm	19	19	19	1~~9~~7	~~19~~20.5	~~19~~23
ROM Coal	Mt	2.2	2.2	2.2	2.~~2~~0	2.~~2~~75	~~2.2~~3.0
Reject[2]	Mt					0.7	0.7
Product Coal	Mt	1.9	1.9	1.9	1.~~9~~8	1.~~9~~8	1.~~9~~8
Gravel	m^3	90,000[3]	90,000[3]	90,000[3]	90,000[3]	90,000[3]	90,000[3]

1 – Although the MOP period ~~doesn't~~ didn't commence until 1 November 2015, the volumes included in this table are for the 2015 calendar year.

2 – The volume of course rejects to be received at Tarrawonga is dependent on reject generation and management at other Whitehaven Coal Operations.

3 – Maximum approved limit of gravel production. Actual production may be less than this value.

3 ENVIRONMENTAL ISSUES MANAGEMENT

3.1 Environmental Risk Assessment

A Risk Assessment was undertaken for this MOP which addressed all risks to rehabilitation at Tarrawonga. This risk assessment was undertaken in accordance with AS/NZS ISO 31000:2009 *Risk Management – Principles and Guidelines*, along with the Whitehaven risk assessment process. The completed risk assessment is provided in **Appendix C** while **Section 3.2** provides proposed risk management measures for the site.

The workshop assessed 16 key rehabilitation risks, all of which were identified as low risk, given the existing controls in place. It should be noted that none of the elements were categorised as being a high risk.

Further, in accordance with the current MOP Guidelines, mine closure and rehabilitation based issues were addressed in the risk assessment.

An additional risk assessment was undertaken in relation to PA 11_0047 MOD 2, in order to consider any risks associated with the proposed changes to receipt of reject. Any considerations are addressed in this section.

Potential environmental risks associated with the historic REA, including rehabilitation of the REA, were specifically assessed by Whitehaven in 2015. An REA specific Trigger Action Response Plan was developed from the assessment and is presented within **Table 27**.

3.2 Environmental Risk Management

~~Tarrawonga has implemented an Environmental Management System (EMS) that details the roles and responsibilities of site personnel and environmental incident response and reporting procedures.~~

~~The EMS is supported by~~TCM operates a comprehensive set of environmental management plans (EMPs). These plans have been developed and implemented by TCPL in accordance with ~~Development Consent DA 88-4-2005 and the more recent approval~~ PA 11_0047 ~~MOD 1~~and other ~~regulatory requirements, including EPL 12365~~. The EMPs describe environmental monitoring that includes meteorological, air quality, noise, blasting, surface water and groundwater monitoring. TCPL will continue to implement the existing strategies, plans and programs at Tarrawonga, and where necessary, undertake their review and/or revision.

The EMPs currently in place at Tarrawonga are outlined below, and can be found on the Whitehaven website.

- ~~Bushfire Management Plan;~~
- ~~Waste Management Plan;~~
- Heritage Management Plan;
- Biodiversity Offset Management Plan – Biobank Site;
- Noise Management Plan;
- Box Gum Woodland EEC Implementation Plan;
- Threatened Fauna Implementation Plan;

- Air Quality and Greenhouse Gas Management Plan; and
- Biodiversity Management Plan ~~– Stage 1 (Mine site)~~.
- Blast Management Plan.
- Water Management Plan
- Blast Management Strategy
- Air Quality Management Strategy
- Noise Management Strategy

~~In addition, the following EMPs are in place in accordance with DA 88-4-2005 and DA 88-4-2005 MOD 1. These will be replaced, or become redundant, by EMPs prepared in accordance with PA 11_0047 MOD 1 during the MOP term.~~

- ~~Blast Management Plan;~~
- ~~Environmental Management Strategy;~~
- ~~Environmental Monitoring Program;~~
- ~~Groundwater Contingency Plan;~~
- ~~Road Noise Management Plan;~~
- ~~Site Water Management Plan; and~~
- ~~Transport Route Construction Plan.~~

The following sections address some of the key environmental risks identified for Tarrawonga.

3.2.1 Erosion and Sedimentation Control

Erosion and sediment control (ESC) at Tarrawonga is managed in accordance with the ~~*Tarrawonga Site*~~ *Water Management Plan (*including an *Erosion and Sediment Control Plan),* relevant regulatory requirements and the guideline documents titled *Managing Urban Stormwater Volume 1: Soils and Construction* (Landcom 2004) and *Managing Urban Stormwater Volume 2E: Mines and Quarries* (DECC 2008a).

Key sources of erosion and sedimentation are generally related to surface water runoff from exposed surfaces, including cleared areas, stockpiles (coal, soil and waste rock) and unsealed roads, and to a lesser degree caused by wind erosion from emplacement areas and stockpiles. Key potential erosion and sediment risks are managed by:

- Diverting clean water runoff around disturbed areas and detaining runoff from disturbance areas (dirty water);
- Treating detained dirty water (for example, settling, flocculation) and discharging from site when water quality is within prescribed limits;

- Minimising the volume of dirty water discharged from the site by maximising re-use (for example, dust suppression);
- Providing engineering solutions to restrict runoff to sub-erosive velocities (for example, channels, dams, banks and drop structures);
- Minimising disturbance areas;
- Stabilising disturbance areas and stockpiles left dormant for extended periods (for example, establishing cover crops); and
- Progressively rehabilitating disturbance areas.

Erosion and sedimentation is monitored and reported in the ~~AEMR/~~Annual Review.

3.2.2 Surface Water and Groundwater

Surface and groundwater at Tarrawonga is managed in accordance with the ~~*Tarrawonga*~~*Water Management Plan*. In accordance with PA 11_0047 ~~MOD 1~~, a Water Management Plan (including Site Water Balance, Surface Water Management Plan, Groundwater Management Plan and a draft Leard Forest Mining Precinct Water Management Strategy) has been prepared for the site.

The EPBC Approval 2011/5923 (see **Table 1**) also requires surface and groundwater management plans to be prepared~~ during this MOP term to meet criteria specified in that Approval, including cumulative groundwater impacts from mining activities at Tarrawonga, Boggabri and Maules Creek Coal Project.~~

PA 11_0047~~ MOD 1~~ and EPL 12365 impose requirements for managing surface and groundwater quality and quantity, monitoring requirements and water quality discharge criteria. EPL 12365 includes licenced discharge points (LDPs).

The primary water use at Tarrawonga is dust suppression on internal haul roads and at the coal crushing and screening facility.

The Tarrawonga surface water management system has been designed to maintain separation between surface water runoff from undisturbed, rehabilitated and active mining areas (where practical) in order to:

- Minimise the capture of surface water runoff from undisturbed areas by optimising the diversion of up-catchment water to downstream receiving waters;
- Provide controlled release for surface water runoff from rehabilitated mine areas through LDPs in accordance with EPL conditions;
- Capture, store and manage surface water runoff from partially rehabilitated mine areas and infrastructure areas, and provide controlled release of these waters through LDPs in accordance with EPL conditions; and
- Capture and store surface water runoff from active mining areas and mine-affected water, with no release off-site.

~~Groundwater impacts will be associated with the intersection of open cut mine workings and groundwater systems, including groundwater seeping into open cut workings.~~

Surface water and groundwater quality monitoring and water discharge and level records are reported in the ~~AEMR/~~Annual Review and/or the EPL Annual Return.

3.2.3 Biodiversity

Impacts to native flora and fauna in remnant native vegetation communities within the mine boundary are managed in accordance with *Stage 1 Biodiversity Management Plan (*Whitehaven 2015b), as modified.~~the *Tarrawonga Biodiversity Management Plan*.~~

Under PA 11_0047~~, The continuation of~~ Tarrawonga is permitted to clear: ~~will result in the progressive removal of:~~

- Approximately 397 ha of native vegetation, including approximately 145 ha of the Leard State Forest. Of this, approximately 13 ha of Box-Gum Woodland Endangered Ecological Community (EEC) / Critically Endangered Ecological Community (CEEC) will be cleared over the life of the Mine.
- Approximately 557 ha of broad fauna habitat types (comprising 334 ha woodland and 223 ha grassland).

Under the EPBC Approval 2011/5923, Tarrawonga is permitted to clear:

- Up to 13 ha of White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland critically endangered ecological community;
- Up to 279 ha habitat for the Regent Honeyeater;
- Up to 54 ha of habitat for the Swift Parrot, and
- Up to 334 ha of habitat for the Greater Long-Eared Bat.

The impacts of clearing and loss of habitat will be minimised by:

- Undertaking clearing on a progressive basis over the 17 years of mining, which will include:
  - Adopting clearing strategies to minimise impacts on fauna (timing, seasons);
  - Delineating areas to be cleared; and
  - Engaging a suitably qualified ecologist to be present during the clearing process.
- Progressive rehabilitation of the post mine landforms, resulting in re-establishment of woodland/forest;
- Salvaging and re-using material from the site where practical for habitat establishment;
- Implement~~ing~~ a nest box program; and
- ~~Enhancing farm dams; and~~
- Controlling feral animals.

Other key management and mitigation measures are:

- The rehabilitation of 752 ha of native woodland community focused on Box Gum Woodland EEC.

- Compensatory habitat offset (legally binding conservation covenant) comprising a minimum of 1,660 ha of existing native vegetation to be enhanced and restored, including 193 ha of Box Gum Woodland EEC at the Willeroi Offset Area. In addition, this area will require equivalent or better quality habitat of no less than:
  - 1,055 ha for the Regent Honeyeater;
  - 397 ha habitat for the Swift Parrot;
  - 1,355 ha habitat for the Greater Long-Eared Bat; and
  - 232 ha White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland EEC.

These areas do not necessarily need to be separate, however represent the minimum for each endangered species/community.

Flora and fauna (including ~~clearing and fauna identified~~weeds and pests) will be monitored and managed in accordance with the PA 11_0047 ~~MOD 1~~ and the approved *Stage 1 Biodiversity Management Plan (*Whitehaven 2015b), as modified.~~*Biodiversity Management Plan*~~. Monitoring results and any control activities will be reported in the ~~AEMR/~~Annual Review.

~~3.2.4 Weeds and Pests~~

~~Weeds and pests are currently managed in accordance with the *Tarrawonga Biodiversity Management Plan*.~~

~~Weeds~~

~~The objective of weed control activities at Tarrawonga is to limit the spread and colonisation of noxious and environmental weeds. Management measures include:~~

- ~~Regular inspections (minimum monthly) of proposed disturbance areas and adjacent land, topsoil stockpiles and rehabilitation areas are conducted for early identification of weed infestations.~~
- ~~Mechanical removal and/or the application of approved herbicides in areas identified as being affected by weeds (in accordance with the Pesticides Act 1999);~~
- ~~Follow-up site inspections to evaluate the effectiveness of weed control programs;~~
- ~~Follow-up weed control in previously treated areas where weed management has been sub-optimal; and~~

~~TCPL will also liaise with local landholders and relevant government agencies as required to monitor the spread and management of weeds within the local area.~~

~~Vertebrate Pests~~

~~Vertebrate pests are not considered a significant risk and control programs are currently only undertaken on an as-needs basis. Management activities include exclusion fencing, trapping and/or baiting programs, and follow-up monitoring programs.~~

~~Vertebrate pest management procedures are documented in the *Biodiversity Management Plan*. TCPL will participate in regional pest control programs undertaken by neighbouring landholders, coordinated by the North West Livestock Health and Pest Authority (LHPA).~~

Weeds and vertebrate pests will be monitored in accordance with the PA 11_0047 MOD 1 and the approved *Biodiversity Management Plan*. Monitoring results and any control activities will be reported in the AEMR/Annual Review.

3.2.5 Spontaneous Combustion

The EMS details the roles and responsibilities of site personnel and the procedures to be undertaken in the event of an environmental incident, such as spontaneous combustion. This includes notification requirements and contingency measures.

Spontaneous Combustion on Coal Stockpiles

The risk of a spontaneous combustion event at Tarrawonga is considered to be low. Testing was conducted on each coal seam to be exposed by mining at Tarrawonga, with 0.44% sulphur content being the highest recorded value (Velyama Seam). The low percentage of inorganic sulphur is indicative of a low potential for exothermic oxidation reactions. This has been demonstrated over the past seven years of operation, with only one instance of spontaneous combustion occurring over that time.

Protocols for managing potential spontaneous combustion on coal stockpiles include:

- Regular inspection of ROM coal stockpiles as part of the site supervisor's check areas for evidence of combustion (visual and/or smell) and general stockpile maintenance.
- General short residence time of ROM coal stockpiles ensures continual cycling of coal through the stockpile.
- Stockpiles are subject to weekly survey to confirm height and volume.
- In longer term stockpiles (for example, TWxr) shallow stockpile batter faces are created to the direction of the prevailing wind.
- Mobile equipment compacts the stockpile area when working in the area.

Tarrawonga Coal personnel and contractors working in proximity to the ROM coal stockpiles have received appropriate training to be alert for, and respond to, indications of spontaneous combustion. Any incident would be followed by excavation of the stockpile to locate the source, and extinguishment by water saturation an appropriate method.

Spontaneous Combustion on Overburden Emplacement Areas

Sampling in 2011 concluded overburden and interburden is unlikely to be reactive. Regardless, the site implements operational protocols to minimise the risk of spontaneous combustion.

The low potential for spontaneous combustion events for coal is described in **Section 3.2.5**. The risk of spontaneous combustion of reject is inherently lower than for coal and is further minimised through the dilution and dispersion effect of overburden co-disposal. Testing completed on the Whitehaven CHPP rejects confirmed this with results showing a low propensity for spontaneous combustion, as follows:

- *Relative Ignition Temperature of 165 to 170 degrees C*
- *Adiabatic Self Heating Test R70 of 0.192 degrees C/hour*

Protocols for overburden and rejects emplacement include:

- Selectively handling partings, interleaves and other carbonaceous waste rock for in-pit emplacement within the pit boundary and at least 5 m below the final landform design to ensure sufficient cover with inert material.

- Co-disposal of reject ~~in pit~~ within the footprint of the void with waste material (refer **Section 2.3.7**).
- Reject represents a small percentage (approximately 2.5%) of overall material disposed of within the pit shell footprint
- Co-disposal of reject ~~in discrete areas~~ within the overburden emplacement, reducing potential for large volumes of reject material and therefore, combustion potential.
- The combustion potential is minimised by the minimum 5m of cover material in the final landform which is considered to be sufficient to reduce exposure to lightning strikes and reduces oxygen dispersion which would be required to sustain combustion.
- Annual sampling and analysis of representative source reject material from the CHPP will be undertaken to assess for spontaneous combustion potential.

Spontaneous combustion events (if any) will be reported in the ~~AEMR/~~Annual Review.

3.2.6 Contaminated Land

Land contamination associated with historic landfilling and derelict farm machinery was identified ~~in~~ during the preparation of the Project EA. All instances of land contamination will be remediated before the land is used for mining. Remediation activities and outcomes will be reported in the ~~AEMR/~~Annual Review.

A number of hazard control and mitigation measures for potential mine-related land contamination are described in the following management plans/systems in place at Tarrawonga:

- *Emergency Management System;*
- *Pollution Incident Response Management Plan;*
- *Contractor Management Standard;*
- *Blast Management Plan;*
- ~~*Bushfire Management Plan;*~~
- *Water Management Plan; and*
- *Waste Management Plan.*

The following controls will be implemented at Tarrawonga to prevent contamination:

- All water from wash-down areas and workshops will be directed to an oil separator and/or containment system;
- All storage tanks will either be self bunded or partitioned within an impermeable bund with a capacity to contain a minimum 110% of the largest storage tank capacity; and
- All hydrocarbon products will be securely stored; ~~and~~

Where land contamination is identified arising from mining activities, the affected area will be regularly inspected to ensure there is no on-going effect on the land that will prevent it from being successfully rehabilitated. A register of known and potential contaminated sites will be maintained by TCPL for remediation at conclusion of mining activities in relevant areas.

All contamination monitoring activities and mitigation measures will be reported in the ~~AEMR/~~Annual Review.

3.2.7 Bushfire

Bushfire is currently managed under the *Tarrawonga Environmental Management Strategy* (EMS) ~~and the *Tarrawonga Bushfire Management Plan*~~. The *Stage 1 Biodiversity Management Plan (*Whitehaven 2015b), as modified, ~~*Biodiversity Management Plan*~~ also addresses bushfire prevention and mitigation of bushfire impacts.

~~The area within ML 1579, and ML 1693 represents a low to medium bushfire hazard while the Leard State Forest (ML1685) represents a significant bushfire hazard in the region.~~

A range of management measures are in place to manage the behaviour of people at Tarrawonga and the overall risk of increased bushfire frequency due to mine activities is likely to be low. Assistance would be sought from the NSW Rural Fire Service in the event of significant bushfire incident or offsite bushfire potentially impacting upon the mine site.

Bushfire events and mitigation measures will be reported in the ~~AEMR/~~Annual Review.

3.2.8 Acid Mine Drainage

Assessments undertaken for the Project EA identified that a small quantity of overburden, including some strata immediately adjacent to some of the coal seams, contains slightly increased sulphur concentrations with low or no acid neutralising capacity. These materials were classified as potentially acid forming – low capacity (PAF-LC).

Acid generating materials will be managed in accordance with relevant requirements of PA 11_0047 ~~MOD 1 and EPL 12365~~ and will utilise advice from a geochemist to ensure appropriate material sampling and analysis is undertaken, particularly in relation to surface water and groundwater management. Any occurrences of PAF-LC material will be managed by selectively handling and emplacing the material so it is covered with at least 15 m of NAF material.

The following reject emplacement methodology will be employed to limit sulphide oxidation and acid generation and/or the migration of any acid or sulphate species that may be generated from migrating beyond the pit shell:

- The acid forming potential of reject will be minimised through the dilution effect of co-disposal with overburden (including ongoing cover of overburden as part of the operational overburden emplacement process).
- Reject will be placed at least 30m inside the pit shell footprint.
- A setback angle of 30° will be utilised for ‘supercharged’ co-disposed rejects and overburden material (i.e. for areas where the backfill is higher than the original topography).
- The final cover of 5m of NAF material will be emplaced within a targeted maximum of 1 month from the time of co-disposal in the final lift of the waste emplacement that contains co-disposed reject (i.e. 5m below final landform), The 5m cover will sufficiently reduce oxygen diffusion and/or water infiltration and provides sufficient thickness for a base for the growth medium, which will overlie the cover.
- In line with MOP commitments, growth medium will be provided above the cover for rehabilitation to support successful long-term revegetation.

Operational checks and controls to be implemented to ensure compliance with this methodology would include:

- Water quality monitoring;
- Survey controls (to identify where reject material has to be placed and to confirm appropriate placement of rejects material);
- Annual geochemical and spontaneous combustion test work; and
- Sampling and testing of cover material.

Tarrawonga will continue to undertake water quality monitoring within on-site water storages during the life of the mine in accordance with the *Water Management Plan*. If in the event acid rock drainage (ARD) is identified, a works program for the identification of any PAF-LC material would be undertaken and specific controls implemented.

Any geochemist advice, monitoring activities and the management of any PAF materials will be reported in the AEMR/Annual Review.

3.2.9 Air Quality

Air quality at Tarrawonga is managed and monitored through the *Air Quality and Greenhouse Gas Management Plan*.

PA 11_0047 ~~MOD 1~~ and EPL 12365 prescribe air quality concentration limits and monitoring requirements to manage air quality impacts. Key air quality impacts are associated with:

- Surface preparation – vegetation removal, soil stripping processes and stockpiling;
- Overburden and interburden removal – drilling, blasting (fugitive fume and particulate matter) emissions, loading, hauling and unloading;
- Coal removal – drilling, blasting (fugitive fume and particulate matter) emissions, loading, hauling, unloading, crushing, screening, movement on stockpiles;
- Wind erosion – on exposed areas and coal stockpiles; and
- Maintenance – road maintenance.

Management measures to minimise and mitigate air quality impacts include:

- Acquisition of affected sensitive receivers as defined by condition 26 of Schedule 3 of PA 11_0047 ~~MOD 1~~, and as demonstrated by air quality monitoring;
- Water application and/or dust suppressants on unsealed roads;
- Minimisation of disturbed/stripped areas;
- Management of loading/unloading and soil, gravel and coal handling operations;
- Enclosure of coal crushing and screening operations;
- Management of drilling and blasting operations; and

- Management of potential spontaneous combustion.

Air quality is monitored in accordance with the *Air Quality and Greenhouse Gas Management Plan*, with meteorology and air quality being continuously monitored. Results are reported on a daily basis online and on an annual basis in the ~~AEMR/~~Annual Review and the EPL Annual Return.

~~A *Particulate Matter Control Best Practice Pollution Reduction Program* has also been prepared for Tarrawonga in accordance with condition U1 of EPL 12365. This report provides best practice recommendations for the ongoing reduction of particulate matter emissions and includes options for the Tarrawonga Coal Project which have been incorporated into the *Air Quality and Greenhouse Gas Management Plan*. A 'Coal Mine Wind Erosion of Exposed Land Assessment' has been completed in July 2015 which compares predicted and actual wind erosion from exposed surfaces at Tarrawonga.~~

Tarrawonga ~~proposes to establish, in co-operation~~in conjunction with the adjoining Boggabri Coal Mine and Maules Creek Coal ~~Project~~Mine has established, a cumulative particulate matter monitoring program as part of the BTM Air Quality Management Strategy, ~~While this program is currently under development, a real time PM_{10} monitor (TEOM) has been installed to the south east of Tarrawonga, with additional monitoring equipment,~~ which includ~~esing~~ predictive meteorological forecasting and dispersion modelling, ~~to be established in consultation with the Boggabri and Maules Creek operations.~~

Note: PM_{10} is particulate matter with an aerodynamic diameter of 10 microns (µm) or less.

3.2.10 Blasting

Blasting is currently managed in accordance with the *Tarrawonga Blast Management Plan (including BTM Blast Management Strategy)~~and Tarrawonga Noise Management Plan~~*.

Measures to minimise potential impacts of blasting include:

- Managing operations to comply with blast frequency limits;
- Co-ordinating blasting days and times with Boggabri Coal and Maules Creek Coal ~~(and other mines within the Leard Forest Mining Precinct)~~ to minimise disruptions and impacts on neighbouring landholders; and
- Engaging with Narrabri Shire Council and private land owners if proposing to blast within 500 m of property not owned by TCPL/Whitehaven or a public road.

Airblast overpressure and ground vibration will continue to be monitored at a selection of surrounding residences as provided in the *Blast Management Plan.*

In the event a landowner or resident claims property or infrastructure has been damaged as a result of blasting, TCPL will, within three months of receiving a written request, commission an investigation into the claim by a suitably qualified person whose appointment is approved by the Secretary of the DP&E. A copy of the investigation report will be provided to the landowner or resident and any damages caused by blasting repaired at the cost of TCPL.

Blasting will be monitored in accordance with PA 11_0047 ~~MOD 1~~ and the approved *Blast Management Plan*. Results will be reported in the ~~AEMR/~~Annual Review.

3.2.11 Noise

Noise is managed in accordance with the *Tarrawonga Noise Management Plan*. PA 11_0047 ~~MOD 1~~ and EPL 12365 prescribe operational noise limits and management requirements.

TCPL will prepare and submit an updated *Noise Management Plan* (including a *Leard Forest Precinct Noise Management Strategy*) to manage potential noise impacts in accordance with PA 11_0047 MOD 1 during the MOP term. Road noise will continue to be managed under the *Tarrawonga Road Noise Management Plan* until coal ceases to be transported via public roads to the Whitehaven CHPP.

Noise sources from the mine operations can be attributed to:

- Blasting;
- Machinery and operations (for example, generators, plant and equipment); and
- Coal (and gravel) processing and handling (for example, crushing); and.
- Road transport (for example, personnel and coal transport to Whitehaven CHPP).

Noise mitigation measures for the mine within the MOP period may include:

- A reduction in the number of mobile fleet items operating during the evening and night-time periods and/or consideration for relocation of equipment to other areas of the mine where noise monitoring indicates systemic noise impacts; and
- Implementation of reasonable and feasible acoustical mitigation measures at impacted receivers in consultation with the affected landholder.

Implementation of the above mitigation measures will be guided by the operation of the real time noise management system and ongoing attended noise monitoring to verify noise performance.

Tarrawonga is approved to operate 24 hours a day seven days per week. Until commercial agreement is reached on use of the Boggabri Rail Spur Line and Boggabri CHPP, the transport of the coal from Tarrawonga to the Whitehaven CHPP is restricted to:

- 6:00 am to 9:15 pm Monday to Friday; and
- 7:00 am to 5:15 pm Saturdays.

There will be no transport of coal between Tarrawonga and Whitehaven CHPP on Sundays or public holidays.

The transport of gravel from Tarrawonga is limited to truck transport hours of 7:00 am to 6:00 pm Monday to Saturday.

Assessment of cumulative noise from the concurrent operation of Tarrawonga, Boggabri, and Maules Creek mines as part of the Tarrawonga Coal Project EA indicated that cumulative noise levels will comply with the specified night-time maximum amenity criteria at all receivers and the specified night-time acceptable amenity criteria for all but two privately-owned receivers. Tarrawonga will has established, in co-operationconjunction with Boggabri Coal Mine and the Maules Creek Coal MineProject, a Boggabri-Tarrawonga-Maules CreekBTM complex Noise Management Strategy during the period of the MOP. .

Noise will be monitored in accordance with PA 11_0047 MOD 1 and the approved *Road Noise Management Plan* and *Noise Management Plan*, and results will be reported in the AEMR/Annual Review.

3.2.12 Visual and Lighting

Visual

Visual impacts associated with the mining operations will be managed in accordance with PA 11_0047 ~~MOD 1~~.

The major aspects of Tarrawonga considered to have the potential to impact on the visual landscape during the MOP term include:

- Modification of topographic features including:
  - the open cut;
  - the Northern and Southern Emplacements;
  - a temporary increase in height of the Southern Emplacement prior to a reduction in final height during rehabilitation; and
- Lighting associated with night-time mining operations.

Cumulative visual impacts of Tarrawonga and the Boggabri Coal Mine are anticipated to be limited to viewpoints from the southern and western sides of Tarrawonga associated with elevated areas where no vegetation screening is present (e.g. from portions of cleared paddocks and public roads).

The mitigation and management measures that would be implemented for the maintenance of visual amenity at Tarrawonga include:-

- Progressive rehabilitation of the Northern Emplacement, Southern Emplacement, open cut and mine infrastructure areas will be undertaken in order to reduce the contrast between the landforms at Tarrawonga and the surrounding environment.
- Rehabilitation will be conducted in accordance with this MOP, along with the *Stage 1 Biodiversity Management Plan*.
- Visual screening (e.g.: a vegetation screen consisting of native plants that are compatible with the existing surrounding vegetation) will be used to reduce potential visual impacts from local sensitive viewpoints.
- Responding to private landholder concerns about visual impacts, by investigating and if appropriate vegetative screening or other measures in consultation with the affected landholder.

Lighting

~~The potential for fugitive night-lighting emissions to be visible at additional locations may change during the MOP term due to the:~~

- ~~Increased elevation of light sources on the Southern Emplacement; and~~
- ~~The increased extent of the mine waste rock emplacements.~~

~~Significant cumulative night-lighting impacts with the Tarrawonga, Maules Creek and Boggabri projects are not expected.~~

Tarrawonga will seek to minimise light emissions by carefully selecting the sites where lighting plants or permanent lighting installations would be placed. Measures that would be employed to mitigate potential impacts from night-lighting would include one or more of the following, where practicable:

- All external lighting associated would comply with AS 4282: 1997 – Control of the Obtrusive Effects of Outdoor Lighting;
- Night-lighting would be restricted to the minimum required for operations and safety requirements;
- Directional lighting techniques would be used; and
- In consultation with the landholder, curtains, cladding and/or screens would be provided at nearby private dwellings to help screen identified adverse night-lighting impacts in the event that significant direct night-lighting views are available.

Visual and lighting responses will be monitored in accordance with the PA 11_0047 ~~MOD 1~~ and results will be reported in the ~~AEMR/~~Annual Review.

3.2.13 Aboriginal Heritage

Aboriginal heritage is currently managed in accordance with the *Heritage Management Plan* which was developed in consultation with Registered Aboriginal Parties (RAPs) and OEH.

The following general approach will be taken to manage Aboriginal cultural heritage during the life of the mine:

- A record of known Aboriginal sites, their status and location would be maintained by Tarrawonga and relevant site personnel aware of the site locations.
- Ongoing consultation would be undertaken with the Aboriginal community over the life of the mine. RAPs would be in attendance during archaeological fieldwork (e.g. salvage of artefacts prior to disturbance).
- Tarrawonga would provide opportunities for Aboriginal community members to access known Aboriginal sites located on Whitehaven-owned land (e.g. for cultural reasons or as part of scheduled field activities). Such access would be subject to Occupational Health and Safety requirements.
- Erosion and sediment control works would be undertaken in accordance with the requirements of the Erosion and Sediment Control Plan and in consideration of Aboriginal cultural heritage management measures.
- Any additional Aboriginal heritage sites which may be identified during the development of the mine would be recorded and registered with the OEH in consultation with the RAPs. Should additional Aboriginal heritage sites be identified, they would be managed in accordance with the measures described in the *Heritage Management Plan*.
- Where avoidance of known Aboriginal heritage sites is not practicable, site(s) would be subject to baseline recording, in consultation with RAPs, prior to disturbance and artefacts would be salvaged for safekeeping in accordance with the wishes of the RAPs and OEH.
- Scar trees located in disturbance areas would be considered for salvage, if appropriate in the context of the tree's condition. A suitable location for the storage and/or display of the salvaged sections would be identified and managed in consultation with the RAPs and OEH.
- Culturally modified trees located outside of (but in close proximity to) the mine disturbance areas would be suitably demarcated and signed to reduce the risk of accidental damage if considered appropriate by the RAPs.

It is anticipated that the RAPs would also provide advice on the management of salvaged artefacts at the completion of mine activities (e.g.: artefact replacement onto the post mining landscape).

In the event of inadvertent damage to any Aboriginal site or place, the activities causing the damage would cease immediately and procedures identified in the *Heritage Management Plan* followed. Subject to the nature of the damage, appropriate professional advice in addition to that provided by Tarrawonga's consultant archaeologist may be sought.

Aboriginal cultural heritage will be monitored in accordance with the *Heritage Management Plan* and the results summarised in the ~~AEMR/~~Annual Review.

3.2.14 European Heritage

There are no items of state or regional non-Aboriginal heritage significance in the vicinity of Tarrawonga.

~~While of no heritage significance, a rubbish dump identified within the proposed mine contains objects that may be of interest to local historical collectors (e.g. old car and truck bodies, farm equipment, an oil engine and building materials). Prior to mine disturbance of the rubbish dump, these objects will be offered to the Boggabri Historical Society and the Gunnedah Museum.~~

3.2.15 Impacts on Agricultural Resources

Land use in the vicinity of Tarrawonga is dominated by grazing (primarily cattle) and cereal/fodder cropping (rain fed) in the flatter and more fertile areas to the south, east and west.

Potential impacts of the mine on soils would relate primarily to:

- Disturbance of in-situ soil resources within additional disturbance areas (e.g. extension of the open cut);
- Alteration of soil structure beneath infrastructure items, hardstand areas and roads;
- Possible soil contamination resulting from spillage of fuels, lubricants and other chemicals;
- Increased erosion and sediment movement due to exposure of soils during construction of mine infrastructure; and
- Alteration of physical and chemical soil properties (e.g. structure, fertility, permeability and microbial activity) due to soil stripping and stockpiling operations.

Mining activities at Tarrawonga will reduce the area of Class 4 agricultural suitability land at the site by approximately 125 ha in the long-term. The proposed rehabilitation of Class 3 agricultural suitability lands will result in no long-term change in the area of Class 3 agricultural suitability lands on the site.

Agricultural land resource management at Tarrawonga will include the following key components:

- Minimisation of disturbance to agricultural lands, where practicable;
- Continued use of adjoining Whitehaven-owned land for agricultural uses;
- Management of soil resources at the site so that they can be used for rehabilitation; and
- Inclusion of agricultural lands in the Tarrawonga rehabilitation strategy (i.e. some 210 ha of Class 3 agricultural suitability land).

Rehabilitation is a key focus of this MOP and the outcomes will be included in the ~~AEMR/~~Annual Review.

3.2.16 Geotechnical Stability of the Reject Emplacement Area (REA)

An assessment of the stability of the REA at TCM was undertaken by Pells Sullivan Meynink (PSM, 2017) to specifically address the following items:-

- Review and assessment of available coarse reject material particle size distribution and geotechnical properties since material deposition started at the REA.

- Completion of a geotechnical stability modelling programme specific to the site and its condition (location of the water table, material properties, and any variation within the unit/s considered etc), including:-

    - Sensitivity analysis to assess how a variation (either significant or minor) within these parameters may alter the modelling results,

    - Considering both current conditions and those proposed or expected during rehabilitation (temporary works) and at mine closure.

- Geotechnical analysis of the proposed inert/benign waste rock and growth medium materials for construction of an REA cap, to ensure suitability.

PSM (2017) concluded the following from the assessment of the above items:-

- Back analysis of the current REA profile indicates the coarse rejects are acting in a drained state and that the uncapped, reshaped REA profile will remain stable.

- Despite assuming undrained conditions in the coarse rejects and very high groundwater tables (both highly conservative), analyses have shown the capped and final profiles will have Factor of Safety (FOS) values exceeding 1.6. With less conservative and more realistic assumptions, the FOS values exceed 2.2.

- Results from the slope stability analysis ultimately indicate that slope stability of the REA will remain adequate before, during and after rehabilitation.

TCM will adopt the REA rehabilitation sequence assessed by PSM (2017) that requires:-

- Rejects to be dozer pushed from the northern to the southern side of the REA in order to reduce the overall height/maximum RL.

- Utilise mine spoil to cap the REA in a series of smaller lifts, not greater than 15m high, instead of a single lift to full height.

- Reshape the surface of the capping material to produce the final landform leaving a minimum of 10m of mine spoil over the REA.

Rejects were reduced in overall height/maximum RL in 2018. Capping of the rejects with mine spoil in lifts not greater than 15m high has been undertaken. Final reshaping of the capping material to produce the final landform is included within the TCM LOM mine schedule.

3.2.17 Closure Cover System and Water Quality Monitoring Programme for the REA

A detailed assessment of a closure cover system for the REA at TCM, including development of a water quality monitoring programme, was undertaken by SLR Consulting Australia Pty Ltd (SLR, 2017) to specifically address the following items:-

- Development of site specific closure design objectives and closure performance criteria for the cover system and landform design.

- Develop a water quality monitoring programme that will review and assess the hydrology of the REA, both for external drainage (surface water runoff) and internal drainage (seepage).

- Geochemical analysis of the proposed inert/benign waste rock and growth medium materials for construction of the cap to ensure suitability.

- Erosion modelling using material specific parameters under the proposed final embankment conditions in order to determine the likely erosion depth on the embankment, including development of a site specific erosion protection features should erosion modelling determine these to be required to ensure long term stability of the facility.

- Development of a soil-plant-atmosphere model of the proposed cover system to determine net percolation and oxygen diffusion into the waste mass under closure conditions:-

    - Uses site specific material properties and climate data.

    - Takes into account relevant climate change scenarios for the area.

    - Determines if the proposed closure cover system will meet the proposed closure design objectives.

- Development of a closure surface water management system that:-

    - Incorporates channel size, storm design criteria and erosion/scour prevention/protection features.

    - Incorporates relevant climate change scenarios for the area.

    - Is reviewed by an independent hydrologist.

A summary of SLR (2017) findings in relation to the above items are presented below.

Specific closure design objectives and closure performance criteria for the cover system and landform design

The overall objectives of the REA closure design is to provide for containment of the rejects in a permanently and stable state, both physically and chemically and a final landform that:-

- Is inherently stable (both in terms of erosion and geotechnical stability).

- Blends in with the topography.

- Aligns with community and land owner's expectations.

- Requires minimal ongoing maintenance in the medium term (5 – 10 years) and no management after 10 years.

SLR (2017) identified the two key criteria for achieving the overall objectives of the REA closure design:-

- The predicted long term average soils losses should be in the "very low" Erosion Hazard rating threshold (< 150 t/ha/yr).

- The Long Term Factor of Safety against circular slip failure of the slope should be greater than 1.5.

Detailed REA performance indicators and closure criteria are presented in Appendix A of SLR (2017) and have been included as **Table 14** within this MOP.

The final REA landform is yet to be established and as such monitoring to determine achievement of above closure criteria is yet to commence.

Water Quality Monitoring Programme

SLR (2017) reviewed the current surface water quality management, monitoring and reporting regimes for TCM, inclusive of approved licensed discharge points with associated water quality criteria, and concluded that the collective regime is adequate for monitoring of water quality from the REA following closure activities.

Water quality monitoring of drainage (seepage) water from the REA was also considered by SLR (2017) who recommended the following:-

- Installation of an additional monitoring bore within the REA footprint. The location of the monitoring bore should be central to the REA or where long term access is available.

- The monitoring bore should be installed to the base depth of the REA. The monitoring bore should be constructed with a screened section (to allow groundwater entry) from the base of the REA to the top of the coal rejects. A gravel filter pack should be placed around the screened section and a bentonite clay seal placed on top of the filter pack to surface. The monitoring bore construction should be in accordance Minimum Construction Requirements for Water Bores in Australia, 2012 and installed by a licence water bore driller.

- Installation of the monitoring bore should be completed post capping to allow long term access.

- If the REA is unsaturated at time of drilling this will indicate that there is no seepage flow within the REA and so the drill-hole should be backfilled with drill cuttings and the surface returned to natural state.

- Installation of the groundwater monitoring bore will enable groundwater levels and quality to be sampled over time and determine if any seepage is occurring (if the REA is unsaturated then no seepage can occur).

- Monitoring and sampling should be incorporated into the Groundwater Monitoring Schedule outlined in the Tarrawonga Water Management Plan. The Groundwater Monitoring Schedule defines the parameters to be sampled in the TCM groundwater monitoring network and the recommended sampling frequency at each sampling location.

- A review and assessment of the internal drainage documented in each Annual Review.

The above recommendations by SLR will be adopted by TCM.

The final REA landform is yet to be established. Once the final landform has been established the groundwater monitoring bores will be commissioned in accordance with SLR recommendations.

Geochemical Analysis

SLR (2017) undertook a desk based review of the available geochemical information on TCM topsoil and waste rock (overburden) material. The conclusions and recommendations of the SLR (2017) review are as follows:

- The topsoil across the site has been analysed for a range of parameters which are related to soils structure and chemistry to support plant growth. The soils appear to be dispersive and thus there is a theoretical risk of soil movement and leaching in periods of erosion at the site. Therefore it is recommended that additional soils should be sampled and analysed as part of the Quality Assurance for the construction of the REA capping for the following:-
    - The total acid extractable metals and metalloids should be analysed at a frequency consistent with the size of the topsoil stockpiles.
    - The deionised water leachate analysis of the soils should also be undertaken on 50% of the topsoil samples.
    - To screen the soils for acid production capability 10% of the samples should be analysed for acid base accounting.
    - At this stage the main source of topsoil is believed to be the two topsoil stockpiles in the in north and south of the site area. It is anticipated that approximately 10-15 soil samples from each stockpile should be sufficient.
- A total of 189 samples of overburden have been collected and analysed. RGS (2017) has made recommendations regarding additional analysis at the site which involves borehole drilling and sampling. Given that the 189 samples have not indicated the presence of PAF, and the GAI shows it to be typical of crustal abundance, there are options regarding the additional analytical work:-
    - It is undertaken during the restoration of the area, where validation samples of the overburden material are analysed for the basic suite of analytes as indicated in the RGS (2017) reporting. If PAF is detected additional analysis and management will be required.
    - The schedule of additional work indicated by RGS (2017) is undertaken now – however it will need to be clarified how many sampling locations will be required.

TCM will undertake the recommended additional sampling and analysis of topsoil and overburden materials once their source has been confirmed, and prior to commencing any final capping of the REA.

Additional sampling and analysis of materials was undertaken and reported by RGS (2019). In summary RGS (2019) concluded:-

- The coal reject materials have relatively low and variable sulfur content and excess ANC, and as a bulk material have a high factor of safety with respect to potential acid generation. Most materials are classified as NAF.
- The concentrations of metals and metalloids in coal reject materials are low compared to typical levels in unmineralised soils.

- Surface runoff and seepage from coal reject materials is likely to be pH neutral to slightly alkaline with low levels of salinity.

- Static leach tests indicate that trace metals/metalloids and major ions will be sparingly soluble in runoff and seepage from coal reject materials. Dissolved concentrations of these parameters are predicted to remain within applied water quality guideline criteria and are not expected to present any significant environmental risks for on-site or downstream water quality. Dilution effects from rainfall and natural attenuation are also likely to occur in the field and further reduce the concentrations of soluble metals and metalloids in any runoff and seepage.

- Based on the predicted geochemical nature of the coal reject materials, no special management measures are required for the handling or storage of these materials, apart from those already planned in the current MOP.

Erosion Modelling

SLR (2017) undertook erosion modelling of the proposed REA cover system using material specific parameters under the proposed final embankment conditions in order to determine the likely erosion depth on the embankment, including:-

(a) development of site specific erosion protection features should erosion modelling determine these to be required to ensure long term stability of the facility.

The conclusions and recommendations of SLR (2017) from the erosion modelling undertaken were as follows:-

- The topsoil earmarked for the rehabilitation is indicated to be Loamy to Sandy Clay and some are dispersive. It is important that gypsum be applied to stabilise the soil, increase the electrolyte concentration and reduce the ESP to less than 4% during rehabilitation.

- Once soils have been stabilised the critical factor for erosion control is the soil cover. During the initial rehabilitation increasing the cover to more than 15% is critical and in the long term to above 70% to ensure targets are reached.

- Climate change should not increase erosion to above target levels if a good cover can be maintained.

TCM will adopt the SLR (2017) recommendations and have included the recommendations in **Table 14** of this MOP.

The final REA landform is yet to be established. TCM will undertake topsoil amelioration and groundcover establishment in accordance with SLR recommendations and this MOP.

Soil-Plant-Atmosphere Model

SLR (2017) developed a soil-plant-atmosphere model of the proposed REA cover system to determine net percolation and oxygen diffusion into the waste mass under closure conditions that:

(a) Uses site specific material properties and climate data.

(b) Takes into account relevant climate change scenarios for the area.

(c) Determines if the proposed closure cover system will meet the proposed closure design objectives.

The SLR (2017) model utilised site specific material properties derived from representative soil samples collected from existing stockpiles of the proposed capping materials and growth media. These properties are presented in previously prepared documents:-

- McKenzie Soil Management (2011). Agricultural Resource Assessment: "Tarrawonga Coal Project", Boggabri, NSW. Included in Appendix I of the Tarrawonga Coal Project Environmental Assessment.

- Landloch (2017). Soil and Spoil Growth Media Characterisation for Rehabilitation. Project Number: 1035.17b.

The model utilised site specific climate data and climate change scenarios derived from Intensity – Frequency – Duration (IFD) data and historical climate data for Gunnedah from the Bureau of Meteorology (BOM). Climate change scenarios were estimated based on for the 'Central Slopes' Natural Resource Management Cluster with reference to the procedure recommended in Book 1, Chapter 6, Section, Section 6.5 of ARR 2016.

The geo-modelling software package, Soilvision, was used by SLR (2017) to develop a 2D soil-plant-atmosphere model. The characteristic soil-water curve was calculated based on the results of soil characterisation testing.

SLR (2017) concluded that the model results show that there is minimal percolation into the rejects below the capping and thus the design objectives of low seepage and maintaining the low phreatic surface within the capped REA will be met with the proposed design.

Closure Surface Water Management System

SLR (2017) developed a closure surface water management system for the REA that:-

(a) Incorporates channel size, storm design criteria and erosion/scour prevention/protection features.

(b) Incorporates relevant climate change scenarios for the area.

(c) Is reviewed by an independent hydrologist.

Key features of the proposed drainage system developed by SLR include:-

1. Contour banks to limit the length of overland flows and control erosion. These will be spaced at approximately 60m centres, and have a longitudinal grade of 1.0% to 1.2%. Contour banks will have adequate capacity to convey the 20 year rainfall event without excessive scour. Contour banks across the REA will collect runoff and direct it westwards to a drop structure.

2. A rock and geofabric lined drop structure, located west of the REA, to convey flows to the base of the final REA landform. The drop structure will have capacity to convey the 50 year rainfall event, without excessive scour. The drop structure has been sized to collect runoff from the REA catchment, as well as adjacent areas of the final landform further west. This will provide a rational scheme for drainage of the adjacent areas without future duplication of the drop structure.

3. A small energy dissipation basin at the base of the drop structure, comprising a shallow rock lined pool.

4. An open channel from the energy dissipation basin will convey flows east, and then join an existing drain that drains south to existing sediment dams SB16A and SB16B located south of the existing Mine Infrastructure Area.

5. Additional sediment basin dam capacity is required since the REA, and adjoining area of the Southern Emplacement Area, will contribute additional catchment area into the existing system of sediment dams. An additional 2.1Ml of sediment dam capacity is required. This may be provided as a new sediment dam near the REA.

6. Alternatively, additional capacity could be built into system of connected sediment dams downstream of the REA. These existing sediment basins manage runoff from a large area covering the coal ROM pads, REA, southern rock dump, and Mine Infrastructure area. This would involve replacing the existing dams SB14 (10.0Ml) and SB16 (30.6Ml) with a new sediment dam with a capacity of 42.7Ml. The new basin would be located south of the proposed relocation of Goonbri Road, and the Licensed Discharge points LDP24 and LDP3 be combined into a single LDP.

7. Design of the drainage system assumes that all final landform surfaces are revegetated, but allows for the most critical period prior to effective establishment of vegetation when the landform is most susceptible to erosion.

8. Intensification of heavy rainfall associated with climate change has been estimated as 10%. This is not material since the period of intensification will occur well beyond the revegetation period for the final landform, the drainage system has surplus capacity, and the consequence of the drainage system being overtopped is not significant since water will still flow into the sediment basin system.

TCM will adopt SLR (2017) concept design features and a refined design will be presented in a subsequent MOP that includes final rehabilitation of the REA area. The final rehabilitation of the REA area will be described in a MOP associated with the TCM LOM modification.

~~3.3 Operational Issues Which Affect Rehabilitation~~

~~This section describes aspects of the operation that have the potential to significantly impact the quality and/or timing of rehabilitation.~~

~~3.3.1 Construction~~

~~As advised in **Section 2.3.2**, the current and future mining operations will maximise the use of existing infrastructure and facilities where possible. There are no construction activities that will disturb rehabilitation areas or activities anticipated during the MOP period.~~

~~**3.3.2 Geology and Geochemistry**~~

3.3.3 Acid Rock Drainage

As outlined in **Section 3.2.7~~5~~**, a small quantity of overburden, including some strata immediately adjacent to some of the coal seams, was identified as potentially containing PAF-LC material. Use of PAF_LC materials at or near the surface of reconstructed landforms presents a risk to rehabilitation due to the potential for generation of acid rock drainage (ARD). Tarrawonga will undertake testing to identify PAF materials, as guided by a geochemist. PAF material will be selectively emplaced under at least 15m of NAF material to minimise the potential for ARD. Volumes of PAF material identified and selectively emplaced will be reported in the Annual Review.

Management of reject material is outlined in **Section 3.2.5**.

~~**Salinity**~~

~~Material testing undertaken for the Project EA concluded that the overburden and interburden materials are typically alkaline and are expected to be generally non-saline. Salinity in rehabilitation areas is therefore considered a low risk.~~

3.3.4 Dispersive Materials

Sodicity test results indicate that a relatively high proportion of the overburden and interburden from the open cut extension areas is likely to be moderately to highly sodic. If these materials are left exposed on the dump surfaces or final pit walls they may be dispersive and highly erodible. To minimise erosion, the final outer surfaces of the overburden emplacements will be constructed with suitable non-sodic or low sodicity material and/or will be treated with gypsum.

Sodic material identified in the final void highwalls and lowwalls will be covered with backfill and/or ameliorated in accordance with the Closure MOP.

4 POST MINING LANDUSE

4.1 Regulatory Requirements

The approvals, licences and leases held for Tarrawonga at the time of MOP preparation are listed in **Table 1**. Regulatory requirements for post mining land use and rehabilitation are listed in the following tables for the various categories specified:

- Offset Areas – **Table ~~5~~4**;
- Rehabilitation – **Table ~~6~~5**; and
- Land Management – **Table ~~7~~6**.

This MOP has been developed to meet the requirements of Condition 3(64) of PA 11_0047. ~~Relevant EPBC 2011/5923 conditions will be addressed separately in a *Mine Site Rehabilitation Management Plan* (MSRMP).~~

Table ~~5~~4- Regulatory Requirements Relating to Offset Areas

Source	Post Mining Land Use, Landscape and Rehabilitation Requirement	Level	~~Timing~~ Comment
	Project Approval PA 11_0047 ~~MOD 1~~		
~~Schedule 3, Condition 40~~	~~The Proponent shall implement the biodiversity offset strategy described in the EA, summarised in Table 14 and shown conceptually in Appendix 7, to the satisfaction of the Director-General.~~ ~~*Willeroi Offset Area* – 1660ha: Existing native vegetation to be enhanced, and additional native vegetation to be established with the restoration of at least 193 ha of Box Gum Woodland EEC, as listed under the TSC Act~~ ~~*Rehabilitation Area* – 752 ha: Native woodland vegetation communities to be re-established, focused on Box Gum Woodland EEC.~~ ~~Note: For the purposes of this approval Box Gum Woodland refers to the EEC listed as White Box Yellow Box Blakely's Red Gum Woodland under the TSC Act, and the CEEC listed as White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grasslands under the EPBC Act, or similar EEC as may be updated from time to time.~~		~~Life of Mine~~

Source	Post Mining Land Use, Landscape and Rehabilitation Requirement	Level	~~Timing~~ Comment
~~Schedule 3, Condition 41~~	~~The Proponent shall contribute to the funding and preparation of the Leard Forest Mining Precinct Regional Biodiversity Strategy, as required under the approvals for the Boggabri coal mine and Maules Creek coal mine, to the satisfaction of the Director-General Secretary.~~ ~~*Notes:*~~ ~~• The approvals for the Boggabri coal mine and Maules Creek coal mine require the proponents of the mines in the Leard Forest mining precinct to prepare the regional biodiversity strategy in 3 stages, including:~~ ~~o Stage 1 Scoping Stage, by the end of January 2013;~~ ~~o Stage 2 Strategy Development Stage, by the end of January 2014; and~~ ~~o Stage 3 Strategy Review Stage, by the end of December 2018.~~ ~~• The strategy is required to be prepared in collaboration with a working group comprising relevant government agencies and the Leard Forest mining precinct mines, and chaired by an independent person.~~ ~~• Funding of the strategy should be based on predicted clearing of native vegetation for the three projects within the Leard Forest Mining Precinct. Based on the predicted clearing for the projects, the funding split would equate to total contributions of 36% from Boggabri (clearing of 1,385 ha), 54% from Maules Creek (clearing of 2,078ha) and 10% from Tarrawonga (clearing of 397 ha). This funding arrangement can be further refined in the Stage 1 Scoping Stage.~~		~~RBS remains in draft.~~
~~Schedule 3, Condition 42~~	~~Within 6 months of the approval of Stage 2 of the Leard Forest Mining Precinct Regional Biodiversity Strategy the Proponent shall review, and if necessary revise, the biodiversity offset strategy for the project to the satisfaction of the Director-General Secretary. The review/revision must:~~ ~~(a) be prepared in consultation with OEH, Namoi CMA LLS, Forests NSW, the CCC, DPI Catchments and Lands and SEWPaC DoEE;~~ ~~(b) not reduce the size or quality of the offset area; and~~ ~~(c) be consistent (as far as possible) with the recommendations and objectives of the Leard Forest Mining Precinct Regional Biodiversity Strategy.~~		~~Not yet applicable. Stage 2 RBS yet to be finalised.~~
Schedule 3, Condition 43	For the White Box – Yellow Box – Blakely's Red Gum Grassy Woodland Endangered Ecological Community the Proponent shall: (a) ensure that the Biodiversity Offset Strategy and site Rehabilitation Strategy is focused on protection rehabilitation, re-establishment and long-term maintenance of viable stands of this community; (b) investigate in consultation with OEH and the ~~Namoi CMA~~ LLS, all factors likely to enhance or impede the effective long term restoration of degraded remnants of this EEC in offset areas or regeneration of this EEC on disturbed areas (both offset areas and the site); (c) within 24 months of the date of this approval (and if possible in conjunction with Stage 2 of the Leard Forest Mining Precinct Regional Biodiversity Strategy), submit a report of this investigation and provide an implementation plan to maximise the prospects for rehabilitation and regeneration of this EEC on the offset areas and the site, for approval by the ~~Director-General~~ Secretary; and (d) incorporate the approved implementation plan into the revised Biodiversity Management Plan, required under condition 48.	Whole Site	Life of Mine Investigation completed 2014. Implementation plan completed 2014 and incorporated into Stage 2 of BMP (currently with DP&E for approval)

Source	Post Mining Land Use, Landscape and Rehabilitation Requirement	Level	~~Timing~~ Comment
Schedule 3, Condition 44	For all threatened species on site, the Proponent shall ensure that the Biodiversity Offset Strategy and Rehabilitation Strategy are focused on protection, rehabilitation and long-term maintenance of viable stands of suitable habitat for these species.	Whole Site	Life of Mine
Schedule 3, Condition 45	The Proponent shall: (a) investigate, in consultation with OEH and the ~~Namoi CMA~~ LLS, all factors likely to enhance or impede the effective long term provision of suitable habitat(s) for the following species: Speckled Warbler, Brown Treecreeper, Grey-crowned Babbler, Hooded Robin, Varied Sittella, Turquoise Parrot, Masked Owl, Yellow-bellied Sheath Tail Bat and Squirrel Glider; (b) within 12 months of the date of this approval (and if possible, in conjunction with Stage 2 of the Leard Forest Mining Precinct Regional Biodiversity Strategy), submit a report of this investigation and provide an implementation plan to ensure delivery of suitable areas of viable habitat for the species included in (a) above, for approval by the ~~Director-General~~ Secretary; and (c) incorporate the approved implementation plan into the revised Biodiversity Management Plan, required under condition 48.	Whole Site	Investigation completed 2014. Implementation plan completed 2014 and incorporated into Stage 2 of BMP (currently with DP&E for approval)
Schedule 3, Condition 46	The Proponent shall make suitable arrangements to provide appropriate long-term security for the offset areas: (a) for the Willeroi Offset Area the long-term security shall be provided by way of: • the Proponent entering into a conservation agreement or agreements pursuant to section 69B of the National Parks and Wildlife Act 1974, recording the obligations assumed by the Proponent under the conditions of this approval in relation to these offset areas, and registering the agreement(s) pursuant to section 69F of the National Parks and Wildlife Act 1974 ; or • a tenure of higher conservation status such as a National Park, or Nature Reserve, under the National Parks and Wildlife Act 1974, The conservation agreement(s) must be registered by the end of December 2013 unless agreed otherwise by the ~~Director-General~~ Secretary after consultation with OEH. The conservation agreements must remain in force in perpetuity; and (b) by the end of December 2030 unless otherwise agreed by the ~~Director-General~~ Secretary, for the woodland to be established in the Rehabilitation Area, as identified in Table 14, to the satisfaction of the ~~Director-General~~ Secretary. Note: The Department acknowledges that the Proponent is investigating the potential to transfer part or all of the Willeroi Offset Area directly to the national park estate, and accepts that interim conservation measures may be implemented prior to this transfer.		Extension provided until 31st December 201~~876;application for further extension currently with DP&E~~ Dec 2030

Source	Post Mining Land Use, Landscape and Rehabilitation Requirement	Level	~~Timing~~ Comment
Schedule 3, Condition 47	The Proponent shall prepare and implement a Biodiversity Management Plan for the project to the satisfaction of the ~~Director-General~~ Secretary. This plan must: (a) be prepared in consultation with OEH, ~~SEWPaC~~ DoEE, Forests NSW, the CCC, DPI Catchments and Lands and the ~~Namoi CMA~~ LLS, and be submitted to the ~~Director-General~~ Secretary for approval by the end of May 2013; (b) describe the short, medium, and long term measures that would be implemented to: • manage the remnant vegetation and habitat on the site and in the offset area; and • implement the biodiversity offset strategy, including detailed performance and completion criteria; (c) include detailed performance and completion criteria for evaluating the performance of the biodiversity offset strategy, and triggering remedial action (if necessary); (d) include a detailed description of the measures that would be implemented for: • enhancing the quality of existing vegetation and fauna habitat; • restoring native vegetation and fauna habitat on the biodiversity offset area and rehabilitation area through focusing on assisted natural regeneration, targeted vegetation establishment and the introduction of naturally scarce fauna habitat features; • maximising the salvage of resources within the approved disturbance area – including vegetative, top and sub soils and cultural heritage resources – for beneficial reuse in the enhancement of the biodiversity offset area or rehabilitation area; • collecting and propagating seed; • minimising the impacts on fauna on site, including undertaking pre-clearance surveys; • managing any potential conflicts between the proposed restoration works in the biodiversity offset area and any Aboriginal heritage values (both cultural and archaeological); • managing salinity; • controlling weeds and feral pests; • controlling erosion; • controlling access; and • managing bushfire risk; (e) include a seasonally-based program to monitor and report on the effectiveness of these measures, and progress against the detailed performance and completion criteria; (f) identify the potential risks to the successful implementation of the biodiversity offset strategy, and include a description of the contingency measures that would be implemented to mitigate against these risks; and (g) include details of who would be responsible for monitoring, reviewing, and implementing the plan. Note: The Biodiversity Management Plan and Rehabilitation Management Plan need to be substantially integrated for achieving biodiversity objectives for the rehabilitated mine-site.		Stage 1 BMP (mine site) approved. Stage 2 BMP (mine site and offset area) with DP&E for approval.

Source	Post Mining Land Use, Landscape and Rehabilitation Requirement	Level	~~Timing~~ Comment
Schedule 3 Condition 48	The Proponent shall review and if necessary revise the Biodiversity Management Plan within 6 months of the completion of Stage 2 of the Leard Forest Mining Precinct Regional Biodiversity Strategy, to the satisfaction of the ~~Director-General~~ Secretary. The review/revision must: (a) be prepared in consultation with OEH, ~~SEWPaC~~ DoEE, Forests NSW, the CCC, DPI Catchments and Lands and the ~~Namoi CMA~~ LLS; (b) be consistent with the findings of Leard Forest Mining Precinct Regional Biodiversity Strategy; and (c) include any implementation plans arising from the studies required under conditions 43~~45~~43 and 45 of this approval.		~~Not yet applicable~~ Stage 2 RBS has been approved and a revised BMP has been submitted for approval.~~is required to be submitted for approval to DPE by end of February 2018~~.
Schedule 3 Condition 49	By the end of May 2013, the Proponent shall lodge a Conservation and Biodiversity Bond with the Department to ensure that the biodiversity offset strategy is implemented in accordance with the performance and completion criteria of the Biodiversity Management Plan. The sum of the bond shall be determined by: (a) calculating the full cost of implementing the biodiversity offset strategy (other than land acquisition costs); and (b) employing a suitably qualified quantity surveyor to verify the calculated costs, to the satisfaction of the ~~Director-General~~ Secretary. If the offset strategy is completed generally in accordance with the completion criteria in the Biodiversity Management Plan to the satisfaction of the ~~Director-General~~ Secretary, the ~~Director-General~~ Secretary will release the bond. If the offset strategy is not completed generally in accordance with the completion criteria in the Biodiversity Management Plan, the ~~Director-General~~ Secretary will call in all, or part of, the conservation bond, and arrange for the satisfactory completion of the relevant works. With the agreement of the ~~Director-General~~ Secretary, this bond may be combined with rehabilitation security deposit administered by DRE. *Notes:* * Alternative funding arrangements for long term management of the Biodiversity Offset Strategy, such as provision of capital and management funding as agreed by OEH as part of a Biobanking Agreement or transfer to conservation reserve estate can be used to reduce the liability of the conservation and biodiversity bond. * The sum of the bond may be reviewed in conjunction with any revision to the biodiversity offset strategy.		Not yet applicable. Bond to be provided within 3 months of approval of Stage 2 BMP.

Source	Post Mining Land Use, Landscape and Rehabilitation Requirement	Level	~~Timing~~ Comment
Schedule 3 Condition 50	By the end of June 2014 and every 3 years thereafter, unless both the ~~Director-General~~ Secretary and OEH agree to a different timeframe, the Proponent shall commission suitably qualified, experienced and independent person/s, whose appointment has been approved by the ~~Director-General~~ Secretary, to undertake an audit of the revegetation of the rehabilitation area and management and restoration within the Biodiversity Offset Strategy areas to the satisfaction of the ~~Director-General~~ Secretary. This audit must: (a) include consultation with OEH, ~~Namoi CMA~~ LLS, DPI Catchments and Lands, ~~SEWPaC~~ DoEE, CCC and DRE; (b) assess the performance of the revegetation in the rehabilitation area completed to date (and the Goonbri Creek Diversion, once commenced) against the completion criteria in the Rehabilitation Management Plan; (c) assess the performance of management and restoration in the off-site Biodiversity Offset Strategy areas completed to date against the completion criteria in the Biodiversity Management Plan; (d) identify any measures that should be implemented to improve the performance of rehabilitation, management and restoration within the rehabilitation and biodiversity offset areas; and (e) identify any additional measures that should be applied in the establishment of native vegetation, including riparian vegetation around the realigned Goonbri Creek, both before and after the realignment is undertaken; (f) if the completion criteria have not been met, or are not adequately trending towards being met, determine the likely ecological value of the rehabilitation and restoration once completed, and recommend additional measures to augment the Biodiversity Offset Strategy to ensure that it adequately offsets the project's impacts on biodiversity. If the audit recommends the implementation of additional measures to augment the Biodiversity Offset Strategy in accordance with (e) above, then within 6 months of the completion of the audit the Proponent shall revise the Biodiversity Offset Strategy, in consultation with the Department, OEH and ~~SEWPaC~~ DoEE, and to the satisfaction of the ~~Director-General~~ Secretary.		June ~~2014~~2017 and thereafter every 3 years
	EPBC Approval 2011/5923		
Condition 6	6. The person taking the action must register a legally binding conservation covenant over offset areas of no less than: a. 1055 ha of an equivalent or better quality of habitat for the regent honeyeater; b. 397 ha of an equivalent or better quality of habitat for the swift parrot; c. 1355 ha of an equivalent or better quality of habitat for the greater long-eared bat; and d. 232 ha of an equivalent or better quality of the White Box—Yellow Box—Blakely's Red Gum Grassy Woodland and Derived Native Grassland ecological community. Note: Offset areas described in condition 6 do not necessarily need to be separate if the same areas can meet the listing criteria for the EPBC listed threatened species or communities as defined in the EPBC listing advice for that threatened species or community and meet the requirements of condition 6.		~~11 Mar 2018~~ 30 March 2020 ~~(5 years from approval – see condition 10)~~

Source	Post Mining Land Use, Landscape and Rehabilitation Requirement	Level	~~Timing~~ Comment
Condition 7	7. The person taking the action must verify through independent review the quantity and condition class of White Box—Yellow Box—Blakely's Red Gum Grassy Woodland and Derived Native Grassland ecological community and the quantity and quality of habitat for the regent honeyeater, swift parrot and greater long-eared bat within all proposed offset areas including those proposed in the Environmental Assessment and any additional offsets as required at condition 8. Details of all independently verified offset areas must be submitted to the Minister for approval by 31 January 2014. The findings of the independent review must be published on the proponent's website.		Completed 31 Jan 2014
Condition 8	8. If the independent review finds that the offset areas do not meet the requirements of conditions 6, 7 and 9 then additional areas must be included in the offset areas until all relevant criteria under these conditions are met.		Ongoing
Condition 9	9. The offset areas must be of an overall equivalent or better quality than the areas being cleared. This means: a. for White Box—Yellow Box—Blakely's Red Gum Grassy Woodland and Derived Native Grassland ecological community, offset areas must meet the definition of the ecological community described in the listing advice, and must be of an overall equivalent or better condition class than the areas being cleared, based on the proportion of each condition class represented and other relevant ecological attributes; b. for the threatened species, the quality of the habitat for the species, taking account of its ecological requirements, must be equivalent to or better than the areas being cleared.		Ongoing
Condition 10	10. The mechanism/s for registering a legally binding covenant must provide protection for the offset areas in perpetuity and be registered within 5 years of the date of this approval. Evidence of registration must be provided to the Department within one month of registration of each legally binding covenant.		11 March 2018
Condition 11	11. If the person taking the action proposes to undertake any action within areas secured under condition 6, other than those management activities related to managing the offset areas or as set out in the conditions of approval, then approval to undertake that action must be obtained in writing from the Minister. In seeking the Minister's approval, the person undertaking the action must provide a detailed assessment of the area where the action is proposed to take place and an assessment of all associated adverse impacts on matters of national environmental significance. If the Minister agrees to the action within the offset areas, the area identified for the action must be excised from the offset area and alternative offsets secured by the person taking the action at a ratio of at least 20:1 in relation to the impact on matters of national environmental significance.		Ongoing
Condition 12	12. The person taking the action must submit to the Minister for approval an Offset management plan for all of the offset areas, specified in condition 6, within 12 months of the date of this approval. The approved Offset management plan must be implemented. Note: for consistency, the proponent may develop a Biodiversity Management plan that includes the requirements set for managing offsets and set out in these conditions, to align with the requirements of the NSW state government Project Approval dated 22 January 2013 (application number 11_0047) and this approval.		OMP incorporated into Stage 2 BMP.

Condition 13	13. The Offset management plan must include, but not be limited to, the following: a) a text description and map which clearly defines the location and boundaries of the offset areas. This must be accompanied by the offset attributes and shapefiles; b) a description of the methodology and results of surveys measuring the baseline ecological conditions in the offset areas. This must be consistent with the State and Transition Model and include but not be limited to: i. the extent and condition of all vegetation communities, including a description of the structure, floristics and tree age class representation of each community; ii. the extent and condition class of all areas of the White Box—Yellow Box—Blakely's Red Gum Grassy Woodland and Derived Native Grassland ecological community; iii. surveys targeting the regent honeyeater, swift parrot and greater long-eared bat; iv. iv. the extent and quality of all areas of habitat for the regent honeyeater, swift parrot and greater long-eared bat; v. the location of all survey sites (including co-ordinates); vi. photo reference points at survey sites. c) clearly defined ecological management objectives for the offset areas; d) detailed description of all ecological management activities proposed to be undertaken, including maps and/or diagrams showing areas to be managed and the timing of the proposed activities; e) details of ongoing ecological monitoring programs, performance criteria, targets and provisions for adaptive management, including but not limited to: i. a set of measurable ecological indicators for detecting changes to the White Box—Yellow Box—Blakely's Red Gum Grassy Woodland and Derived Native Grassland ecological community, including those that may be ascribed to ongoing water stress; ii. a monitoring plan to assess the success of the management activities measured against the baseline condition. The monitoring must be statistically robust and able to quantify change in the condition of the White Box—Yellow Box—Blakely's Red Gum Grassy Woodland and Derived Native Grassland ecological community and habitat for the regent honeyeater, swift parrot and greater long-eared bat. This should include the use of control sites and periodic ecological surveys to be undertaken by a qualified ecologist; iii. a list of performance criteria based on the ecological management objectives for the White Box—Yellow Box—Blakely's Red Gum Grassy Woodland and Derived Native Grassland ecological community and habitat for the regent honeyeater, swift parrot and greater long-eared bat; iv. measures to exclude weeds from all offset areas for the period covered by this approval; v. a description of the potential risks to successful management against the performance criteria, and a description of the contingency measures that would be implemented to mitigate against these risks; vi. a process by which to report to the department the progress of management activities undertaken in the offset areas and the outcome of those activities, including identifying any need for improved management and activities to undertake such improvement. f) details of all parties responsible for management, monitoring and implementing the management activities, including their position or status as a separate contractor. g) details of the funding requirements for the ongoing management activities, including an estimate of the costs of the activities and details of the parties responsible for funding the activities.		OMP incorporated into Stage 2 BMP.

Source	Post Mining Land Use, Landscape and Rehabilitation Requirement	Level	~~Timing~~ Comment
Condition 14	14. Unless otherwise agreed to in writing by the department, the baseline surveys for threatened species must be conducted in accordance with the department's Survey Guidelines for Australia's Threatened Birds and the Survey Guidelines for Australia's Threatened Bats. Subsequent monitoring must be carried out annually at the same time of year as the baseline surveys, unless otherwise agreed to in writing by the department.		Annually – March
Condition 22	22. The person taking the action must implement the regional biodiversity strategy as required under condition 41 of the NSW state government project approval dated 22 January 2013 (application number 11_0047). The required scoping report for the development of the strategy must be submitted to the Minister for approval on or before 31 July 2013. The approved strategy must be implemented.		Completed 31 July 2013
	Tarrawonga Coal Project EA Statement of Commitments		
Biodiversity Offset Measures	TCPL Commitment TCPL commits to the provision of an area to offset the residual impacts of the Project on flora and fauna and maintain or improve the biodiversity values of the region in the medium to long-term. The biodiversity offset for the Project comprises approximately 1,600 ha of freehold land that has been purchased by Whitehaven. The offset is situated approximately 20 km to the north-east of the Project and adjoins Mount Kaputar National Park (Figure SOC-2). Prior to its recent purchase by Whitehaven the offset area was part of a larger agricultural property. Ecological gains from the biodiversity offset include: • Similar vegetation communities/fauna habitats, compared to the Project area, will be conserved/enhanced in the biodiversity offsetarea. • The biodiversity offset area is suitably located to benefit flora and fauna populations (biodiversity values) potentially impacted by the Project. • The biodiversity offset area is located adjacent to Mount Kaputar National Park. • Ephemeral creeks occur within the biodiversity offset area, providing a diversity of habitats. • Substantial areas of Box-Gum Woodland (232 ha) occur in the biodiversity offset area. Through active management, particularly of areas previously cleared for agriculture, the ecological values of the biodiversity offset area can be further improved. TCPL commits to a number of management measures to enhance the offset area's flora and fauna values. These measures will be detailed in the Offset Area Management Plan to be prepared for the Project.		Life of Mine

Table ~~65~~- Regulatory Requirements Relating to Rehabilitation

Source	Post Mining Land Use, Landscape and Rehabilitation Requirement	Level	~~Timing~~ Comment
	Project Approval PA 11_0047 ~~MOD 1~~		
~~Schedule 3, Condition 41~~	~~The Proponent shall contribute to the funding and preparation of the Leard Forest Mining Precinct Regional Biodiversity Strategy, as required under the approvals for the Boggabri coal mine and Maules Creek coal mine, to the satisfaction of the Director-General Secretary.~~ ~~*Notes:*~~ ~~• The approvals for the Boggabri coal mine and Maules Creek coal mine require the proponents of the mines in the Leard Forest mining precinct to prepare the regional biodiversity strategy in 3 stages, including:~~ ~~o Stage 1 Scoping Stage, by the end of January 2013;~~ ~~o Stage 2 Strategy Development Stage, by the end of January 2014; and~~ ~~o Stage 3 Strategy Review Stage, by the end of December 2018.~~ ~~• The strategy is required to be prepared in collaboration with a working group comprising relevant government agencies and the Leard Forest mining precinct mines, and chaired by an independent person.~~ ~~• Funding of the strategy should be based on predicted clearing of native vegetation for the three projects within the Leard Forest Mining Precinct. Based on the predicted clearing for the projects, the funding split would equate to total contributions of 36% from Boggabri (clearing of 1,385 ha), 54% from Maules Creek (clearing of 2,078ha) and 10% from Tarrawonga (clearing of 397 ha). This funding arrangement can be further refined in the Stage 1 Scoping Stage.~~		~~RBS remains in draft.~~

Source	Post Mining Land Use, Landscape and Rehabilitation Requirement	Level	~~Timing~~ Comment
~~Schedule 3, Condition 47~~	~~The Proponent shall prepare and implement a Biodiversity Management Plan for the project to the satisfaction of the Director-General Secretary. This plan must:~~ ~~(a) be prepared in consultation with OEH, SEWPaC DoEE, Forests NSW, the CCC, DPI Catchments and Lands and the Namoi CMA LLS, and be submitted to the Director-General Secretary for approval by the end of May 2013;~~ ~~(b) describe the short, medium, and long term measures that would be implemented to:~~ ~~• manage the remnant vegetation and habitat on the site and in the offset area; and~~ ~~• implement the biodiversity offset strategy, including detailed performance and completion criteria;~~ ~~(c) include detailed performance and completion criteria for evaluating the performance of the biodiversity offset strategy, and triggering remedial action (if necessary);~~ ~~(d) include a detailed description of the measures that would be implemented for:~~ ~~• enhancing the quality of existing vegetation and fauna habitat;~~ ~~• restoring native vegetation and fauna habitat on the biodiversity offset area and rehabilitation area through focusing on assisted natural regeneration, targeted vegetation establishment and the introduction of naturally scarce fauna habitat features;~~ ~~• maximising the salvage of resources within the approved disturbance area – including vegetative, top and sub soils and cultural heritage resources – for beneficial reuse in the enhancement of the biodiversity offset area or rehabilitation area;~~ ~~• collecting and propagating seed;~~ ~~• minimising the impacts on fauna on site, including undertaking pre-clearance surveys;~~ ~~• managing any potential conflicts between the proposed restoration works in the biodiversity offset area and any Aboriginal heritage values (both cultural and archaeological);~~ ~~• managing salinity;~~ ~~• controlling weeds and feral pests;~~ ~~• controlling erosion;~~ ~~• controlling access; and~~ ~~• managing bushfire risk;~~ ~~(e) include a seasonally-based program to monitor and report on the effectiveness of these measures, and progress against the detailed performance and completion criteria;~~ ~~(f) identify the potential risks to the successful implementation of the biodiversity offset strategy, and include a description of the contingency measures that would be implemented to mitigate against these risks; and~~ ~~(g) include details of who would be responsible for monitoring, reviewing, and implementing the plan.~~ ~~Note: The Biodiversity Management Plan and Rehabilitation Management Plan need to be substantially integrated for achieving biodiversity objectives for the rehabilitated mine site.~~		~~Stage 1 BMP (mine site) approved. Stage 2 BMP (mine site and offset area) with DP&E for approval.~~

Source	Post Mining Land Use, Landscape and Rehabilitation Requirement		Level	~~Timing~~ Comment
~~Schedule 3, Condition 48~~	~~The Proponent shall review and if necessary revise the Biodiversity Management Plan within 6 months of the completion of Stage 2 of the Leard Forest Mining Precinct Regional Biodiversity Strategy, to the satisfaction of the Director-General Secretary. The review/revision must:~~ ~~(a) be prepared in consultation with OEH, SEWPaC DoEE, Forests NSW, the CCC, DPI Catchments and Lands and the Namoi CMA LLS;~~ ~~(b) be consistent with the findings of Leard Forest Mining Precinct Regional Biodiversity Strategy; and~~ ~~(c) include any implementation plans arising from the studies required under conditions 43~~~~45~~ ~~of this approval.~~			~~Not yet applicable~~
~~Schedule 3, Condition 43~~	~~For the White Box – Yellow Box – Blakely's Red Gum Grassy Woodland Endangered Ecological Community the Proponent shall:~~ ~~(a) ensure that the Biodiversity Offset Strategy and site Rehabilitation Strategy is focused on protection rehabilitation, re-establishment and long-term maintenance of viable stands of this community;~~ ~~(b) investigate in consultation with OEH and the Namoi CMA LLS, all factors likely to enhance or impede the effective long term restoration of degraded remnants of this EEC in offset areas or regeneration of this EEC on disturbed areas (both offset areas and the site);~~ ~~(c) within 24 months of the date of this approval (and if possible in conjunction with Stage 2 of the Leard Forest Mining Precinct Regional Biodiversity Strategy), submit a report of this investigation and provide an implementation plan to maximise the prospects for rehabilitation and regeneration of this EEC on the offset areas and the site, for approval by the Director-General Secretary; and~~ ~~(d) incorporate the approved implementation plan into the revised Biodiversity Management Plan, required under condition 48.~~			~~Life of Mine Investigation completed 2014. Implementation plan completed 2014 and incorporated into Stage 2 of BMP (currently with DP&E for approval)~~
Schedule 3, Condition 61	The Proponent shall rehabilitate the site to the satisfaction of the ~~Executive Director Mineral Resources~~ DRE. This rehabilitation must be generally consistent with the proposed Rehabilitation Strategy described in the EA (and depicted conceptually in Appendix 8) and comply with the objectives in Table 15. **Table 15: Rehabilitation Objectives**			Life of Mine
	Feature	**Objective**		
	Mine site (as a whole)	• Safe, stable and non-polluting • Constructed landforms drain to the natural environment • Landforms fully integrated with the final landform for the Boggabri coal mine		
	Final void	• Minimise the size and depth of the final void as far as is reasonable and feasible • Minimise the drainage catchment of the final void as far as is reasonable and feasible • Negligible high wall instability risk • Minimise risk of flood interaction for all flood events up to and including the Probable Maximum Flood level		
	Surface infrastructure	• To be decommissioned and removed, unless the Executive Director, Mineral Resources agrees otherwise		
	Agricultural land	• Establish a minimum of 210 hectares of Class 3 agricultural suitability land, including 160 hectares with cropping capability		

Source	Post Mining Land Use, Landscape and Rehabilitation Requirement		Level	~~Timing~~ Comment
	All land – excluding the 210 ha of agricultural land and the final void	• Restore ecosystem function, including maintaining or establishing self-sustaining ecosystems comprised of: - local native plant species (particularly Box Gum Woodland EEC); and - a landform consistent with the surrounding environment		
	Goonbri Creek diversion and LPB	See Table 13 Note: Goonbri Ck diversion and LPB not proposed within this MOP period		
	Community	• Ensure public safety • Minimise the adverse socio-economic effects associated with mine closure		
Schedule 3, Condition 62	The Proponent shall in consultation with the ~~Namoi CMA~~ LLS: (a) develop a detailed soil management protocol that identifies procedures for: • comprehensive soil surveys prior to soil stripping; assessment of top-soil and sub-soil suitability for mine rehabilitation; and annual soil • balances to manage soil handling including direct respreading and stockpiling; (b) maximise the salvage of suitable top-soils and sub-soils and biodiversity habitat components such as bush rocks, tree hollows and fallen timber for rehabilitation of disturbed areas within the site and for enhancement of biodiversity offset areas; and (c) ensure that coal reject, or any potentially acid forming interburden materials, are not emplaced at elevations in the pit shell where they may promote acid or sulphate species generation and migration beyond the pit shell.			Life of Mine
Schedule 3, Condition 63	The Proponent shall rehabilitate the site progressively, that is, as soon as reasonably practicable following disturbance. All reasonable and feasible measures must be taken to minimise the total area exposed for dust generation at any time. Interim rehabilitation strategies shall be employed when areas prone to dust generation cannot yet be permanently rehabilitated. Note: It is accepted that the parts of the site that are progressively rehabilitated may be subject to further disturbance in future.			Life of Mine

Source	Post Mining Land Use, Landscape and Rehabilitation Requirement	Level	~~Timing Comment~~
Schedule 3, Condition 64	The Proponent shall prepare and implement a Rehabilitation Management Plan to the satisfaction of the Executive Director, Mineral Resources. This plan must: (a) be prepared in consultation with the Department, Forests NSW, ~~NOW~~ DPI, OEH, ~~Namoi CMA~~ LLS and Council; (b) be submitted to the ~~Executive Director, Mineral Resources DRE~~ for approval by the end of May 2013; (c) be prepared in accordance with any relevant DRE guideline; (d) describe how the rehabilitation of the site would be integrated with: • the implementation of the biodiversity offset strategy; and • the final landform for the Boggabri coal mine; (e) include detailed performance and completion criteria for evaluating the performance of the rehabilitation of the site, and triggering remedial action (if necessary); (f) describe the measures that would be implemented to ensure compliance with the relevant conditions of this approval, and address all aspects of rehabilitation including mine closure, final landform and final land use; (g) include interim rehabilitation where necessary to minimise the area exposed for dust generation; (h) include a program to monitor, independently audit and report on the effectiveness of the rehabilitation measures, and progress against the detailed performance and completion criteria; (i) include a coal rejects disposal procedure and monitoring program for potential acid generation; and (j) build to the maximum extent practicable on the other management plans required under this approval. Note: The Biodiversity Management Plan and Rehabilitation Management Plan require substantial integration to achieve biodiversity objectives for the rehabilitated mine site.		Part of this MOP

Source	Post Mining Land Use, Landscape and Rehabilitation Requirement	Level	~~Timing~~ Comment
Schedule 3, Condition 65	The Proponent shall prepare and implement an updated Final Void and Mine Closure Plan (as a component of the overall Rehabilitation Management Plan required under condition 64 of schedule 3) to the satisfaction of ~~the Executive Director Mineral Resources~~ DRE, following consultation with the ~~Director General~~ Secretary. A draft plan must be prepared and submitted to ~~the Executive Director Mineral Resources~~ DRE by the end of December 2019, and a final plan must be prepared and submitted to ~~the Executive Director Mineral Resources~~ DRE by the end of December 2024. Each version of the plan must: (a) be subject to independent review and verification by suitably qualified, experienced and independent person/s (including a groundwater expert) whose appointment has been approved by the ~~Director General~~ Secretary; (b) identify and consider: • options for continued mining beyond current project life; • interactions with the final landform of adjoining mines (including any direct or indirect interaction between final voids); • opportunities for integrated mine planning with adjoining mines to minimise environmental impacts of the mines' final landforms; • all reasonable and feasible landform options for the final void (including filling); • predicted stability of the proposed landforms; and • predicted hydrochemistry and hydrogeology (including long-term groundwater recovery and void groundwater quality); (c) include a detailed proposed landform design; and (d) demonstrate that the proposed final landform: • satisfies the relevant objectives in Table 15; • minimises the extent of any resulting pit lake; • avoids salt scalding; • maximises the capacity of emplaced spoil to drain to the natural environment; and • ensures that drained waters do not adversely affect the downstream environment.		December 2019
Schedule 3, Condition 66	The Proponent shall use its best endeavours to ensure that the agricultural productivity and production of non-operational project-related land is maintained or enhanced. Note: This includes properties primarily used for agriculture that are acquired by the Proponent due to noise and/or air quality impacts. However, it does not include land where disturbance is permitted under the conditions of this approval or land that forms part of the biodiversity offset area.		Life of Mine
	EPBC Approval 2011/5923		

Source	Post Mining Land Use, Landscape and Rehabilitation Requirement	Level	~~Timing~~ Comment
Condition 3	The person taking the action must submit to the Minister for approval within three months of commencement of construction, an approach that: a. limits the maximum disturbance (in hectares) specified for each of the years 5, 10, 15 and 17 from the date of this approval of the White Box—Yellow Box—Blakely's Red Gum Grassy Woodland and Derived Native Grassland ecological community and the habitat or potential habitat for the regent honeyeater, swift parrot and greater longeared bat; b. incorporates an analysis, undertaken by independent ecological experts approved by the Department, that demonstrates the maximum disturbance limits which will minimise any impacts on relevant matters of national environmental significance; c. demonstrates collaboration with the person taking the action to develop and operate the Boggabri Coal Project (EPBC 2009/5256) and the person taking the action to develop and operate the Maules Creek Coal Project (EPBC 2010/5566), in order to minimise progressive project area disturbance limits across all three sites. The progressive disturbance limits are to be reflected in the development of the Leard Forest Mining Precinct Biodiversity Strategy.	Whole Site	~~Within 3 months of construction activities commencing~~ Refer to the MSRMP
~~Condition 22~~	~~22. The person taking the action must implement the regional biodiversity strategy as required under condition 41 of the NSW state government project approval dated 22 January 2013 (application number 11_0047). The required scoping report for the development of the strategy must be submitted to the Minister for approval on or before 31 July 2013. The approved strategy must be implemented.~~		~~31 July 2013~~
Condition 23	~~23.~~ To mitigate the impacts to the White Box-Yellow Box –Blakely's Red Gum Grassy Woodland and Derived Native Grassland and the habitat of the regent honeyeater, swift parrot and greater long-eared bat, the person taking the action must, within ~~12 months of the commencement of construction~~ six months of the date of this variation to conditions of approval, submit to the Minister for approval a mine site rehabilitation plan for the progressive rehabilitation and revegetation of no less than 752 ha of native forest and woodland in the project area including 13 ha using species consistent with a White Box—Yellow Box—Blakely's Red Gum Grassy Woodland and Derived Native Grassland Ecological Community. This approved mine site rehabilitation plan must be implemented.	Whole Site	~~MSRMP to be submitted by 31 August 2015~~ Refer to the MSRMP
Condition 24	~~24.~~ The person taking the action must rehabilitate the site to be consistent with the proposed rehabilitation strategy as provided in the Environmental Assessment and, as required under the NSW State Government approval dated 22 January 2013 (Application 11_0047).	Whole Site	Life of Mine

Source	Post Mining Land Use, Landscape and Rehabilitation Requirement	Level	~~Timing~~ ~~Comment~~
Condition 25	~~25.~~ The mine site rehabilitation plan must include, at a minimum, the following information: a. targets and performance indicators to achieve effective restoration of potential habitat for the regent honeyeater, swift parrot and greater long-eared bat and White Box—Yellow Box—Blakely's Red Gum Grassy Woodland and Derived Native Grassland ecological community, including weed management; b. details of the vegetation communities to be rehabilitated and the timing of progressive rehabilitation (commencing as soon as practicable following disturbance); c. detailed soil depth surveys and analysis to inform the effective placement and restoration of soils underlying the proposed rehabilitation sites; including mapping of soils across the disturbance sites and soil sampling at no less than one sample point per 20 ha of each soil type identified. Sampling must identify; type, depth, water holding capacity, structure and physio-chemical properties of each of the soil and subsoil layers; d. processes and methodologies for the removal, storage and re-layering of the top soil and sub soil layers underlying the disturbed sites being prepared for rehabilitation. These processes and methodologies must ensure the replacement of top soil and sub soil layers as provided in the Environment Assessment. e. a process to report annually to the department the rehabilitation management actions undertaken and the outcome of those actions, and the mechanisms to be used to identify the need for improved management; f. a description of the potential risks to successful management and rehabilitation on the project site, including weed invasion, and a description of the contingency measures that would be implemented to mitigate these risks; g. details of long-term management and protection of the mine site, including details of the commitment of funds to achieve this.	Whole Site	~~MSRMP to be submitted by 31 August 2015~~ Refer MSRMP
Condition 26	~~26.~~ The mine site rehabilitation plan must be subject to an independent review by a qualified ecologist prior to being submitted to the Minister for approval. The findings of the independent review must be published on the ~~proponent's~~ website of the person taking the action at the same time as the approved *Mine Site Rehabilitation Plan* is published. Note: for consistency, the person taking the action may develop a single mine rehabilitation plan to align with the requirements, including timing of reporting, of the NSW State Government approval dated 22 January 2013 (Application 11_0047) and this approval. The Offset Management Plan and the Rehabilitation management Plan need to be substantially integrated for achieving biodiversity objectives for the rehabilitated mine-site.	Whole Site	~~Before submitting to Minister for approval.~~ Refer MSRMP
~~Condition 27~~	~~27. The person taking the action is required to submit a Conservation and Biodiversity Bond under condition 49 of the New South Wales state government project approval dated 22 January 2013 (application 11_0047). It is noted that this bond may be combined with the rehabilitation security deposit as required under the New South Wales Mining Act 1992. The person taking the action must submit details of this bond and the rehabilitation security deposit, to the Minister, within six months of this approval one month of lodgement of the bond and deposit with the NSW state government. If the Minister is not satisfied that the bond and rehabilitation security deposit lodged by the person taking the action is adequate to provide for the requirements referred to under conditions 19, 20, 22, 23 and 24, the Minister may require the person taking the action establish an additional bond or equivalent financial instrument in trust, under conditions approved in writing by the Minister.~~		~~Not yet applicable. Bond to be provided within 3 months of approval of Stage 2 BMP.~~

Source	Post Mining Land Use, Landscape and Rehabilitation Requirement	Level	~~Timing~~ Comment
Condition 28	~~28.~~ The person taking the action must undertake rehabilitation to ensure the final landform provides the optimum opportunity for the successful restoration of native forest and woodland including the critically endangered White Box—Yellow Box—Blakely's Red Gum Grassy Woodland and Derived Native Grassland ecological community.	Whole Site	Life of Mine
Condition 29	~~29.~~ The person taking the action must undertake rehabilitation to ensure the final void and landform minimises the extent of any resulting pit lake, avoids salt scalding and ensures that drained waters do not adversely affect the downstream environment and avoids any impacts on matters of national environmental significance. Note: the State approval conditions for project 11_0047 require the preparation and implementation of a Final Void and Mine Closure Plan that considers interactions with the adjoining mines, including interaction between final voids, opportunities for integrated mine planning with adjoining mines to minimise environmental impacts, all reasonable and feasible landform options for the final void (including filling) and predicted hydrochemistry and hydrogeology (including long-term groundwater recovery and void groundwater quality).	Whole Site	Life of Mine
	Tarrawonga Coal Project EA Statement of Commitments		
Low Permeability Barrier	TCPL Commitment TCPL commits to construction of the low permeability barrier to meet the following design objectives: • minimise the potential for local drainage of alluvial groundwater into the open cut during operations and post-mining; • minimise the potential for future instability of the open cut batters formed in the alluvium; • maintain the hydraulic character of Goonbri Creek by minimising the potential loss of baseflow; and • maintain the value of alluvial groundwater, by minimising potential interactions with the mine final void, post-mining.area's flora and fauna values. In addition, TCPL will augment the existing piezometer network with additional sites to validate the performance of the low permeability barrier.		Approximately Year12 of the Project

Source	Post Mining Land Use, Landscape and Rehabilitation Requirement	Level	~~Timing~~ Comment
Permanent Goonbri Creek Alignment and Associated Flood Bund	TCPL Commitment TCPL commits to the design, construction and implementation of the permanent Goonbri Creek alignment to meet the following design objectives: • construct a low flow channel that approximates the existing section of Goonbri Creek upstream of the Project in terms of stream geometry, hydrology and geomorphology; • mimic the meandering path of the existing alignment of Goonbri Creek, such that the length of the permanent Goonbri Creek alignment is approximately the same length as the section of Goonbri Creek being removed; • minimise the disturbance to the reaches of Goonbri Creek upstream of the permanent Goonbri Creek alignment; and • provide a stable transition back to the existing Goonbri Creek alignment which results in no detectable change to the hydraulic conditions in the reaches of Goonbri Creek or the Bollol Creek floodplain area downstream. In addition, TCPL commits to the design and construction of the permanent flood bund to a height that will provide protection against the peak flood height associated with a Probable Maximum Precipitation rainfall event. TCPL will develop and implement a Goonbri Creek Management Plan prior to the commencement of construction activities associated with the low permeability barrier, permanent Goonbri Creek alignment and flood bund. The Goonbri Creek Management Plan will describe: • the design and construction details of the permanent Goonbri Creek alignment and flood bund; • revegetation objectives and activities; water quality, ecological, hydrological and geomorphic performance and completion criteria for the permanent Goonbri Creek alignment based on baseline conditions; and • a monitoring/maintenance program for water quality, ecological, hydrological and geomorphic integrity of the permanent Goonbri Creek alignment.		Approximately Year 12 of the Project Prior to commencement of construction

Source	Post Mining Land Use, Landscape and Rehabilitation Requirement	Level	~~Timing~~ Comment
Rehabilitation Objectives and Final Landform	*TCPL Commitment* The Project final landform and revegetation program will provide for a combination of approximately 752 ha of native woodland/forest and some 210 ha of Class 3 agricultural suitability land. The agricultural land will be capable of being used for pasture production for grazing and occasional cropping. Revegetation of woodland/forest areas will include the planting of species characteristic of the local vegetation communities, including species from the Box-Gum Woodland endangered ecological community. In addition, TCPL commits to a riparian vegetation enhancement program on a 3.2 km section of Goonbri Creek downstream of the Project open cut, through measures such as revegetation and stock exclusion. A Rehabilitation Management Plan will be developed and implemented for the Project, including a rehabilitation monitoring program designed to track the progress of rehabilitation and revegetation.		Life of mine
Management of the Project Final Void	*TCPL Commitment* TCPL commits to installing permanent perimeter bunds and/or diversion channels to limit the catchment area of the final void. In addition, TCPL will design and construct the final void to minimise the long-term drawdown and potential water quality effects on local groundwater aquifers. This will be achieved by adjusting the final void batter angles and/or placing additional waste rock backfill in the final void such that a permanent water body will form and reach an equilibrium level close to, but below, the local pre-mining groundwater level in the coal measures. TCPL will adopt an adaptive management approach to the final void design and mine closure planning for the Project. Final void design and mine planning will be undertaken by TCPL in consultation with relevant government agencies as a component of the Rehabilitation Management Plan.		At completion of mining. 5 years prior to mine closure

Table ~~7~~6- Regulatory Requirements Relating to Land Management

Source	Post Mining Land Use, Landscape and Rehabilitation Requirement	Timing
Project Approval PA 11_0047 ~~MOD 1~~		
Schedule 3, Condition 31	The Proponent shall ensure that it has sufficient water for all stages of the project, and if necessary, adjust the scale of mining operations on site to match its available water supply, to the satisfaction of the ~~Director-General~~ Secretary.	Life of Mine

Schedule 3, Condition 39	The Proponent shall prepare and implement a Water Management Plan for the project to the satisfaction of the ~~Director General~~ Secretary. This plan must: (a) be prepared in consultation with OEH, ~~NOW~~ DPI and ~~Namoi CMA~~ LLS, by suitably qualified and experienced person/s whose appointment has been approved by the ~~Director General~~ Secretary, (b) be submitted to the ~~Director General~~ Secretary for approval by the end of May 2013; and (c) in addition to the standard requirements for management plans (see condition 3 of schedule 5), include a: (i) Site Water Balance, that includes: • details of: o sources and security of water supply, including contingency for future reporting periods; o water use and management on site; o any off-site water discharges; o reporting procedures, including the preparation of a site water balance for each calendar year; • a program to validate the surface water model, including monitoring discharge volumes from the site and comparison of monitoring results with modelled predictions; and • describes the measures that would be implemented to minimise clean water use on site; (ii) Surface Water Management Plan, that includes: • detailed baseline data on surface water flows and quality in the water-bodies that could potentially be affected by the project; • detailed baseline data on soils within the irrigation area; • detailed baseline data on hydrology across the downstream drainage system of the Namoi River floodplain from the mine site to the Namoi River, including Barbers Lagoon and The Slush Holes; • a detailed description of the water management system on site, including the: o clean water diversion systems; o erosion and sediment controls (mine water system); o mine water management systems including irrigation areas; o discharge limits in accordance with EPL requirements; and o water storages; • detailed plans, including design objectives and performance criteria for: o design and management of final voids; o design and management for the emplacement of reject materials, sodic and dispersible soils and acid or sulphate generating materials; o the Goonbri Creek diversion and low permeability barrier; o reinstatement of drainage lines on the rehabilitated areas of the site; and o control of any potential water pollution from the rehabilitated areas of the site;	WMP to be submitted to DP&E by 31 August 2015

Source	Post Mining Land Use, Landscape and Rehabilitation Requirement	Timing
	• performance criteria for the following, including trigger levels for investigating any potentially adverse impacts associated with the project: o the water management system; o soils within the irrigation area; o downstream surface water quality; o downstream flooding impacts, including flood impacts due to the flood bunds required for the project; and o stream and riparian vegetation health, including the Namoi River and its tributaries including Barbers Lagoon and The Slush Holes; • a program to monitor and assess: o the effectiveness of the water management system; o soils within the irrigation area; o the effectiveness of the Goonbri Creek diversion and flood bunds (see conditions 34-38); o surface water flows and quality in the watercourses that could be affected by the project; and o downstream flooding impacts; • reporting procedures for the results of the monitoring program; and • a plan to respond to any exceedences of the performance criteria, and mitigate and/or offset any adverse surface water impacts of the project;	WMP to be submitted to DP&E by 31 August 2015
Schedule 3, Condition 39	(iii) Groundwater Management Plan, that includes: • detailed baseline data of groundwater levels, yield and quality in the region, and privately-owned groundwater bores including a detailed survey/schedule of groundwater dependent ecosystems (including stygo-fauna), that could be affected by the project; • detailed plans, including design objectives and performance criteria, for the design and management of: o the proposed final void; and o coal reject and potential acid forming material emplacement; • groundwater assessment criteria including trigger levels for investigating any potentially adverse groundwater impacts; • a program to monitor and assess: o groundwater inflows to the open cut mining operations; o the effectiveness of the LPB; o the seepage/leachate from the LPB, water storages, emplacements and the final void; o interconnectivity between the alluvial and bedrock aquifers; o background changes in groundwater yield/quality against mine-induced changes; o the impacts of the project on: - regional and local (including alluvial) aquifers; - groundwater supply of potentially affected landowners;	

Source	Post Mining Land Use, Landscape and Rehabilitation Requirement	Timing
	- groundwater dependent ecosystems (including potential impacts on stygo-fauna) and riparian vegetation; • a program to validate the groundwater model for the project, including an independent review of the model every 3 years, and comparison of monitoring results with modelled predictions; and • a plan to respond to any exceedences of the performance criteria; and (iv) Leard Forest Mining Precinct Water Management Strategy, that has been prepared in consultation with other mines within the precinct to: • minimise the cumulative water quality impacts of the mines; • review opportunities for water sharing/water transfers between mines; • co-ordinate water quality monitoring programs as far as practicable; • undertake joint investigations/studies in relation to complaints/exceedences of trigger levels where cumulative impacts are considered likely; and • co-ordinate modelling programs for validation, re-calibration and re-running of the groundwater and surface water models using approved mine operation plans. Note: The Leard Forest Mining Precinct Water Management Strategy can be developed in stages and will need to be subject to ongoing review, dependent upon the determination of and commencement of other mining projects in the area.	
Schedule 3, Condition 49	The Proponent shall: (a) implement all reasonable and feasible measures to minimise the waste (including coal reject) generated by the project; (b) ensure that the waste generated by the project is appropriately stored, handled and disposed of; and (c) monitor and report on the effectiveness of waste minimisation and management measures in the Annual Review.	Life of Mine
Mining Lease ML 1579		
Condition 2	(1) Mining operations, including mining purposes, must be conducted in accordance with the Mining Operations Plan (the Plan) satisfactory to the Director-General. The Plan together with environmental conditions of development consent and other approvals will form the basis for:- (a) Ongoing mining operations and environmental management; and (b) Ongoing monitoring of the project. (2) The Plan must be prepared in accordance with the Director-Generals guidelines current at the time of lodgement. (3) A Plan must be lodge with the Director-General:- (a) Prior to the commencement of mining operations (including mining purposes); (b) Subsequently as appropriate prior to the expiry of any current Plan; and (c) In accordance with any direction issued by the Director-General. (4) The 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:- (a) Area(s) proposed to be disturbed under the Plan; (b) Mining and rehabilitation methods(s) to be used and their sequence; (c) Areas used for the disposal of tailings/waste;	Prior to mining – for approved MOP period (up to 7 years max.)

Source	Post Mining Land Use, Landscape and Rehabilitation Requirement	Timing
	(d) Existing and proposed surface infrastructure; (e) Existing flora and fauna on the site; (f) Progressive rehabilitation schedules; (g) Areas of particular environmental, ecological and cultural sensitivity and measures to protect these areas; (h) Water management systems (including erosion and sediment controls); (i) Proposed resource recovery; and (j) 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. (5) The Plan when lodged will be reviewed by the Department. (6) The Director-General may within two (2) months of the lodgement of a Plan, require modification and re-lodgement. (7) If a requirement in accordance with clause (6) is not issued within two (2) months of lodgement of a Plan, the lease holder may proceed with implementation of the Plan; (8) During the life of Mining Operations Plan, proposed modifications to the Plan must be lodged with the Director-General and will be subject to the review process outlines in clauses (5) – (7) above.	
Environment Protection Licence EPL 12365		
Section 3 Condition L3.3	L3.3 Reject material from the Whitehaven CHPP can be disposed of at the premises in accordance with the disposal method outlined in the ~~Environmental Impact Statement titled "East Boggabri Joint Venture, Environmental Impact Statement for the Proposed East Boggabri Coal Mine, May 2005" prepared by R.W. Corkery & Co. Pty. Limited dated May 2005,~~ Environmental Assessment titled 'Tarrawonga Coal Project – Environmental Assessment', prepared by Resources Strategies, or as modified, or as otherwise approved by the EPA.	Life of Mine
~~Section 4 Condition LO4.1~~	~~O4.1 The quantity of effluent applied to the utilisation area(s) must not exceed the capacity of the utilisation area(s) to effectively utilise the effluent. For the purpose of this condition, "effectively utilise" includes the ability of the soil to absorb the nutrient, salt and hydraulic loads and the applied organic material without causing harm to the environment.~~	~~Life of Mine~~

4.2 Post Mining Landuse ~~and Landscape~~ Goals

The final land use goal at Tarrawonga is to create a physically and chemically stable mine landform that is adequately drained and integrates with the adjoining hilly topography of the Willowtree Range and the southern extent of the Boggabri Coal Mine waste rock emplacement. The rehabilitation of mining disturbed areas into the surrounding landscape will deliver final land uses that achieve biodiversity and agricultural outcomes. Rehabilitated landforms will also integrate with the adjoining Leard State Forest to enhance regional biodiversity and conservation outcomes. The final void will be designed and constructed to have minimal adverse impacts upon post-mining land use outcomes, and surface and groundwater resources.

A biodiversity offset is located at the Willeroi Offset Area (20 km to north-east of Tarrawonga), that comprises some 1,600 ha of existing vegetation, which will be enhanced and additional vegetation established with the restoration of at least 193 ha of Box Gum Woodland EEC. In addition, a regional Biobank site has been established to meet requirements of DA-88-4-2005 MOD 1.

4.3 Post Mining Landuse Objectives

The post mining land use goal advised above in **Section 4.2** will be realised by achieving the individual objectives listed in **Table ~~8~~7.**

Table ~~8~~7- Key Rehabilitation Objectives for Post Mining Land Uses

~~Post Mining Land Use~~	~~Key Rehabilitation Goals~~
~~Final Land forms~~	• ~~Create a physically and chemically stable and non-polluting post – mining landform.~~ • ~~Construct the Northern Emplacement to a maximum height of 370 m AHD to integrate with the adjoining southern extent of the Boggabri Coal Mine waste rock emplacement and blend with the surrounding undisturbed environment including Leard State Forest (adjacent ridgeline has local high points between 370 and 382 m) and the Willowtree Range.~~ • ~~Re-profile the Southern Emplacement to a final height of 330 m AHD and partially infill the adjoining services corridor so that it integrates with the Northern Emplacement.~~ • ~~The Northern and Southern Emplacements will be shaped to be free draining with outer batters predominantly 10 degrees or shallower.~~ • ~~Construct the final top surface of the Northern Emplacement so that it drains in a stable manner to Goonbri Creek via a series of terraces with drop structures on the intervening batters.~~
~~Final Void~~	• ~~Progressively backfill the open cut with overburden and interburden and reshape completed areas to their final landform shape so that they can be progressively rehabilitated.~~ • ~~Partially backfill the final void to the extent required to minimise long-term drawdown and water quality effects on local groundwater aquifers, so that their beneficial use is not compromised.~~ • ~~The total catchment for the final void will be defined by perimeter bunds and limited to achieve a target final void water equilibrium level of approximately 240 to 260 m AHD.~~

~~Post Mining Land Use~~	~~Key Rehabilitation Goals~~
~~Rehabilitation and Revegetation Areas~~	• ~~Rehabilitation of land disturbed by the project will contribute to approximately 752 ha of native woodland vegetation communities within the project area, focused on Box Gum Woodland EEC.~~ • ~~Native vegetation areas in the Northern Emplacement will be vegetated with species to integrate with Boggabri's waste rock emplacement and the adjoining Leard State Forest.~~ • ~~The Southern Emplacement will be rehabilitated with native tree, shrub and grass species to achieve a native woodland / forest post mining land use.~~ • ~~The establishment of a minimum of 210 ha of Class 3 agricultural suitability land, including 160 ha with cropping capability. The final landform for agricultural areas will be developed to blend with the adjoining agricultural areas consistent with that area immediately adjacent to Goonbri Creek.~~ • ~~Minimise active disturbance areas by progressively rehabilitating, and by restricting clearing to the minimum required for operations.~~ • ~~Recover vegetation and habitat resources during clearing activities where practically possible and re-use in rehabilitated areas to provide habitat resources for fauna (e.g. trees, hollows).~~ • ~~Use soil resources stripped from disturbance areas directly for rehabilitation, but if this is not possible, minimise the time soil is stored in temporary stockpiles before being re-used.~~ • ~~Install erosion and sediment control measures prior to the commencement of soil stripping and rehabilitation activities.~~ • ~~Plant sterile cover crops on newly rehabilitated mine landform areas (and topsoil stockpiles) as soon as possible after completing earthworks, to minimise the potential for soil erosion.~~ • ~~Stabilise new infrastructure disturbance areas (e.g. road and dam embankments) as soon as possible by topsoiling and seeding.~~ • ~~Plant vegetation screens in key areas ahead of mine disturbance activities, to allow growth and screening to occur prior to the commencement of disturbance activities.~~ • ~~Revegetate the mine landforms to a combination of native woodland/forest and agricultural land uses that meet community and regulatory expectations in consideration of existing land uses and conservation values~~ • ~~Construct the low permeability barrier and permanent Goonbri Creek alignment such that they achieve their design objectives and the low flow channel is revegetated with riparian and floodplain vegetation, by using species characteristic of the Bracteate Honeymyrtle (*Melaleuca bracteata*) community. (**Note: Not to be undertaken within this MOP period).**~~ • ~~Enhance the habitat values and biodiversity of the 3 km section of Goonbri Creek downstream of ML 1693, through revegetation, stock exclusion, and remedial earthworks if required. (**Note: Not undertaken within this MOP period**).~~

Feature	Objective
Mine Site	• Safe, stable and non-polluting. • Constructed landforms drain to the natural environment.
Final Void	• Minimise the size and depth of the final void as far as is reasonable and feasible. • Minimise the drainage catchment of the final void as far as is reasonable and feasible.

Feature	Objective
Surface Infrastructure	• To be decommissioned and removed, unless the Executive Director Mineral Resources agrees otherwise.
All land, other than the final void	• Restore ecosystem function, including maintaining or establishing self-sustaining ecosystems comprised of: – local native plant species; and – a landform consistent with the surrounding environment, in accordance with the Biodiversity Offset Strategy and the BMP.
Community	• Ensure public safety. • Minimise the adverse socio-economic effects associated with mine closure.

5 REHABILITATION PLANNING AND MANAGEMENT

5.1 Domain Selection

Primary and secondary domains have been defined in accordance with the methodology prescribed in ESG3 (DTIRIS 2013). As such the following applies:

- Primary Domains are defined as the set of discrete areas that have a particular operational or functional purpose. Land management units with similar operational function are likely to have similar geophysical features and constraints /opportunities for rehabilitation.
- Secondary Domains are land management units with similar post mining land use objectives, such as woodland communities and native grasslands.

Accordingly, domains have been defined considering the operational function and specific final land use objectives. Domains at the commencement of the MOP period are shown in **Plan 2,** and listed in **Table ~~9~~8**.

Table ~~9~~8- Domains adopted for this MOP term

Domain	Code	Description
Primary Domains (Operational)		
~~Final Void / Active Mining~~Void (Open cut void)	~~1~~6	Footprint for the open cut mining pit(s).
Water Management Area	~~2~~3	Network of dams, channels and associated water management infrastructure (pipelines and pumps etc.). ~~Includes disturbance footprint for works for the permanent Goonbri Creek re-alignment.~~
Infrastructure Area	~~3~~1	Existing infrastructure and facilities existing ~~to be constructed~~ during the MOP period, including administration areas, workshops, and coal handling and preparation facilities.
~~Topsoil Stockpile Area~~ Stockpiled Material	~~4~~5	Areas disturbed to stockpile topsoil and vegetation for reuse in rehabilitation.
Overburden Emplacement Area	~~5~~4	Footprint of out of pit (Northern Emplacement and Southern Emplacement and environmental bunds) and in-pit waste rock dump areas.
~~Temporary Rehabilitation~~	~~6~~	~~Area of overburden emplacement temporarily rehabilitated.~~
Rehabilitation Area	7	Foot print of existing rehabilitation areas.
Secondary Domains (Post Mining Land Use)		
Final Void	~~A~~I	Tarrawonga has approval to retain a single void along the eastern perimeter of the open cut pit. The final void will include flood mitigation ~~as required,~~ and safety infrastructure and will be rehabilitated with woodland vegetation above the permanent water level (approx. 240 to 260 m AHD).
Water Management Area	B	Footprint of water management structures and dams retained in the final landform.

Domain	Code	Description
~~Agricultural~~ Rehabilitation Area - Pasture	~~C~~D	Middle and lower terraces of the open cut in-fill areas (280 to 300 m AHD) will be rehabilitated with selected topsoil resources suitable for Class 3 agricultural suitability land, capable of pasture production and occasional cropping. Some infrastructure areas and topsoil stockpile areas constructed on the Goonbri Creek alluvial floodplain will also be rehabilitated to Class 3 agricultural suitability land.
~~Woodland~~Rehabilitation Area - Woodland	~~D~~E	Slopes and upper terraces (>300m AHD) rehabilitated with woodland species commensurate with adjacent remnant vegetation. This domain will include at least 13 ha commensurate with the White Box Yellow Box Blakeley's Red Gum Grassy Woodland and Derived Native Grassland EEC. Species selection and planting densities will vary to enhance integration with adjacent Leard State Forest and Boggabri waste emplacement area. This domain also includes riparian vegetation corridors adjacent to drainage structures and watercourses including the permanent Goonbri Creek realignment.

It is expected that each domain will require particular rehabilitation objectives and methodologies to achieve the desired final land use outcomes. Domain objectives and rehabilitation methods are discussed in the following sections.

5.2 Domain Rehabilitation Objectives

The key rehabilitation objectives for the Domains identified in **Section 5.1** are defined in **Table ~~10~~9**.

Table ~~10~~9 - Domain Rehabilitation Objectives

Domain	Rehabilitation Objective
Primary Domains	
~~Final Void / Active Mining~~ Void (Open cut void)	• Rehabilitation resources including vegetation, topsoil and habitat resources will be identified for salvage ahead of mining. • Vegetation and topsoil will be progressively stripped ahead of mining to minimise the total area of disturbance and the potential period of soil storage. • Mined areas will be progressively backfilled and rehabilitated where possible.
Water Management Area	• Clean water will be diverted around operational areas prior to disturbance, where practical. • Mine water and sediment laden (dirty) water runoff from disturbance areas will be captured and diverted to mine water and dirty water dams. • Mine water and dirty water will be preferentially used for operational requirements such as dust suppression and earthworks. • Dirty water will be treated before discharge from site in accordance with regulatory requirements. • No mine water will be discharged from site. • Water management structures will be designed and constructed prior to disturbance, in accordance with Best Practice and "the Blue Book". • Sediment dams and associated water management structures will remain in place until the catchment is rehabilitated and discharge water quality is similar to comparable undisturbed landforms.

Domain	Rehabilitation Objective
Infrastructure Area	• Mining infrastructure will be removed progressively, and the area rehabilitated, when no longer required, • All land contamination will be identified and appropriately remediated.
~~Topsoil Stockpile Areas~~ Stockpiled Material	• Topsoil stockpiles will be stabilised with sterile cover crops to minimise weed infestation and retain soil biological health. • Topsoil stockpiles will be constructed and managed to optimise physical, chemical and biological characteristics. • Topsoil stockpile areas will be rehabilitated progressively when no longer required.
Overburden Emplacements	• Final landform will be safe, stable and adequately drained. • Final landforms will be designed to integrate with the surrounding landscape. • The Northern Emplacement will be progressively constructed to a maximum height of 370 m AHD to integrate with the southern extent of the Boggabri waste rock emplacement. • The Southern Emplacement will be progressively constructed to a maximum height of 340 m AHD. • Outer batter slopes for the Northern and Southern Emplacements will be predominantly constructed at 10 degrees or shallower. • Any potentially acid forming (PAF) material will be covered with at least 15 m of non-acid forming material (NAF). • Final outer surfaces of overburden emplacements will be constructed with non-sodic or low sodicity and/or will be treated with gypsum. • Dump sequencing will be optimised to facilitate progressive shaping and rehabilitation.
~~Temporary Rehabilitation~~	~~• Rehabilitation will be managed and maintained to minimise dust and visual impact.~~
Rehabilitation Area	• As per objectives for Overburden Emplacements.
Secondary Domains	
Final Void	• Final void will be safe, stable and non-polluting. • Final void northern and eastern highwalls will be profiled to be geotechnically stable with slopes approximately 60 degrees. • Material from the Southern Emplacement will be used to partially infill the southern and western low walls of the open cut to construct final grades generally between 10 and 15 degrees. • Surface water inflows to the final void will be managed through appropriate landform design (including final void perimeter bunding and the permanent flood bund) to minimise long term drawdown and potential water quality impacts on local aquifers. • Native vegetation will be established above the permanent water level (260 m AHD).
Water Management Area	• The final landform drainage will integrate with the surrounding catchments and will achieve long term geomorphic stability and minimise erosion. • Sediment dams identified for retention in the final landform will be decontaminated and preserved as clean water farm dams or water sources for native fauna.

Domain	Rehabilitation Objective
~~Agricultural~~ Rehabilitation Area - Pasture	• At least 210 ha of Class 3 agricultural land (including 160 ha constructed on emplaced overburden) will be reinstated on areas disturbed by mining. • Soil profiles (soil characteristics and soil depths) will be reinstated to produce an Effective Rooting Depth at least 1.5 m, and capable of sustaining cereal and pasture production comparable to pre-mining agricultural areas near Goonbri Creek.
~~Woodland~~ Rehabilitation Area - Woodland	• Approximately 752 ha of open woodland/forest, with riparian corridors (including Goonbri Creek realignment) and including 13 ha of species consistent with a White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland Ecological Community, will be established on areas disturbed by mining. • Woodland Rehabilitation Areas will be comparable with adjacent undisturbed remnant native vegetation including areas commensurate with Box-Gum Woodland EEC.

5.3 Rehabilitation Phases

The rehabilitation process can be described as a sequence of conceptual rehabilitation phases to achieve a final land use that is self-sustaining. These phases of rehabilitation are described in **Table ~~11~~10**.

Table ~~1110~~ - Rehabilitation Phases

Phase No	Phase	Description
1	Decommissioning	~~The process of removing plant and equipment from active services and rendering the area safe.~~ Infrastructure removed, contamination remediated, electricity decommissioned, heritage buildings retained;
2	Landform Establishment	~~The process of shaping unformed rock of other sub-stratum material into a desired land surface profile. This includes earthworks activities such as cut and fill, rock raking, water storage and drainage construction.~~ Characterisation and reshaping of material;
3	Growth Medium Development	~~The process of establishing and enhancing the physical structure, chemical properties and biological properties of a soil stratum suitable for plant growth. This includes placing and spreading soil and applying ameliorants.~~ Placement of topsoil, and integration of ameliorants as required, upon reshaped material;
4	Ecosystem Establishment	~~The process of seeding, planting and transplanting plant species. Incorporates management actions such as weed and feral pest control to achieve species establishment and growth to juvenile communities, and habitat augmentation.~~ Revegetation of growth medium;
5	Ecosystem Sustainability	~~The process of applying management techniques to encourage an ecosystem to grow and develop towards a desired and sustainable post mining land use outcome. Incorporates features including species reproduction, nutrient recycling and community structure.~~ Floristics and structure, recruitment and recovery, fauna presence, growth, ecosystem resilience;
6	Land Relinquishment	~~The completion criteria for rehabilitation are met and the land is determined to be suitable to be relinquished from the mining tenement.~~ Demonstrated ultimate success of rehabilitation process.

Section 7.3 provides a general overview of the rehabilitation methodology for each rehabilitation phase and **Table ~~12~~11** provides a summary of the phases expected to be completed for each domain at the end of the MOP period.

Table ~~12~~11 - Summary of Rehabilitation Phases Proposed for Completion at end of the MOP Term

Domain / Rehabilitation Phase	~~Final Void / Active Mining~~ Void (Open cut void)	Water Management Area	Infrastructure Area~~s~~	~~Topsoil Stockpile Area~~ Stockpiled Material	Overburden Emplacement Area	~~Temporary Rehabilitation~~	Rehabilitation Area
Active	✓	✓	✓	✓	✓	~~✓~~	✓
Phase 1 – Decommissioning	×	×	×	✓	✓	~~×~~	✓
Phase 2 – Landform Establishment	×	×	×	✓	✓	~~×~~	✓
Phase 3 – Growth Medium Development	×	×	×	×	×	~~×~~	✓
Phase 4 – Ecosystem and Land Use Establishment	×	×	×	×	×	~~×~~	✓
Phase 5 – Ecosystem and Land Use Sustainability	×	×	×	×	×	~~×~~	×
Phase 6 – Land Relinquishment	×	×	×	×	×	~~×~~	×

✓ = Some areas of this domain are subject to this rehabilitation phase during MOP term.
× = Domain not expected to enter this rehabilitation phase during the MOP term.

5.4 Rehabilitation Methodologies for Activities in the MOP Term

5.4.1 Decommissioning Phase

The Decommissioning Phase encompasses all works required to prepare land for rehabilitation including removal of built infrastructure, foundation and hardstand materials, services, equipment and materials including wastes and contamination.

No decommissioning activities are proposed during the MOP term. All mining related infrastructure will be removed at mine closure.

5.4.2 Landform Establishment

Landform establishment is the process of shaping the final landform to a safe, stable and free draining landform that is appropriate for the desired final land use and consistent with the surrounding landscape. The final landform for Tarrawonga is shown on **Plan 4**. Final landforms will have acceptable slopes and unimpeded drainage lines. Slopes are generally to be graded to no more than 10 degrees and no more than 18 degrees without DRG's approval, as per DRG's guidelines.

Domain 6 – Void (Open cut void)

There are no activities associated with landform establishment in this domain during the MOP term.

The principal objective of landform establishment activities associated with the final void is to create a safe and stable landform that is non-polluting. A detailed methodology to treat the final void will be developed in a *Final Void and Mine Closure Plan* that will be developed closer to mine closure when more certainty about the final void conditions will be known. General principles that may be adopted to make the final void safe and stable include:

- Battering back low wall and highwalls to minimise potential for failures and mass movement;
- Capping (or excavating) exposed coaliferous material with inert material to prevent ignition from spontaneous combustion, bushfires or human interference;
- Constructing a physical barrier to isolate the perimeter of the void to prevent human access. The highwall areas will be secured by the construction of a trench and a safety berm, as well as a security fence along the entire length of the eastern and northern highwalls;
- Suitable signs, clearly stating the risk to public safety and prohibiting public access will be erected at intervals along the entire length of the fence; and
- Surface runoff from land surrounding the void will be diverted so as to prevent any potential development of instability of the void walls.

Domain 3 – Water Management Area

There are no activities associated with landform establishment in this domain during the MOP term.

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. Contour and catch drains are designed to collect surface runoff from rehabilitation or disturbed areas. Sedimentation dams will be constructed and retained during rehabilitation to collect runoff from rehabilitated areas until discharge water quality meets regulatory criteria and dams can be decommissioned.

Domains 1, 4 and 5 – Infrastructure Area/Overburden Emplacement Area/Stockpiled Material

The Northern Emplacement will be shaped to integrate with the Boggabri Coal Mine waste rock emplacement to the north during the MOP term, and the Leard State Forest to the east (outside of this MOP term), providing continuity between the Tarrawonga and Boggabri Coal Mine post mining landforms, and habitat connectivity with undisturbed vegetation communities at Leard State Forest. In the Southern Emplacement Area, an area of overburden will be subject to landform establishment activities in 2018.

Both the Northern Emplacement and Southern Emplacement will be shaped to integrate with the open cut infill area.

Waste rock will be selectively handled and blended to avoid emplacement of potentially acid forming material in concentrated areas. As outlined in **Section 3.2.5** where PAF-LC material is identified it will be encapsulated with at least 15 m of NAF to minimise potential for acid leachate.

Dispersive materials will be avoided for material layers at the final landform surface where practical to minimise potential for significant scouring or land slumping. Non-sodic and low sodicity materials will be selectively handled and preferentially emplaced at or near the surface. Where there are potentially dispersive materials emplaced at or near the surface, appropriate amelioration with lime or gypsum will be undertaken to stabilise soils, particularly foundation materials for earthworks structures such as contour banks.

No areas of infrastructure will be subject to the landform establishment phase during the MOP term.

Domain 7 – Rehabilitation Area

The existing rehabilitation areas will remain during the MOP term and will not undergo any landform establishment activities.

5.4.3 Growth Media Development

In the context of this MOP, growth medium development encompasses activities to reinstate soils with the initial physical, chemical and biological characteristics required to establish the desired vegetation community.

Where possible, soils will be re-spread directly onto re-shaped landforms. Subsoils and topsoils will be characterised prior to re-spreading to determine the type and application rates for any required soil ameliorants (e.g. lime, gypsum, fertiliser and organics). The use of soil ameliorants improves germination and vegetation establishment by minimising surface crusting, increasing moisture retention and organic content, and buffering surface temperatures.

Secondary Domain D – Rehabilitation Area - Pasture

The re-establishment of a soil profile consistent with Class 3 agricultural suitability land will be achieved by selectively emplacing, rock raking, ripping, and ameliorating the surface 300 mm of spoil, emplacing approximately 1 m of select subsoil, and 0.5 m of topsoil. The ripped and ameliorated surface spoils will assist achieve an effective rooting depth (ERD) of at least 1.5 m.

To develop a soil profile with an ERD greater than 1.5 m, the soil profile will be reconstructed in a staged approach. A staged re-spreading methodology will be developed prior to the anticipated timing of the reinstatement of agricultural soils (Year 12 of the project) to optimise the structure, chemical and biological properties throughout the soil profile. The re-spreading methodology will be developed in consultation with stakeholders and agencies and documented in future MOPs.

While the clay-rich subsoils in the Stratic Rudosol soil profiles are considered high-value plant growth media, soil mapping undertaken for the Agricultural Resource Assessment (McKenzie, 2011) indicates that some topsoils have severe limitations for plant growth due to:

- Loss of soil structure and acidification from past farming practices: and
- Depositional layers with high sand and gravel fractions.

All topsoils intended for re-use in agricultural rehabilitation areas will be further assessed prior to stripping to determine their suitability for re-use and determine specific amelioration requirements. Once soils are spread, ameliorants such as gypsum will be applied and the area deep-ripped along the contour.

It should be noted that Agricultural Rehabilitation Areas will not be established in this MOP period.

Secondary Domain E – Rehabilitation Area - Woodland

Native vegetation areas encompass all woodland rehabilitation areas and areas within the final void above the predicted permanent water level (i.e. above 260 m AHD).

Soil resources for native vegetation rehabilitation will generally be re-spread 20 cm deep. Once soils are re-spread, ameliorants such as gypsum will be applied and the area deep-ripped along the contour to produce a friable soil surface that optimises water infiltration and soil – seed contact.

5.4.4 Ecosystem Establishment

In the context of this MOP, ecosystem establishment includes activities to establish the desired floristic composition (species diversity and density) and habitat features.

Secondary Domain D – Rehabilitation Area - Pasture

Agricultural Rehabilitation Areas will not be established in this MOP period. Up to 160 ha of agricultural land capable of being used for a combination of pasture production for grazing and occasional cropping (Class 3 Agricultural Suitability) will be re-established on the lower terraces of the open cut infill area. Detailed management of Agricultural Rehabilitation Areas will be further developed in subsequent MOPs.

Secondary Domain E – Rehabilitation Area - Woodland

Tubestock Planting

Native vegetation areas are planted with native tubestock species, selected on a site by site basis considering factors such as adjacent remnant vegetation communities, aspect, slope, and soil types. Woodland Rehabilitation Areas will include areas planted with species commensurate with the Box-Gum Woodland EEC.

Species used in revegetation will consider a range of species such as grasses, herbs, forbs, low shrubs, mid-sized shrubs and trees as per **Table 12**.

Table 12 - Indicative Revegetation Species List

Common Name	Scientific Name	Common Name	Scientific Name
Overstorey		**Understorey**	
* White Box	*Eucalyptus albens*	* Smooth Darling Pea	*Swainsona galegifolia*
* Yellow Box	*Eucalyptus melliodora*	* Barb-wire Grass	*Cymbopogon refractus*
* Blakely's Red Gum	*Eucalyptus blakelyi*	* Silk Blue-grass	*Dicanthium sericeum*
Narrow-leaved Ironbark	*Eucalyptus crebra*	* Daises	*Brachysome spp.*
Narrow-leaved Grey Box	*Eucalyptus pilligaenensis*	* Everlasting Daises	*Chrysocephalum spp.*
Inland Grey Box	*Eucalyptus microcarpa*	* Kangaroo Grass	*Themeda triandra*
Dwyer's Red Gum	*Eucalyptus dwyeri*	* Wallaby Grass	*Austrodanthonia indutai*
Midstorey		*Winter Apple	Eremophila debilis
*Sticky Hop-Bush	Dodonaea viscosa ssp. angustifolia	Blue Trumpet	Brunoniella australis
*Wilga	Geijera parviflora	Three-awn Speargrass	Aristida vagans
Belah	Casuarina cristata	Slender Stackhousia	Stackhousia viminea
-	Allocasuarina spp.	Yellow Burr-daisy	Calotis lappulacea

Black Tea-tree	Melaleuca bracteata	-	Rostellularia adscendens var. adscendens
Silver Wattle	Acacia dealbata	Plains Grass	Austrostipa aristiglumis
Hickory Wattle	Acacia implexa	-	Panicum spp.
White Cypress Pine	Callitris glaucophylla	-	Austrodanthonia spp.
Buloke	Allocasuarina leuhmanii	-	Bothriochloa spp.
		-	Chloris spp.

* Specifically associated with the Box-Gum Woodland EEC/CEEC.

In accordance with Condition 23 of EPBC 2011/5923 and Condition 61 Schedule 3 of PA 11_0047, revegetation will include 13 ha of White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland Ecological Community, and 752 ha of native forest and woodland. The proposed locations of these revegetation types are presented in series 3 MOP Plans.

TCM will consider use of native or self-sterile cover crops (i.e. Vampire Ryecorn) in accordance with the MSRMP and BMP if required to improve initial soil surface stabilisation of rehabilitation areas.

Weed and Vertebrate Pest Control

Ecosystem Establishment includes initial management actions to limit the introduction of weeds and vertebrate pest species in rehabilitation areas as described in **Section 3.2.7**. Ongoing weed and pest management and monitoring is considered in the ecosystem development phase (**Section 7.3.5**).

Management measures include:

- Treatment of weeds on topsoil stockpiles prior to re-spreading in rehabilitation areas;
- Ensuring all plant and equipment are weed free prior to mobilisation to rehabilitation areas;
- Maximising the retention of ground cover (cover crop stubble) when planting tubestock to minimise opportunities for weed activity; and
- Installation of fauna exclusion fencing and/or tree guards for newly planted tubestock where predation by grazing herbivores represents a risk to establishment.

5.4.5 Ecosystem Sustainability Phase

For the purposes of this MOP the Ecosystem Sustainability phase represents those activities required to develop sustainable ecosystems that have characteristics comparable to similar undisturbed vegetation associations in the area.

All Domains

Activities associated with the ecosystem sustainability phase of rehabilitation are generally ongoing maintenance and land management activities and rehabilitation monitoring. Maintenance at rehabilitated areas will include, but not be limited to:

- Ongoing environmental management to minimise risks to rehabilitation;
- Comparing specific ecosystem characteristics such as soil profile development, floristic composition and structure and faunal diversity and abundance with the characteristics of appropriate analogue sites; and
- Undertaking adaptive management and remedial works where characteristics of the rehabilitation are not trending toward desired outcomes.

Rehabilitation monitoring will be undertaken throughout the ecosystem sustainability phase until it can be demonstrated that rehabilitation areas have met all conditions for relinquishment. Rehabilitation monitoring for the MOP term is discussed in **Section 8.1.**

6 PERFORMANCE INDICATORS AND COMPLETION/RELINQUISHMENT CRITERIA

The completion criteria are objective target levels or values assigned to a variety of indicators (e.g.: slope, species diversity, percent groundcover), which can be measured to demonstrate progress and ultimate success of rehabilitation. As such, they provide a defined end point, at which point in time rehabilitation can be deemed successful and the lease relinquishment process can proceed. The rehabilitation completion criteria for Tarrawonga are listed in **Tables 13 and ~~14to 18~~.**

These completion criteria, which may be subject to refinement as the operation progresses, including through consultation with the relevant stakeholders, will be utilised to demonstrate achievement of rehabilitation objectives. The achievement (or otherwise) of the completion criteria will be monitored and reported within the annual reports to be submitted to relevant government agencies.

~~**Table 13 - Decommissioning Phase**~~

~~Domain Objective~~	~~Performance Indicator~~	~~Completion Criteria~~	~~Justification/ Source~~	~~Complete (Yes/No)~~	~~Link to TARP~~	~~Progress at start of MOP~~
~~**All Domains**~~						
~~Public safety~~	~~Site Security~~	~~Appropriate security measures (e.g. adequate fencing) has been implemented (where required) prior to commencing decommissioning and demolition works~~	~~This MOP/ Whitehaven HSE Policy~~	~~No~~	~~No~~	~~Ongoing~~
~~**Domain 2 - Water Management Areas**~~						
~~Mine water dams and sediment dams are decontaminated prior to removal or re-use as retained clean water dams in the final landform.~~	~~Obsolete water management structures~~	~~Mine water dams are emptied into the final void, supported by records.~~	~~EA Section 5.5.5~~	~~No~~	~~No~~	~~Not commenced~~
	~~Sedimentation~~	~~Sediments accumulated in mine water and sediment dams is removed from the dam floor and emplaced in the final void with at least 2m of inert cover, supported by records.~~	~~EA Section 5.5.5~~	~~No~~	~~No~~	~~Not commenced~~
	~~Pumping Infrastructure~~	~~All ancillary equipment including pumps and pipelines have been removed and services terminated.~~	~~EA Section 5.4.7~~	~~No~~	~~No~~	~~Not commenced~~
~~**Domain 3 - Infrastructure Areas**~~						

~~Domain Objective~~	~~Performance Indicator~~	~~Completion Criteria~~	~~Justification/ Source~~	~~Complete (Yes/No)~~	~~Link to TARP~~	~~Progress at start of MOP~~
~~Infrastructure will be decommissioned progressively as plant, equipment and infrastructure becomes obsolete.~~	~~Demolition of infrastructure~~	~~All demolition work has been carried out in accordance *with AS2601-2001: The Demolition of Structures* or its latest version.~~	~~AS2604-2001~~	~~No~~	~~No~~	~~Not Commenced~~
		~~All surface infrastructure that is not required for the post-mining land use has been demolished (or dismantled) and removed from the site (including fuel plants, hydrocarbon storage facilities, sewer treatment plants, workshops, administration facilities, roads and car parks.~~	~~ML 1579 - Condition 13(a)~~ ~~EA Section 5.4.7~~	~~No~~	~~No~~	~~Not Commenced~~
	~~Site Services~~	~~All site electricity and telecommunication services have been disconnected and removed.~~		~~No~~	~~No~~	~~Not Commenced~~
	~~Foundations and pavements~~	~~All concrete footings, foundation pads and pavements have been removed.~~		~~No~~	~~No~~	~~Not Commenced~~
~~All hazardous and contaminated materials are appropriately removed or remediated in accordance with the recommendations of a contamination site assessment.~~	~~Carbonaceous material~~	~~All carbonaceous material has been removed from the site and disposed of in the void with at least 2m of inert cover (supported by records).~~	~~ML 1579 - Condition 13(a)~~ ~~EA Section 2.1.5~~ ~~DECC(b) 2008~~ ~~ANZECC 1992~~ ~~EPA 1998~~	~~No~~	~~No~~	~~Ongoing as identified.~~
	~~Hazardous materials~~	~~Site investigation records indicate that infrastructure areas are free of any hazardous materials (e.g. petroleum, chemicals and explosive products).~~		~~No~~	~~No~~	~~Not Commenced~~
	~~Contaminated soils~~	~~Records indicate that contaminated soils have been identified and remediated or removed in accordance with legislation.~~		~~No~~	~~No~~	~~Ongoing as required~~

Table 14 - Landform Establishment Phase

Domain Objective	Performance Indicator	Completion Criteria	Justification / Source	Complete (Yes/No)	Link to TARP	Progress at start of MOP
All Domains						
Final landform will be suitable for the intended final land use, and blend into the surrounding landforms as far as practicable.	Visual	Landforms are shaped and revegetated in accordance with EA.	EA Sections 5.4.1 and 5.4.2	No	1	Not Commenced
Final landforms including slopes and drainage will be designed to be safe, stable and non-polluting.	Slopes.	Landform is regraded to a stable grade, generally at 10 degrees or shallower and no more than 18 degrees without the DRE's consent.	EA Sections 5.4.1 and 5.4.2	No	1	Ongoing
Domain 1 - Final Void						
Minimise the size and depth of the final void as far as is reasonable and feasible	Design	Final void is designed in accordance with the Final Void and Mine Closure Plan. Final void assessed by a suitably qualified and experienced geotechnical engineer to validate high walls are stable and do not pose an unacceptable safety risk.	EA Section 5.4.3	No	No	Not commenced
Minimise the drainage catchment reporting to the final void and minimise risk of flood interaction for all flood events up to and including the Probable Maximum Flood level	Final void catchment analysis	Final void and perimeter bunding is designed in accordance with the Final Void and Mine Closure Plan. Final void and bunding is constructed to minimise risk of flooding, supported by survey.	EA Section 5.4.3	No	No	Not commenced
Domain 2 - Water Management Areas						

~~Domain Objective~~	~~Performance Indicator~~	~~Completion Criteria~~	~~Justification / Source~~	~~Complete (Yes/No)~~	~~Link to TARP~~	~~Progress at start of MOP~~
~~Safe, stable, adequately drained post mining landforms consistent with the surrounding landscape.~~	~~Final landform drainage design~~	~~Water management structures including drains, banks, drop structures and dams are constructed in accordance with Managing Urban Stormwater: Soils and Construction (Landcom 2004) and the Water Management Plan.~~ ~~Drop structures are designed to convey 1:50 ARI~~	~~EA Section 5.4.6~~ ~~ACARP C13048~~ ~~DECC 2008a~~	~~No~~	~~4~~	~~Ongoing~~
		~~Channel banks and drains are designed to convey 1:20 ARI with max slope 1% (unless lined).~~				
	~~Geomorphic stability~~	~~Drainage structures are assessed to be stable with no active gully heads, tunnel erosion or bank failure.~~				
~~Water quality is appropriate for final land use~~	~~EPL discharge criteria~~	~~Surface water is non-polluting~~ ~~All discharge water quality criteria (pH, TSS, EC, oil/grease) complies with EPL 12365~~	~~EPL 12365~~ ~~ANZECC 2000~~	~~No~~	~~6~~	~~Ongoing.~~
~~**Domain 5 - Overburden Emplacement Areas**~~						
~~Final landforms are shaped appropriately for final land use~~	~~Maximum slope~~	~~**Agricultural Rehabilitation Areas:**~~ ~~Final landforms are graded at 1 – 2% grades~~ ~~Landform slope / drainage complies with Agricultural Class 3 land criteria~~	~~Emery, 1986~~	~~No~~	~~1~~	~~Not Commenced~~
	~~Visual compatibility of final landforms.~~	~~**Woodland Rehabilitation Areas:**~~ ~~Landforms are shaped and revegetated in accordance with EA.~~ ~~Landform is generally compatible with surrounds and integrates with Leard State Forest and Boggabri Coal Mine final landform.~~	~~EA Section 5.4.6~~	~~No~~	~~No~~	~~Not Commenced~~

~~Domain Objective~~	~~Performance Indicator~~	~~Completion Criteria~~	~~Justification / Source~~	~~Complete (Yes/No)~~	~~Link to TARP~~	~~Progress at start of MOP~~
~~Final landforms including slopes and drainage will be designed to be safe, stable and non-polluting.~~	~~Dispersive soil and spoil capping depth~~	~~Dispersive soils and spoils are selectively handled and encapsulated beneath non-sodic or low sodicity materials.~~ ~~Moderately to highly sodic overburden and interburden is not emplaced at or near the surface of final landforms~~	~~EA Section 2 24, 25~~ ~~Charman PEV and Murphy BW, 2007~~	~~No~~	~~7~~	~~Ongoing~~
	~~Slumping or uncontrolled erosion~~	~~Presence of slumping is limited and not compromising landform stability.~~ ~~Gullies and rills occurring in 50 m transects are assessed to be stabilising.~~ ~~No rills > 200 mm deep~~	~~DECC(a) 2008~~	~~No~~	~~2~~	~~Ongoing monitoring~~
	~~Active erosion~~	~~Visual inspection confirms active erosion is not compromising landform.~~ ~~Soil loss due to gullying and rilling is assessed and determined to be limited and stabilising.~~	~~DECC(a) 2008~~	~~No~~	~~2~~	~~Ongoing monitoring~~
	~~PAF capping depth~~	~~Potentially acid forming (PAF) overburden/interburden materials are encapsulated with at least 15 m of non acid-forming (NAF) materials.~~ ~~15 m non-acid forming cover is verified by survey.~~	~~EA Section 2.24~~	~~No~~	~~No~~	~~Ongoing~~
	~~Rejects capping depth~~	~~Rejects are encapsulated by a minimum of 2 m of inert material.~~ ~~2 5 m of inert cover is verified by survey~~	~~EA Section 2.1.5~~ ~~Modification 2~~	~~No~~	~~No~~	~~Ongoing~~

Table 15 - Growth Medium Development Phase

Domain Objective	Performance Indicator	Completion Criteria	Justification/ Source	Complete (Yes/No)	Link to TARP	Progress at MOP start
All Rehabilitation Areas						
Growth media resources are retained and managed to retain structure, chemical and biological properties.	Topsoil stripping depth	Topsoils and subsoils are mapped, then stripped and re-spread or stockpiled for later re-use in accordance with management plans and procedures.	EA Section 5.5.2 McKenzie Soil Management 2011	No	10	Ongoing
Topsoil/subsoil resources are characterised and selectively stripped for re-use in Agricultural and Woodland Rehabilitation Areas	Topsoil resource characterisation	Tests are undertaken to assess topsoil and/or spoil: • Physical properties (texture, structure and Emerson Aggregate assessment); • Chemical properties (pH, salinity, nitrogen, potassium and phosphorous.); and • Biological properties and organic content.	EA Section 5.5.2 Elliot and Reynolds 2007	No	9	Ongoing
Soils/spoils are ameliorated where determined necessary	Soil amelioration specification	Develop specification for ameliorants (soils and spoils) during land disturbance (in accordance with Land Disturbance Protocol) to develop soil characteristics suitable for final landuse (Class 3 agricultural land and woodland).	DECC(a) 2008	No	No	Ongoing
	Ameliorant application	Soil ameliorants (e.g.: gypsum, mulch, biosolids, composts) are applied where necessary in accordance with recommended rate resulting from soil characterisation.	DECC(a) 2008	No	No	Ongoing
Erosion is minimised	Temporary ESC installation	Temporary erosion and sediment controls (ESCs) are installed prior to topsoil re-spreading in accordance with a site Erosion and Sediment Control Plan (ESCP).	EA Section 5.5.5	No	No	Ongoing

~~Domain Objective~~	~~Performance Indicator~~	~~Completion Criteria~~	~~Justification/ Source~~	~~Complete (Yes/No)~~	~~Link to TARP~~	~~Progress at MOP start~~
	~~Cover crop sowing rate~~	~~Topsoiled rehabilitation areas are sown with a non-persistent cover crop at recommended sowing rate / ha.~~	~~DECC(a) 2008~~	~~No~~	~~No~~	~~Ongoing~~

~~Domain Objective~~	~~Performance Indicator~~	~~Completion Criteria~~	~~Justification/ Source~~	~~Complete (Yes/No)~~	~~Link to TARP~~	~~Progress at MOP start~~
~~**Domain C - Agricultural Rehabilitation Areas**~~						
~~Class 3 agricultural cropping land has soils reinstated with an Effective Rooting Depth > 1.5 m~~	~~Surface rock density.~~	~~Surface spoils are graded to produce a friable surface.~~	~~McKenzie 2011~~	~~No~~	~~No~~	~~Not commenced~~
	~~Stratic Rudosol soil profile depth.~~	~~Stratic Rudosol soils are spread directly onto reshaped landforms to a total profile depth of 1.5 m, in accordance with the EA.~~	~~McKenzie 2011~~ ~~Elliot & Reynolds 2007~~ ~~EA Section 5.5.2~~	~~No~~	~~10~~	~~Not commenced~~
~~**Domain D - Woodland Vegetation Areas**~~						
~~Topsoil / subsoil is re-spread to the recommended depth for woodland final landuse~~	~~Topsoil and subsoil depth~~	~~Soils are spread onto reshaped landforms at a depth of 0.2 m, in accordance with the EA.~~	~~McKenzie 2011~~ ~~Elliot & Reynolds 2007~~ ~~EA Section 5.5.2~~	~~No~~	~~10~~	~~Ongoing~~
~~Habitat features are salvaged and re-used in woodland rehabilitation to provide fauna habitat resources~~	~~Habitat features~~	~~Habitat features (hollow bearing logs, felled timber not mulched and large rocks) are salvaged during pre-stripping operations for re-use where practicable.~~	~~EA Section 5.5.1~~	~~No~~	~~No~~	~~Ongoing~~
	~~Log, hollows and nest box density~~	~~Habitat features are incorporated into woodland rehabilitation areas (including within watercourses and retained dams) where appropriate.~~	~~EA Section 5.5.1~~	~~No~~	~~No~~	~~Ongoing~~

~~Table 16- Ecosystem Establishment Phase~~

~~Domain Objective~~	~~Performance Indicator~~	~~Completion Criteria~~	~~Justification / Source~~	~~Complete (Yes/No)~~	~~Link to TARP~~	~~Progress at start of MOP~~
~~All Domains~~						
~~Management and mitigation measures will be implemented to minimise the introduction and spread of weeds on TCPL land.~~	~~Weed density.~~	~~Weed species presence and densities are monitored and control programs implemented in accordance with approved Biodiversity Management Plan (BMP) and draft Vertebrate Pest Management Plan (VPMP).~~	~~TSC Act 1995 – Key Threatening Processes~~ ~~Noxious Weeds Act, 1993~~ ~~BMP~~ ~~VPMP~~	~~No~~	~~12~~	~~Ongoing~~
~~Vertebrate pests are controlled and excluded from rehabilitation areas.~~	~~Fence / tree guard installation.~~	~~Faunal exclusion fencing and/or tree guards are installed (where required) to exclude vertebrate pest species from rehabilitation areas / juvenile vegetation.~~	~~TSC Act 1995 – Key Threatening Processes~~	~~No~~	~~14~~	~~Ongoing~~
	~~Vertebrate pest density.~~	~~Vertebrate pest species presence and densities are monitored, and control programs implemented in accordance with approved Biodiversity Management Plan (BMP) and draft Vertebrate Pest Management Plan (VPMP).~~	~~TSC Act 1995 – Key Threatening Processes~~ ~~Rural Lands Protection Act 1998~~ ~~BMP~~ ~~VPMP~~	~~No~~	~~14~~	~~Ongoing~~
~~Management measures will be implemented to minimise bushfire risks in rehabilitation areas.~~	~~Bushfire~~	~~Bushfire mitigation actions, including managing fuel loads, maintaining fire breaks and fire fighting access, are implemented in accordance with the Bushfire Management Plan.~~	~~Bushfire Management Plan~~	~~No~~	~~No~~	~~Ongoing~~

~~Domain Objective~~	~~Performance Indicator~~	~~Completion Criteria~~	~~Justification / Source~~	~~Complete (Yes/No)~~	~~Link to TARP~~	~~Progress at start of MOP~~
~~Domain C - Agricultural Rehabilitation Areas~~						
~~210 ha of Class 3 agricultural land is established on areas disturbed by mining.~~	~~Pasture species sowing rate.~~	~~Approved pasture species mix (refer Table 22) is sown at the specified sowing rate per hectare.~~	~~Statement of Commitments~~	~~No~~	~~No~~	~~Not commenced .~~
~~Open woodland tree plantings are established in nominated grazing areas.~~	~~Tubestock planting.~~	~~Open woodland tree species tubestock planting combined with direct seeding to achieve densities equivalent to analogue sites.~~	~~This MOP~~	~~No~~	~~No~~	~~Ongoing~~
~~Domain D -Woodland Vegetation Areas~~						
~~Approximately 752 ha of areas disturbed by mining will be rehabilitated with native vegetation communities including areas commensurate with Box Gum Woodland EEC~~	~~Flora survey.~~	~~Required native vegetation species associations are established.~~	~~Statement of Commitments~~	~~No~~	~~No~~	~~Ongoing~~

Table 17 - Ecosystem Sustainability Phase

Domain Objective	Performance Indicator	Completion Criteria	Justification / Source	Complete (Yes/No)	Link to TARP	Progress at MOP start
All Domains						
Soil stability and profile development is self-sustaining	Percent nitrogen, potassium and phosphorous.	Soil nitrogen, potassium and phosphorus levels are within two standard deviations of the mean value at analogue sites by Years 1, 5 and Year 15, respectively.	CSIRO 2008. Ecosystem Function Analysis (EFA) Annual Monitoring Reports	No	9	Ongoing
	Percent ground cover.	Ground cover and / or leaf litter cover is greater than 70% at Year 5.	DECC 2008	No	11	Ongoing
	Percent soil loss.	Net annual soil loss is equivalent to the mean net annual soil loss from analogue sites.	CSIRO 2008. EFA Annual Monitoring Reports	No	8	Ongoing
Domain C - Agricultural Rehabilitation Areas						
Soil stability and profile development is self-sustaining	Effective Rooting Depth (ERD)	Effective Rooting Depth (ERD) exceeds 1.5 m at year 5.	McKenzie 2011 EA Section 5.5.4	No	No	Not commenced
		Salinity (EC), pH, and Cation Exchange Capacity (CEC) down the soil profile is within two standard deviations of mean values analogue sites at year 5.		No	7	Not commenced
Agricultural Rehabilitation Areas maintain Class 3 Agricultural land suitability with only the typical land management actions	Agricultural land suitability assessment.	Agricultural Rehabilitation Areas are demonstrated to be capable of grazing and cropping in accordance with the general limitations that apply to Class 3 agricultural land.	EA Section 5.5.4	No	No	Not commenced

~~Domain Objective~~	~~Performance Indicator~~	~~Completion Criteria~~	~~Justification / Source~~	~~Complete (Yes/No)~~	~~Link to TARP~~	~~Progress at MOP start~~
~~Domain D - Woodland Rehabilitation Areas~~						
~~Open woodland and riparian rehabilitation areas are on a trajectory to forming self-sustaining ecosystem function equivalent to appropriate analogue sites~~	~~Vegetation health index.~~	~~Percentage of healthy shrubs and trees (when ranked healthy, sick or dead.) is equivalent to the mean percentage across analogue sites~~	~~Tongway D, and Hindley, L. 2004~~ ~~EFA Annual Monitoring Reports~~	~~No~~	~~13~~	~~Not commenced~~
	~~Tree height and girth~~	~~Minimum tree height and girth standards for selected indicator species of the vegetation association is equivalent to the mean within analogue site benchmarks at 1, 5 and 15 years.~~		~~No~~	~~No~~	~~Not commenced~~
	~~Percent canopy cover.~~	~~Percent canopy cover is equivalent to the mean percent cover of analogue sites at 1, 5 and 15 years.~~		~~No~~	~~No~~	~~Not commenced~~
	~~Flowering specimen density / second generation presence~~	~~Species are capable of setting viable seed, flowering or otherwise reproducing.~~ ~~Second generation of at least four vegetation community species recorded.~~		~~No~~	~~No~~	~~Not commenced~~
	~~Tree hollow and nesting site density~~	~~Total hollows and nesting sites is greater than 50% of that of analogue sites at Year 15.~~		~~No~~	~~No~~	~~Not commenced~~
~~Soil stability and profile development is self-sustaining~~	~~Litter biomass (depth, total mass)~~	~~Depth and mass of litter varies by less than 10% in consecutive surveys by Year 15.~~	~~CSIRO 2008~~ ~~EFA Annual Monitoring Reports~~	~~No~~	~~No~~	~~Not commenced~~

~~Table 18 – Relinquishment~~

~~Domain Objective~~	~~Performance Indicator~~	~~Completion Criteria~~	~~Justification / Source~~	~~Complete (Yes/No)~~	~~Link to TARP~~	~~Progress at end of MOP~~
~~All Domains~~						
~~Site will be restored to a landform capable of sustaining the post mining landuses~~	~~Completion Criteria~~	~~All relevant completion criteria for the land proposed for relinquished (Rehabilitation Phases) are acknowledged to be met by the DRE (or contemporary equivalent).~~	~~This document~~	~~No~~	~~No~~	~~Not commenced~~
	~~Access Tracks~~	~~Access tracks not required in the final landform are decommissioned and rehabilitated.~~	~~This document~~	~~No~~	~~No~~	~~Not commenced~~
	~~Monitoring Points~~	~~Any ancillary disturbance or equipment associated with surface water and rehabilitation monitoring points is removed and/or rehabilitated.~~	~~This document~~	~~No~~	~~No~~	~~Not commenced~~

Table 13 - Rehabilitation Completion Criteria

Domain Objective	Performance Indicator	Completion Criteria	Justification/ Source	Complete (Yes/No)	Link to TARP	Progress at start of MOP
Phase – Decommissioning of Infrastructure						
All mine-related infrastructure removed from the site and disposed of at an appropriate facility, relocated to another Whitehaven site, or sold.	Communications, power supply, water supply, and water management services and infrastructure removed.	All infrastructure components dismantled and/or removed from the site unless otherwise agreed with the Administering Authority and landholder.	MOP Section 5.2	No	No	To commence
	Offices, workshops and other buildings removed.		MOP Section 5.2	No	No	To commence
	Fuel, chemical, explosive storage tanks and containers removed.		MOP Section 5.2	No	No	To commence
	Roads and rail infrastructure removed.		MOP Section 5.2	No	No	To commence
All hazardous materials removed and contaminated areas remediated.	Hazardous materials such as hydrocarbons, chemicals and explosives removed from site.	All hazardous materials removed from the site and appropriately disposed of.	Contaminated Land Management Act 1997 POEO Act	No	No	To commence

Table 13 (Continued)
Rehabilitation Completion Criteria

Domain Objective	Performance Indicator	Completion Criteria	Justification/ Source	Complete (Yes/No)	Link to TARP	Progress at start of MOP
Phase – Decommissioning of Infrastructure (Cont.)						
	Areas where hazardous materials have been stored or transferred have been assessed for contamination and remediated if required.	Land contamination assessments and remediation (if necessary) conducted in accordance with the relevant legislative requirements.	Contaminated Land Management Act 1997 POEO Act	No	No	To commence
Groundwater bores and piezometers decommissioned and sealed if no longer required for monitoring or water supply purposes.	Groundwater bores and piezometers stand pipes removed and sealed.	Bentonite seal installed, standpipe and piezometer 'cap' removed and cement grout installed to the surface.	Minimum Construction Requirements for Water Bores in Australia, 2011	No	No	To commence
Phase – Landform Establishment						
Mine landform integrates and generally blends in with surrounding landscape and is stable.	Minimal active erosion.	Absence of gullies > 200 mm wide or deep, or gullies stable.	MOP Section 4.3	No	Yes	Commenced
	Minimal active erosion.	Absence of tunnel erosion intake or outlets points.	MOP Section 4.3	No	Yes	Commenced
		Landform has an average overall slope of 10 degrees	MOP Section 4.3, 5.2, 5.4.2	No	Yes	Commenced

Table 13 (Continued)
Rehabilitation Completion Criteria

Domain Objective	Performance Indicator	Completion Criteria	Justification/ Source	Complete (Yes/No)	Link to TARP	Progress at start of MOP
Phase – Landform Establishment (Cont.)						
Water quality non-polluting and appropriate for conservation end land use.	Water quality.	Oil/grease ≤ 10 milligrams per litre (mg/L).	MOP Section 3.2.8	No	Yes	Ongoing
		EC < 600 micro Siemens per centimetre (µS/cm).	MOP Section 3.2.8	No	Yes	Ongoing
		pH between 6.5 and 8.5 as per the EPL.	MOP Section 3.2.8	No	Yes	Ongoing
		TSS < 50 mg/L.	MOP Section 3.2.8	No	Yes	Ongoing
Phase – Growth Medium Development						
Mixture of native vegetation communities including grassy woodland, shrubby woodland/ open forest.	Soils ameliorated to sustain pasture or native ecosystems.	The depth and layering of respread subsoil and topsoil are in accordance with the EA.	EA	No	Yes	Commenced
		Soil based criteria equal analogue sites (to be determined based on sampling results). Will include: • pH; • Organic matter; and • Phosphorous.	EA	No	No	Commenced

Table 13 (Continued)
Rehabilitation Completion Criteria

Domain Objective	Performance Indicator	Completion Criteria	Justification/ Source	Complete (Yes/No)	Link to TARP	Progress at start of MOP
Phase – Ecosystem Establishment						
Woodland rehabilitation established consistent with analogue vegetation communities. Note: Local benchmarks[1] will be developed in consultation with OEH in 2018[2] for the purpose of the completion criteria from analogue vegetation communities.	Native Species Richness	Increase to at least 10% of lower benchmark.	TCM BMP Table 6.8	No	Yes	Not commenced
	Native Overstorey Cover	Increase to at least 10% of lower benchmark.	TCM BMP Table 6.8	No	Yes	Not commenced
	Native Mid-storey Cover	Increase to at least 10% of lower benchmark.	TCM BMP Table 6.8	No	Yes	Not commenced
	Native Groundcover (Grasses)	Increase to at least 10% of lower benchmark.	TCM BMP Table 6.8	No	Yes	Not commenced
	Native Groundcover (Shrubs)	Increase to at least 10% of lower benchmark.	TCM BMP Table 6.8	No	Yes	Not commenced
	Native Groundcover (Other)	Increase to at least 10% of lower benchmark.	TCM BMP Table 6.8	No	Yes	Not commenced
	Exotic Plant Cover	Decreasing number and cover of exotic species	TCM BMP Table 6.8 Biosecurity Act 2015	No	Yes	Not commenced

Table 13 (Continued)
Rehabilitation Completion Criteria

Domain Objective	Performance Indicator	Completion Criteria	Justification/ Source	Complete (Yes/No)	Link to TARP	Progress at start of MOP
Phase – Ecosystem Sustainability						
Woodland rehabilitation established consistent with analogue vegetation communities. Note: Local benchmarks[1] will be developed in consultation with OEH in 2018[2] for the purpose of the completion criteria from analogue vegetation communities.	Native Species Richness	Increase to at least 80% of lower benchmark.	TCM BMP Table 6.10	No	Yes	Not commenced
	Native Overstorey Cover	Increase to at least 80% of lower benchmark.	TCM BMP Table 6.10	No	Yes	Not commenced
	Native Mid-storey Cover	Increase to at least 80% of lower benchmark.	TCM BMP Table 6.10	No	Yes	Not commenced
	Native Groundcover (Grasses)	Increase to at least 80% of lower benchmark.	TCM BMP Table 6.10	No	Yes	Not commenced
	Native Groundcover (Shrubs)	Increase to at least 80% of lower benchmark.	TCM BMP Table 6.10	No	Yes	Not commenced
	Native Groundcover (Other)	Increase to at least 80% of lower benchmark.	TCM BMP Table 6.10	No	Yes	Not commenced
	Exotic Plant Cover	Less than 10% of domain area	TCM BMP Table 6.10	No	Yes	Not commenced
	% Canopy Recruitment	Some natural regeneration of Eucalypt canopy species present.	TCM BMP Table 6.10	No	Yes	Not commenced
Phase – Relinquishment						
Site will be restored to a landform capable of sustaining the post-mining land uses.	Achievement of completion criteria.	All relevant completion criteria for the land proposed for relinquishment are acknowledged to be met by DRG (or contemporary equivalent).	This document	No	No	Not commenced.

[1] Benchmark is the required standard for each respective Performance Indicator established for specific native vegetation communities (Biometric vegetation communities) in NSW, as determined by the Office of Environment and Heritage. Lower benchmarks are used for completion criteria as they best align to establishing systems such as areas under rehabilitation.

[2] Completion Criteria will be updated and finalised with OEH by 30 September 2018 including:-

1. Inclusion of sufficient parameters/indicators such that successful completion of each rehabilitation phase can be demonstrated,
2. Inclusion of defined trigger points to inform trajectory analysis, and
3. Defined reference sites and site specific benchmarks.

Once finalised, Completion Criteria will be incorporated into an amended MOP that will be provided to agencies for consultation, and DRG for approval.

Table 14 – REA Rehabilitation Criteria

Domain Objective	General Objective	Performance Indicator	Completion Criteria	Justification/ Sources	Complete (Yes/No)	Link to TARP	Progress at start of MOP
Free of public safety risks or measures implemented to restrict access and protect public safety	Minimise risk of injury to site people and animals from decommissioning activities	Complete and action a risk assessment.	Appropriate security measures implement (where required) prior to commencing construction and capping.	SLR (2017)	Yes	No	Ongoing
	Public access managed and minimised				Yes	No	Ongoing
	Minimise risk of injury to people and animals from construction and capping activities	Nil	Engineered design and final construction reports		No	No	Not commenced.
		Stable Slopes	Engineered design, final construction reports and monitoring for slumping or slipping.		No	No	Not commenced.

Domain Objective	General Objective	Performance Indicator	Completion Criteria	Justification/ Sources	Complete (Yes/No)	Link to TARP	Progress at start of MOP
Chemically stable within accepted criteria	Minimise risk of injury to site people and animals from decommissioning activities	Ground and Surface Water Monitoring results	Analyte levels below criteria of the site water management plan.		No	Yes	Not commenced.
Capable of supporting and maintaining the designated post mining land use	Cover and drainage implemented to minimise erosion and encourage plant growth	Site records and engineering reports	Completed Drainage and 70% grass cover.	SLR (2017)	No	Yes	Not commenced.
	Areas rehabilitation top-dressed with a suitable growing media	Visual assessment of depth and rehabilitation establishment records	The depth and layering of respread topsoil is in accordance with the EA ie 1.5m (agriculture areas), 0.2m (other disturbance areas).	EA	No	Yes	Not commenced.
	Growth media characterised and ameliorated for use in final land uses	Rehabilitation establishment records	Ameliorants (such as gypsum, organics and fertilisers) that are certified and non-contaminated are spread at the recommended rate per hectare as recommended by soil analysis appropriate to the final land use.		No	Yes	Not commenced.
	Appropriate access and supporting infrastructure retained on cap	Nil	Adequate access and infrastructure are retained (e.g. access tracks and drainage) for relinquishment. Monitoring and associated disturbances rehabilitated post closure prior to relinquishment as required.		No	No	Not commenced.
	Site will be capable of sustaining the post mining land uses	Authority sign off records	Sign off from DRG that the landforms developed are compatible with the surrounding landscape and they approve such landform as part of the MOP approval		No	No	Not commenced.
	Bushfire risk management	Nil	Bushfire management planning incorporated into the rehabilitation plan.		No	No	Not commenced.

Domain Objective	General Objective	Performance Indicator	Completion Criteria	Justification/ Sources	Complete (Yes/No)	Link to TARP	Progress at start of MOP
Free draining to the surface water system via hydraulically and geomorphically suitable features and discharging from approved locations as per EPLs	Landform suitable for final land use and compatible with surrounding landscape	Visual and/or Remote Sensing GIS assessment of slope and stability at Walkover/Flyover	Rehabilitated slopes are 10 degrees or to the satisfaction of the appropriate regulatory authority.		No	Yes	Not commenced.
			Visual inspections confirm rehabilitated landforms exhibit an absence of significant slumping.		No	Yes	Not commenced.
			Spillways constructed where required to be stable and facilitate free draining landforms.	SLR (2017)	No	Yes	Not commenced.
		Visual assessment record	Runoff directed away from re-established landforms, where practicable.		No	Yes	Not commenced.
Within acceptable erosion and sediment mobilisation rates	Minimal active accelerated erosion	Visual and/or Remote Sensing GIS assessment of gully erosion at Walkover/Flyover	No evidence of tunnel erosion.		No	No	Not commenced.
			Rill erosion is limited to isolated areas of minor rilling up to 200 mm deep.		No	Yes	Not commenced.
			There is no active scouring where the runoff from rehabilitation areas discharges into natural channels.		No	No	Not commenced.
	Erosion will be controlled	Assessment of erosion and sediment control structures at Walkover/Flyover and at transects using erosion rating system	Monitoring indicates there is no significant and active erosion (gully depth >200 mm) that compromises land capability or the intended final land use.		No	No	Not commenced.
	Erosion does not present a safety hazard or compromise the post mining land capability	Assessment of erosion and sediment control structures at Walkover/Flyover and at transects using rating system	No significant erosion is present that constitutes a safety hazard or compromises the capability of the supporting the end land use.		No	No	Not commenced.

Domain Objective	General Objective	Performance Indicator	Completion Criteria	Justification/ Sources	Complete (Yes/No)	Link to TARP	Progress at start of MOP
Within acceptable soil and leachate quality	Monitoring demonstrates appropriate soil quality in rehabilitated areas	Soil testing/ monitoring records	Bare areas of soil >400m^2 are tested for pH, EC, ESP, macronutrients and trace elements.	SLR (2017)	No	No	Not commenced.
Consistent with the final post mining land use	Weeds are controlled cap area	Quantitative assessment of weed presence	Decreasing number and cover of exotic species	TCM BMP Table 6.8	No	Yes	Not commenced.

7 REHABILITATION IMPLEMENTATION

7.1 Status at MOP Commencement

Table ~~1915~~ describes the status of each domain at the commencement of this MOP period. This information is also presented graphically in **Plan 2.** The asset register (**Section 2.2**) provides a summary of the total area and key features of each domain in the MOP period.

Table ~~1915 -~~ Rehabilitation Status at MOP Commencement

Domain	Status at MOP Commencement
Primary Domains (Operational)	
Domain ~~16~~ – ~~Final Void / Active Mining~~ Void (Open cut void)	This domain is currently active and subject to ongoing operations.
Domain ~~23~~ – Water Management Area	This domain occupies~~d~~ 58.85 ha and is currently active and subject to ongoing operations.
Domain ~~31~~ – Infrastructure Area	This domain occupies~~d~~ 53.28 ha and is currently active and subject to ongoing operations.
Domain ~~45~~ – ~~Topsoil Stockpile Area~~ Stockpiled Material	This domain is currently active and subject to ongoing operations.
Domain ~~54~~ – Overburden Emplacement Area	This domain is currently active and subject to ongoing operations.
~~Domain 6 – Temporary Rehabilitation~~	~~This domain is currently active and subject to ongoing operations.~~
Domain 7 – Rehabilitation Area	This domain is currently active, with 50.38 ha of rehabilitation established at the commencement of the MOP term.
Secondary Domains (Post Mining Land Use)	
Domain ~~A~~I – Final Void	This domain is currently active and subject to ongoing operations.
Domain B – Water Management Area	This domain is currently active and subject to ongoing operations.
Domain ~~C~~D – Agricultural Rehabilitation Area - Pasture	There has been no agricultural rehabilitation established at the commencement of the MOP term
Domain ~~D~~ E – Woodland Rehabilitation Area	50.38 ha of woodland rehabilitation has~~d~~ been established at the commencement of the MOP term

7.2 Proposed Rehabilitation Activities during the MOP Term

Table ~~20~~ 16summarises the forecast total disturbance and rehabilitation areas at Tarrawonga for each year of the MOP term.

Table 16- Rehabilitation and Disturbance Rates during the MOP Term

Period	Disturbance (ha)	Rehabilitation (ha)	Cumulative Rehabilitation (ha)	Comments
Start of MOP	582.~~439~~	50.~~438~~	50.~~438~~	See Plan 2
2015[1]	0	7.6~~1~~	5~~87.99~~	Plan 3A - Rehabilitation on the Northern Emplacement Area
2016	32.~~987~~	6.9~~1~~	64.9	Plan 3B - Progression of the active mining area to the east and rehabilitation in the Northern Emplacement Area
2017	24.3~~1~~	5.~~986~~	70.~~876~~	Plan 3C - Progression of the active mining area to the east and rehabilitation in the Northern Emplacement Area
2018	~~14.63~~63.1	~~34.24~~12.8	~~105~~83.6	Plan 3D - Progression of the active mining area to the east and rehabilitation in the Northern Emplacement Area and Southern Emplacement Area
2019	~~37.05~~19.8	~~16.69~~24.1	~~121.69~~107.7	Plan 3E - Progression of the active mining area to the east and rehabilitation in the Northern Emplacement Area and Southern Emplacement Area
2020	~~18.64~~17.5	~~7.62~~20.4	~~129.31~~128.1	Plan 3F - Progression of the active mining area to the east and rehabilitation in the Northern Emplacement Area and Southern Emplacement Area
End of MOP	~~709.89~~740	-	~~129.31~~128.1	

1 – Although MOP term commence~~sd~~ 1 November 2015, the areas in this table are relating to disturbance during the 2015 calendar year.

~~**Table 21** summarises the proposed rehabilitation activities in the MOP term for each domain. Rehabilitation methodologies for the proposed activities are described in **Section 7.3**.~~

~~**Table 16 - Proposed Rehabilitation Activities during the MOP Term**~~

~~**Domain**~~	~~**Proposed Rehabilitation Activities**~~
~~**Primary Domains**~~	
~~Domain 1 – Final Void / Active Mining~~	~~This domain will remain active in the MOP term.~~
~~Domain 2 – Water Management Area~~	~~This domain will remain active in the MOP term.~~
~~Domain 3 – Infrastructure Area~~	~~This domain will remain active in the MOP term.~~
~~Domain 4 – Topsoil Stockpile Area~~	~~This domain will remain active in the MOP term.~~

Domain	Proposed Rehabilitation Activities
Domain 5 – Overburden Emplacement Area	This domain will remain active in the MOP term. Landform establishment activities will be undertaken as described in Section 7.3.2.
Domain 6 – Temporary Rehabilitation	This domain will remain active in the MOP term and will be subject to ongoing maintenance and management as required
Domain 7 – Rehabilitation	This domain will remain active in the MOP term and will be subject to ongoing maintenance and management as required. The domain will increase by 71.31 ha during the MOP term.
Secondary Domains	
Domain A – Final Void	This domain refers to the final void to be retained in the final landform. The locality of this final void is shown on **Plan 4**.
Domain B – Water Management Area	This domain refers to the surface water management structures (dams) that will be retained in the final landform following mine closure. The locality of these structures that will retained in the final landform have been shown on **Plan 4**
Domain C – Agricultural Rehabilitation Area	There is no agricultural rehabilitation in place at the commencement of the MOP term, and none is proposed to be established during the MOP term.
Domain D – Woodland Rehabilitation Area	50.38 ha of Woodland rehabilitation is in place at the commencement of the MOP term. A total of 78.93 ha will be completed during the term of the MOP.

7.3 Rehabilitation Methodologies for Activities in the MOP Term

7.3.1 Decommissioning Phase

The Decommissioning Phase encompasses all works required to prepare land for rehabilitation including removal of built infrastructure, foundation and hardstand materials, services, equipment and materials including wastes and contamination.

No decommissioning activities are proposed during the MOP term. All mining related infrastructure will be removed at mine closure.

7.3.2 Landform Establishment

Landform establishment is the process of shaping the final landform to a safe, stable and free draining landform that is appropriate for the desired final land use and consistent with the surrounding landscape. The final landform for Tarrawonga is shown on **Plan 4**. Final landforms will have acceptable slopes and unimpeded drainage lines. Slopes are generally to be graded to no more than 10 degrees and no more than 18 degrees without DRE's approval, as per DRE's guidelines.

Domain 1

There are no activities associated with landform establishment in this domain during the MOP term.

The principal objective of landform establishment activities associated with the final void is to create a safe and stable landform that is non-polluting. A detailed methodology to treat the final void will be developed in a *Final Void and Mine Closure Plan* that will be developed closer to mine closure when more certainty about the final void conditions will be known. General principles that may be adopted to make the final void safe and stable include:

- Battering back the lowwalls and highwall to minimise potential for failures and mass movement;
- Capping (or excavating) exposed coaliferous material with inert material to prevent ignition from spontaneous combustion, bushfires or human interference;
- Constructing a physical barrier to isolate the perimeter of the void to prevent human access. The highwall areas will be secured by the construction of a trench and a safety berm, as well as a security fence along the entire length of the eastern and northern highwalls;
- Suitable signs, clearly stating the risk to public safety and prohibiting public access will be erected at intervals along the entire length of the fence; and
- Surface runoff from land surrounding the void will be diverted so as to prevent any potential development of instability of the void walls.

Domain 2

There are no activities associated with landform establishment in this domain during the MOP term.

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. Contour and catch drains are designed to collect surface runoff from rehabilitation or disturbed areas. Sedimentation dams will be constructed and retained during rehabilitation to collect runoff from rehabilitated areas until discharge water quality meets regulatory criteria and dams can be decommissioned.

Domains 3, 4 and 5

The Northern Emplacement will be shaped to integrate with the Boggabri Coal Mine waste rock emplacement to the north during the MOP term, and the Leard State Forest to the east (outside of this MOP term), providing continuity between the Tarrawonga and Boggabri Coal Mine post mining landforms, and habitat connectivity with undisturbed vegetation communities at Leard State Forest. In the Southern Emplacement Area, an area of overburden will be subject to landform establishment activities in 2018.

Both the Northern Emplacement and Southern Emplacement will be shaped to integrate with the open cut infill area.

Waste rock will be selectively handled and blended to avoid emplacement of potentially acid forming material in concentrated areas. As outlined in **Section 3.2.5** where PAF-LC material is identified it will be encapsulated with at least 15 m of NAF to minimise potential for acid leachate.

Dispersive materials will be avoided for material layers at the final landform surface where practical to minimise potential for significant scouring or land slumping. Non-sodic and low sodicity materials will be selectively handled and preferentially emplaced at or near the surface. Where there are potentially dispersive materials emplaced at or near the surface, appropriate amelioration with lime or gypsum will be undertaken to stabilise soils, particularly foundation materials for earthworks structures such as contour banks.

No areas of infrastructure will be subject to the landform establishment phase during the MOP term.

Domains 6 and 7

The existing rehabilitation areas, along with the area of temporary rehabilitation on the southern face of the southern waste emplacement will remain during the MOP term and will not undergo any landform establishment activities.

7.3.3 Growth Media Development

In the context of this MOP, growth medium development encompasses activities to reinstate soils with the initial physical, chemical and biological characteristics required to establish the desired vegetation community.

Where possible, soils will be re-spread directly onto re-shaped landforms. Subsoils and topsoils will be characterised prior to re-spreading to determine the type and application rates for any required soil ameliorants (e.g. lime, gypsum, fertiliser and organics). The use of soil ameliorants improves germination and vegetation establishment by minimising surface crusting, increasing moisture retention and organic content, and buffering surface temperatures.

Domains C

The re-establishment of a soil profile consistent with Class 3 agricultural suitability land will be achieved by selectively emplacing, rock raking, ripping, and ameliorating the surface 300 mm of spoil, emplacing approximately 1 m of select subsoil, and 0.5 m of topsoil. The ripped and ameliorated surface spoils will assist achieve an effective rooting depth (ERD) of at least 1.5 m.

To develop a soil profile with an ERD greater than 1.5 m, the soil profile will be reconstructed in a staged approach. A staged re-spreading methodology will be developed prior to the anticipated timing of the reinstatement of agricultural soils (Year 12 of the project) to optimise the structure, chemical and biological properties throughout the soil profile. The re-spreading methodology will be developed in consultation with stakeholders and agencies and documented in future MOPs.

While the clay-rich subsoils in the Stratic Rudosol soil profiles are considered high-value plant growth media, soil mapping undertaken for the Agricultural Resource Assessment (McKenzie, 2011) indicates that some topsoils have severe limitations for plant growth due to:

- Loss of soil structure and acidification from past farming practices: and
- Depositional layers with high sand and gravel fractions.

All topsoils intended for re-use in agricultural rehabilitation areas will be further assessed prior to stripping to determine their suitability for re-use and determine specific amelioration requirements. Once soils are spread, ameliorants such as gypsum will be applied and the area deep-ripped along the contour.

It should be noted that Agricultural Rehabilitation Areas will not be established in this MOP period.

Domain D

Native vegetation areas encompass all woodland rehabilitation areas and areas within the final void above the predicted permanent water level (i.e. above 260 m AHD).

Soil resources for native vegetation rehabilitation will generally be re-spread 20 cm deep. Once soils are re-spread, ameliorants such as gypsum will be applied and the area deep-ripped along the contour to produce a friable soil surface that optimises water infiltration and soil – seed contact.

7.3.4 Ecosystem Establishment

In the context of this MOP, ecosystem establishment includes activities to establish the desired floristic composition (species diversity and density) and habitat features.

Domain C

Agricultural Rehabilitation Areas will not be established in this MOP period. Up to 160 ha of agricultural land capable of being used for a combination of pasture production for grazing and occasional cropping

(Class 3 Agricultural Suitability) will be re-established on the lower terraces of the open cut infill area. This area, combined with the rehabilitated mine facilities area (40 ha) and 10 ha from the temporary soils stockpile location near the permanent Goonbri Creek realignment, will provide for a total of 210ha of agricultural land in the final rehabilitated landform. Additionally, as mine closure approaches, final land use options may be reviewed based on ongoing consultation with the community, regulators and other stakeholders. Agricultural Rehabilitation Areas will be sown with pasture species and, where appropriate, planted with woodland tree species (in copses or isolated paddock trees) and managed as native grasslands during life of mine. Detailed management of Agricultural Rehabilitation Areas will be further developed in subsequent MOPs.

Domain D

Cover Crop Establishment

Following soil preparation all rehabilitation areas are stabilised with a cover crop (ie. Millet in Summer or Oats in Winter).

Pasture Establishment

Seed mixes appropriate to the season include fast growing, short lived species to optimise rapid stabilisation and increase soil organic content, and perennial grasses and legumes to fix nitrogen and establish native grasses groundcover for open woodland. Typical species mixes are presented in **Table 22**.

Table 17 - Typical Pasture Species Mix

Pasture Species Mix	Rate (kg/ha)
Warm Season Mix	
Bombatsi Panic	1 – 2
Green Panic	2 – 4
Purple Pidgeon Grass	1 – 2
Subterranean Clover	4 – 5
Cool Season Mix	
Phalaris (Sirolan or Holdfast)	1 – 2
Wallaby Grass	0.3 – 1
Barrel (Sephi) medic	2 – 4
Snail (sava) medic	3 – 5
Woolly Pod Vetch	4 – 6
Serradella (Elgara)	1 – 2
Lucerne	0.5

Tubestock Planting

Native vegetation areas are planted with native tubestock species, selected on a site by site basis considering factors such as adjacent remnant vegetation communities, aspect, slope, and soil types.

Woodland Rehabilitation Areas will include areas planted with species commensurate with the Box-Gum Woodland EEC. Retained dams and watercourses including the Goonbri Creek Alignment will be

planted with riparian species. The Final Void domain will be planted with native vegetation tubestock above the predicted permanent water line.

Tubestock planting is preferentially undertaken in Autumn and early Winter when weather conditions are generally suited to avoid heat stress on newly planted seedlings; however opportunistic plantings are undertaken in spring and late summer following suitable rainfall. Whenever possible, tubestock seedlings will be propagated from seed collected on-site and in adjacent areas or sourced from suppliers in the region.

TCPL will also trial direct seeding of eucalypts and some understorey species for woodland areas. If these trials are successful consideration will be given to utilising direct seeding to rehabilitate open woodland rehabilitation areas. Direct seeding research trials are discussed further in **Section 8.2.2**.

Species currently used for native vegetation planting at Tarrawonga are shown in **Table 23**. TCPL will consult Forests NSW regarding inclusion of commercially desirable species for future timber harvesting for rehabilitation areas adjacent to the Leard State Forest (Northern Emplacement Area).

Table 18 - Typical Species for Native Vegetation Areas

Common Name	Scientific Name
Trees	
White Box	*Eucalyptus albens*
Blakely's Red Gum	*Eucalypus blakelyi*
Yellow Box	*Eucalyptus melliodora*
Narrow-leaved Ironbark	*Eucalyptus creba*
Bimble Box	*Eucalyptus populnea*
Tumbledown Gum	*Eucalyptus dealbata*
Pilliga Grey Box	*Eucalyptus pilligaensis*
Wilga	*Geijera parviflora*
Belah	*Casuarina cristata*
Western Rosewood	*Alecttyon oleifolius*
Shrubs	
Western Golden Wattle	*Acacia decora*
Amulla	*Eremophila debilis*
Sandlewood	*Santalum lanceolatum*
Eastern Cottonbush	*Marireana microphylla*
Native Jasmine	*Jasminium lineare*
Gangaloo	*Parsonsia eucalyptophylla*
Yellow Berry Bush	*Maytenus cunninghamii*
Wild Lemon	*Canthium oleifolum*
Wild Orange	*Capparis mitchelli*
Hopbush	*Dodomaea spp.*

Common Name	Scientific Name
Emubush	*Eremophila longofolia*
Native Olive	*Notelaea macrocarpa*
Butterbush	*Pittosporum angustifolium*
Cough Bush	*Cassinia laevis*

Weed and Vertebrate Pest Control

Ecosystem Establishment includes initial management actions to limit the introduction of weeds and vertebrate pest species in rehabilitation areas as described in **Section 3.2.7**. Ongoing weed and pest management and monitoring is considered in the ecosystem development phase (**Section 7.3.5**).

Management measures include:

- Treatment of weeds on topsoil stockpiles prior to re-spreading in rehabilitation areas;
- Ensuring all plant and equipment are weed free prior to mobilisation to rehabilitation areas;
- Maximising the retention of ground cover (cover crop stubble) when planting tubestock to minimise opportunities for weed activity; and
- Installation of fauna exclusion fencing and/or tree guards for newly planted tubestock where predation by grazing herbivores represents a risk to establishment.

7.3.5 Ecosystem Sustainability Phase

For the purposes of this MOP the Ecosystem Sustainability phase represents those activities required to develop sustainable ecosystems that have characteristics comparable to similar undisturbed vegetation associations in the area.

All Domains

Activities associated with the ecosystem sustainability phase of rehabilitation are generally ongoing maintenance and land management activities and rehabilitation monitoring. Maintenance at rehabilitated areas will include, but not be limited to:

- Ongoing environmental management to minimise risks to rehabilitation;
- Comparing specific ecosystem characteristics such as soil profile development, floristic composition and structure and faunal diversity and abundance with the characteristics of appropriate analogue sites; and
- Undertaking adaptive management and remedial works where characteristics of the rehabilitation are not trending toward desired outcomes.

Rehabilitation monitoring will be undertaken throughout the ecosystem sustainability phase until it can be demonstrated that rehabilitation areas have met all conditions for relinquishment. Rehabilitation monitoring for the MOP term is discussed in **Section 8.1.**

7.4 Summary of Rehabilitation Areas during this MOP term

Table 2417 summarises the rehabilitation status for each domain at the start of the MOP and anticipated status at the end of the MOP period.

Table 17- Summary of Rehabilitation Proposed during the MOP Term

Primary Domain	Secondary Domain	Code	Rehabilitation Phase	Total Area at MOP start (ha)	Area at end of MOP (ha)
~~Final Void / Active Mining (1)~~ Void (Open cut void) (6)	~~Agricultural Rehabilitation Area (C)~~ Rehabilitation Area – Pasture (D)	~~1C~~ 6D	Active	51~~.28~~	~~82.7151.4~~
			Decommissioning	0	0
			Landform Establishment	0	0
			Growth Medium Development	0	0
			Ecosystem Establishment	0	0
			Ecosystem Development	0	0
			Total	51~~.28~~	~~82.7151.4~~
~~Final Void / Active Mining (1)~~ Void (Open cut void) (6)	~~Woodland Rehabilitation Area (D)~~ Rehabilitation Area – Woodland (E)	~~1D~~ 6E	Active	81~~.04~~	~~27.9257.1~~
			Decommissioning	0	0
			Landform Establishment	0	0
			Growth Medium Development	0	0
			Ecosystem Establishment	0	0
			Ecosystem Development	0	0
			Total	81~~.04~~	~~27.9257.1~~
Final Void ~~/ Active Mining~~ (Open cut void) Total				**132~~.31~~**	**~~110.63108.5~~**
Water Management Area (~~23~~)	Final Void (~~A~~I)	~~2A~~ 3I	Active	0	~~4.340~~
			Decommissioning	0	0
			Landform Establishment	0	0
			Growth Medium Development	0	0
			Ecosystem Establishment	0	0
			Ecosystem Development	0	0
			Total	0	~~4.340~~
Water Management Area (~~23~~)	Water Management Area (B)	~~2B~~ 3B	Active	23~~.01~~	~~21.77165.5~~
			Decommissioning	0	0
			Landform Establishment	0	0
			Growth Medium Development	0	0
			Ecosystem Establishment	0	0

Primary Domain	Secondary Domain	Code	Rehabilitation Phase	Total Area at MOP start (ha)	Area at end of MOP (ha)
			Ecosystem Development	0	0
			Total	23~~.01~~	~~21.77~~165~~.5~~
Water Management Area (~~2~~3)	~~Agricultural Rehabilitation Area (C)~~ Rehabilitation Area – Pasture (D)	~~2C~~ 3D	Active	6~~.27~~	~~6.93~~15~~.05~~
			Decommissioning	0	0
			Landform Establishment	0	0
			Growth Medium Development	0	0
			Ecosystem Establishment	0	0
			Ecosystem Development	0	0
			Total	6~~.27~~	~~6.93~~15~~.05~~
Water Management Area (~~2~~3)	~~Woodland Rehabilitation Area (D)~~ Rehabilitation Area – Woodland (E)	~~2D~~ 3E	Active	30~~29.58~~	~~26.06~~43~~.54~~
			Decommissioning	0	0
			Landform Establishment	0	0
			Growth Medium Development	0	0
			Ecosystem Establishment	0	0
			Ecosystem Development	0	0
			Total	30~~29.58~~	~~26.06~~43~~.54~~
Water Management Area Total				**5~~98.86~~**	**~~59.10~~754~~.09~~**
Infrastructure Area (~~3~~1)	Final Void (~~A~~I)	~~3A~~ 1I	Active	0	0~~.35~~
			Decommissioning	0	0
			Landform Establishment	0	0
			Growth Medium Development	0	0
			Ecosystem Establishment	0	0
			Ecosystem Development	0	0
			Total	0	0~~.35~~
Infrastructure Area (~~3~~1)	~~Agricultural Rehabilitation Area (C)~~ Rehabilitation Area – Pasture (D)	~~3C~~ 1D	Active	0.5~~47~~	~~3.43~~32~~.78~~
			Decommissioning	0	0
			Landform Establishment	0	0
			Growth Medium Development	0	0

Primary Domain	Secondary Domain	Code	Rehabilitation Phase	Total Area at MOP start (ha)	Area at end of MOP (ha)
			Ecosystem Establishment	0	0
			Ecosystem Development	0	0
			Total	0.5~~47~~	~~3.43~~32.~~78~~
Infrastructure Area (~~3~~1)	~~Woodland Rehabilitation Area (D)~~ Rehabilitation Area – Woodland (E)	~~3D~~ 1E	Active	5~~32.81~~	~~51.4046.32~~
			Decommissioning	0	0
			Landform Establishment	0	0
			Growth Medium Development	0	0
			Ecosystem Establishment	0	0
			Ecosystem Development	0	0
			Total	5~~32.81~~	~~51.4046.32~~
Infrastructure Area Total				**53.~~528~~**	**~~55.1849.1~~**
~~Topsoil Stockpile Area (4)~~ Stockpiled Material (5)	~~Woodland Rehabilitation Area (D)~~ Rehabilitation Area – Woodland (E)	~~4D~~ 5E	Active	6~~65.94~~	68.~~9422~~
			Decommissioning	0	0
			Landform Establishment	0	0
			Growth Medium Development	0	0
			Ecosystem Establishment	0	0
			Ecosystem Development	0	0
			Total	6~~65.94~~	68.~~9422~~
~~Topsoil Stockpile Area~~ Stockpiled Material Total				**6~~65.94~~**	68.~~9422~~
Overburden Emplacement Area (~~5~~4)	~~Agricultural Rehabilitation Area (C)~~ Rehabilitation Area – Pasture (D)	~~5C~~ 4D	Active	0	~~52.52598.95~~
			Decommissioning	0	0
			Landform Establishment	0	0
			Growth Medium Development	0	0
			Ecosystem Establishment	0	0
			Ecosystem Development	0	0
			Total	0	~~52.52598.95~~
Overburden Emplacement Area (~~5~~4)	~~Woodland Rehabilitation Area (D)~~	~~5D~~ 4E	Active	2032.~~95~~	~~215.54250.27~~
			Decommissioning	0	0

Primary Domain	Secondary Domain	Code	Rehabilitation Phase	Total Area at MOP start (ha)	Area at end of MOP (ha)
	Rehabilitation Area – Woodland (E)		Landform Establishment	0	~~7.620~~
			Growth Medium Development	0	0
			Ecosystem Establishment	0	0
			Ecosystem Development	0	0
			Total	2032.95	~~215.54~~250~~.27~~
Overburden Emplacement Area Total				2032.95	**~~275.68~~309~~.22~~**
~~Temporary Rehabilitation (6)~~	~~Woodland Rehabilitation Area (D)~~	~~6D~~	~~Active~~	~~18.67~~	~~18.67~~
			~~Decommissioning~~	~~0~~	~~0~~
			~~Landform Establishment~~	~~0~~	~~0~~
			~~Growth Medium Development~~	~~0~~	~~0~~
			~~Ecosystem Establishment~~	~~0~~	~~0~~
			~~Ecosystem Development~~	~~0~~	~~0~~
			~~Total~~	~~18.67~~	~~18.67~~
~~**Temporary Rehabilitation Total**~~				~~**18.67**~~	~~**18.67**~~
Rehabilitation (7)	~~Woodland Rehabilitation Area (D)~~ Rehabilitation Area – Woodland (E)	7~~DE~~	Active	0	0
			Decommissioning	0	0
			Landform Establishment	0	0
			Growth Medium Development	0	~~16.025.14~~
			Ecosystem Establishment	50~~.38~~	~~105.09~~1032~~.96~~
			Ecosystem Development	0	0
			Total	50~~.38~~	~~121.69~~128~~.1~~
Rehabilitation Total				**50~~.38~~**	**~~121.69~~128~~.1~~**
Overall Total				**563.582~~.39~~**	**~~709.89~~7376**

7.5 Relinquishment Phase Achieved During MOP Period

No areas within the MOP boundary are anticipated to be relinquished during the ~~current~~ MOP period.

8 REHABILITATION MONITORING, RESEARCH AND REPORTING

The inspection and monitoring of rehabilitation will be undertaken by TCM personnel through regular inspections as well as through engaging suitably qualified specialists (as required).

Aspects of rehabilitation to be inspected will include:

- Evidence of any erosion or sedimentation from areas with establishing vegetation cover;
- Success of initial grass cover establishment;
- Success of tree and shrub plantings;
- Adequacy of drainage controls;
- Presence/absence of weeds; and
- General stability of the rehabilitation site.

The aim of the vegetation monitoring program at TCM is to evaluate the success of revegetation of the Rehabilitation towards achieving the performance and completion criteria specified in **Section 6**. The Rehabilitation monitoring program will be consistent with the monitoring program implemented for the Biodiversity Offsets in the BMP (2018 in draft). The experimental design for TCM's Rehabilitation monitoring program will involve three types of vegetation monitoring sites (including replicate plots to increase statistic robustness) aiming to sample revegetation management (treatment = action sites) compared to no management (untreated/unmanaged = control sites) and the development of revegetation towards the desired woodland final land use (remnant woodland vegetation = analogue/reference sites).

TCM will engage qualified ecologists to undertake vegetation monitoring on an annual basis in spring. Fixed vegetation monitoring plots measuring 20 x 50 m will be established at each monitoring site and permanently marked with a star picket and within each plot a 20 x 20 m quadrat will also be established based on the BioBanking Assessment Methodology (BBAM) (OEH, 2014). The BBAM vegetation monitoring methodology includes monitoring vegetation structural parameters and flora species diversity consistent with the performance and completion criteria in **Section 6**.

The Tarrawonga rehabilitation monitoring program will be reviewed as part of a broad Whitehaven Ecological Monitoring Methodology review program and standardisation across all rehabilitation and offset areas. This review will commence in 2018 with an anticipated duration of 12 months.

Annual Reviews will report on monitoring results including discussion on trends and management effectiveness.

No time limit has been placed on post-mining rehabilitation monitoring and maintenance in terms of lease relinquishment. Maintenance will continue until such time as the performance and completion criteria are met.

~~8.1 Rehabilitation Monitoring~~

~~TCPL undertakes annual rehabilitation monitoring to provide quantitative and qualitative data to:~~

- Assess rehabilitation progress against completion criteria and/or triggers for re-work and adaptive management; and
- Assist in refining rehabilitation methods.

8.1.1 Active Mining Records

TCPL maintains active mining records related to processes that may impact on future rehabilitation quality. These records contribute to future assessment of rehabilitation outcomes and inform the continual improvement process. Records maintained include the following:

- Detailed rehabilitation procedures;
- Register of hazardous and explosive materials;
- Register of contaminated sites;
- Records of production wastes and other waste streams and where they are located on site;
- Environmental monitoring records, including surface and groundwater quality and detailed annual rehabilitation monitoring reports from qualified ecologists;
- A topsoil and subsoil stockpile register which includes the date stockpiles were formed and maintenance works undertaken (e.g. weed control, planting with cover crops etc.), and
- Environmental incident records.

8.1.2 Rehabilitation Methodology Records

TCPL records the details of each rehabilitation campaign so that they are available to provide context for rehabilitation monitoring results and assist the continuous improvement process.

The key monitoring parameters to be included in the program include:

- Landform and drainage design details;
- Substrate (spoil) characterisation;
- Site preparation techniques (for example, topsoil source and depth, soil ameliorants used etc.);
- Revegetation methodologies (for example, rate and type of fertiliser, cover crop and rate, time of sowing /planting);
- Weather conditions;
- Photographic records; and
- Initial follow-up care and maintenance works.

8.1.3 Annual Rehabilitation Surveys

TCPL engage ecologists to undertake spring monitoring campaigns at:

- Existing Woodland Rehabilitation Area sites at the Northern Emplacement and Southern Emplacement;
- Regenerating native vegetation in the north east corner of ML 1579;
- Analogue sites located at the southern extent of ML 1579 (agricultural land control sites) and in undisturbed native vegetation to the east of ML 1579 (Woodland analogue site); and
- During the MOP term additional monitoring will be undertaken within ML1685.

Monitoring at rehabilitation areas and analogue sites includes survey programs tailored for both Agricultural and Woodland Rehabilitation Areas Secondary Domains.

Vegetation and fauna surveys in Woodland sites monitor vegetation diversity and abundance in each stratum and presence of arboreal and terrestrial fauna species. Woodland surveys also include soil profile characterisation and measure the accumulation of leaf litter, bare patches and presence of weeds.

Surveys in pastoral control sites monitor the pastoral vegetation species, total biomass per hectare and soil physical-chemical data. Rehabilitation monitoring outcomes are reported annually in the Annual Review.

Monitoring at the analogue sites will be used for further development of quantitative indicators and completion criteria for Agricultural Rehabilitation Areas and Woodland / Forest Rehabilitation Areas (refer to **Section 8.2** below).

TCPL is trialling multi-spectral remote sensing monitoring techniques including the Normalised Difference Vegetation Index (NDVI) technique to detect any deterioration in vegetation health in rehabilitation areas. Should NDVI data indicate a deterioration in vegetation health, additional 'on the ground' monitoring will be undertaken to determine if any remedial actions are required in accordance with the rehabilitation TARP (refer to **Section 9.2**).

8.1.4 Independent Biodiversity Audit

In addition to the scheduled monitoring events, Tarrawonga will be independently audited every 3 years to assess compliance with the requirements of PA 11_0047 MOD 1, EPL 12365 and ML 1579, along with any assessment, management plan, strategy or program required under those approvals. The next audit is scheduled for 2017.

All rehabilitation areas will be audited in the Independent Biodiversity Audit independent audit to verify rehabilitation progress documented in the MOP and Annual Review.

8.2 Research and Rehabilitation and Use of Analogue Sites

8.2.1 Use of Analogue Sites

Monitoring at the pastoral control sites will be used to develop baseline data for pasture species densities and diversity, total biomass per hectare and agricultural soil physical-chemical data at representative productive pastoral control sites. Baseline data will be used to quantify indicators and completion criteria for Agricultural Rehabilitation Areas and will be documented in future MOPs.

Similarly, surveys in the Woodland/Forest analogue site is undertaken to build baseline data for soil profiles, vegetation features and presence of fauna and habitat features.

The project will disturb the existing analogue woodland site when mining advances into ML 1693. TCPL will engage in consultation with Forests NSW to secure access to alternative appropriate analogue sites in this MOP period.

8.2.2 Research and Rehabilitation Trials

There are no specific rehabilitation trials or research proposed for TCM. Rehabilitation monitoring and rehabilitation methodology records are, however, shared among Whitehaven operations to inform decision making regarding future rehabilitation campaigns. Specifically the near by Maules Creek mine has a requirement to undertake a $1M research program into rehabilitation of Box Gum Grassy

Woodland upon mine rehabilitation, the findings from which will be considered by TCM and integrated into future MOP amendments as appropriate.

~~Continuous Improvement~~

~~Tarrawonga adopts a continuous improvement approach to rehabilitation. Results from rehabilitation monitoring surveys and opportunistic monitoring observations are used to refine rehabilitation methodologies on an on-going basis. For example, the success rate for cool and warm climate seed mix variations are monitored to determine the most effective cover crop seed mixes.~~

~~Direct Seeding Trials~~

~~TCPL will trial direct seeding techniques in small areas to determine the effectiveness of direct seeding to establish native vegetation. TCPL will engage contractors to undertake direct seeding works. Rehabilitation progress will be monitored to identify potential benefits to supplementing tubestock planting with direct seeding. Trial results will be reported in the Annual Review and if successful, direct seeding methodologies will be formalised in future MOPs.~~

~~Native Vegetation Tubestock Trials~~

~~TCPL and Boggabri share growth rate data for tubestock sourced from different areas to verify if stock from different sources produces better growth.~~

~~Future Research~~

~~No additional research is proposed for rehabilitation during the term of this MOP. Should suitable research/trial opportunities be identified they will be investigated and implemented.~~ Reference site/s representative of the TCM Rehabilitation final land uses will be selected from the various number of regionally based vegetation monitoring sites across Whitehaven Coal's Gunnedah Basin wide rehabilitation and biodiversity offset areas monitoring programs.

9 INTERVENTION AND ADAPTIVE MANAGEMENT

Where rehabilitation monitoring indicates that rehabilitation outcomes are not trending toward the nominated completion criteria TCPL will instigate early intervention and adaptive management to minimise the potential for rehabilitation failure. Identification of threats to rehabilitation and the subsequent intervention is discussed in the sections below.

9.1 Threats to Rehabilitation

Unpredictable events such as bushfires, droughts and floods may present risks to rehabilitation both during the life of mine and post closure. These events generally have significant consequences for rehabilitation quality and are likely to require adaptive management in order to mitigate risks and achieve relinquishment of affected rehabilitation areas within a satisfactory timeframe.

Although these events may have a high degree of unpredictability, monitoring the status of contributing factors enables an assessment of the likelihood of a major impact to rehabilitation occurring. For example, measuring fuel loads in and adjacent to woodland rehabilitation areas informs a periodic assessment of the likelihood of a bushfire event.

Other major risks to rehabilitation may not present as sudden events, but as an increasing impact over an extended period of time. For example evolution of regulator or community expectations regarding post mining land-uses may present a risk to achieving relinquishment, or increasing feral pest numbers may increase pressure on native fauna and vegetation communities.

Key threats to rehabilitation were identified in the Risk Assessment (**Appendix C**) and are listed in **Table ~~25~~18** below.

Table 18 – Key Threats to Rehabilitation

Threat	Caused by
Erosion and Sediment Control	Rainfall events Lack of appropriate vegetation cover Failure of water management structures
Acid Mine Drainage	Poor knowledge of material that may result in AMD. Poor management of the materials that have a propensity to AMD
Spontaneous Combustion	Poor management of materials with propensity for spontaneous combustion
Geotechnical	Geotechnical failure
Soil Type(s) and Suitability	Inadequate topsoil available Poor topsoil quality Weed infested topsoil Poor recovery of topsoil from currently rehabilitated areas
Flora and Fauna	Failure to manage weeds Pest species / grazing pressures (kangaroos, rabbits etc.)
Bushfire	Proximity to state forest
Contaminated Land	Long term use of the site Spills, leaks etc.

Where rehabilitation monitoring indicates that there is a significant threat to rehabilitation, TCPL will undertake adaptive management in accordance with the Rehabilitation Trigger Action Response Plan (TARP) described in **Section 9.2**.

9.2 Trigger Action Response Plan

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

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

The TARP is provided as **Table ~~26~~**19, and will be reviewed and may be revised as conditions at TCPL change or new threats to rehabilitation are identified.

9.2.1 First Tier Triggers

First tier triggers are intended to detect early indications that rehabilitation is not trending toward desired completion criteria. ~~As described in **Section 8.1.3** TCPL is trialling use of NDVI remote sensing techniques to establish and monitor first tier triggers to identify:~~

- ~~Deteriorating vegetation health in rehabilitation and offset areas;~~
- ~~Variability in total biomass and vegetation density in each strata of vegetation communities; and~~
- ~~Changes in soil properties without disturbance.~~

~~A statistical variation in monitoring results, or a statistically significant overall decline in vegetation health, will trigger further on-ground assessments to confirm any adverse impacts, and early intervention management responses.~~

~~Remote sensing monitoring enhances early intervention since instances where rehabilitation indicators are trending toward trigger values can be identified from desktop assessments independent of scheduled on-ground monitoring campaigns. Additionally, adjacent vegetation health can be assessed using remote sensing without requiring access arrangements or disturbance, and can assist to identify external risks to rehabilitation.~~

9.2.2 Second Tier Triggers

Quantitative or quantitative trigger values for key indicators will be developed and documented for ~~both~~ the Project Area~~and biodiversity offsets areas~~. Trigger values will be developed based on monitoring program outcomes, including rehabilitation areas, ~~biodiversity offset areas~~ and selected analogue sites

Table 19 - Trigger Action Response Plan

~~Aspect/ Category~~	~~Key Element~~	~~Element Number~~	~~Trigger Response~~	~~1st Level Trigger~~	~~2nd Level Trigger~~
~~Landform stability~~	~~Slope gradient~~	~~1~~	~~Trigger~~	~~<70% of the rehabilitation area has slopes within the limits stipulated in the MOP.~~	~~<55% of the rehabilitation area has slopes within the limits stipulated in the MOP.~~
			~~Response~~	~~Undertake re-grading and revegetation of the area.~~	~~Undertake a review of the landform design, including survey if required. Undertake re-grading and revegetation of the area.~~
	~~Erosion control~~	~~2~~	~~Trigger~~	~~Minor gully or tunnel erosion present and/or minor rilling (rilling up to 200 mm in depth or width).~~	~~Slumping and/or significant gully or tunnel erosion present and/or significant rilling, which is compromising landform.~~
			~~Response~~	~~An inspection of the site will be undertaken by a suitably trained person. Investigate opportunities to install water management infrastructure to address erosion. Remediate as appropriate.~~	~~Engage a consultant suitably qualified person(s) 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.~~
	~~Free Draining Landforms~~	~~3~~	~~Trigger~~	~~Landforms exhibiting ponding in excess of design~~	~~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~~	~~4~~	~~Trigger~~	~~Water management structures (sediment dams, channels, contour banks) minor erosion and/or scouring as determined by Landscape Function Analysis (LFA).~~	~~Water management structures fail or display significant scouring / erosion as determined by LFA.~~

Aspect/ Category	Key Element	Element Number	Trigger Response	1st Level Trigger	2nd Level Trigger
			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 a suitably qualified person to develop a site specific remediation plan and review water management structure design criteria. Provide for physical works on the basis of design review.
Water Quality	Water quality (Nagero Creek, Goonbri Creek, Bollol Creek and Namoi River)	5	Trigger	Water quality exceeds baseline values	Long term upward trend outside ANZECC quality guideline limits values
			Response	Review and investigation of water quality monitoring and management where appropriate. Implement relevant remedial measures where required.	Hydrologist (or similar specialist) to review sampling and climate data and review likely cause(s). If mine related, undertake assessment to identify sources of water quality degradation and recommend remedial actions Implement specialist recommendations
	Discharge water quality at licence discharge points	6	Trigger	Sediment basin discharge exceeds EPL criteria for pH, TSS and/or oil/grease	Long term upward trend outside ANZECC quality guideline limits
			Response	Re-sampling will be undertaken during the next discharge event to confirm results exceed limits, and investigate potential causes.	Review sediment basin maintenance and discharge procedures, and sediment basin capacity requirements. Undertake required corrective actions.
Soil/spoil Quality	Salinity	7	Trigger	Increasing trend in soil/water salinity levels	Presence of salt scalds
			Response	Undertake soil/spoil testing to verify EC and recommend further soil / spoil amelioration	Engage a specialist consultant suitably qualified person to develop a site specific management report to be implemented to remediate salinity scalds. Undertake works as required.
		8	Trigger	Increasing trend in soil dispersivity (EAT)	Soil are moderately to highly dispersive

Aspect/ Category	Key Element	Element Number	Trigger Response	1st Level Trigger	2nd Level Trigger
	Spoil surface layers chemical characteristics		Response	Undertake testing to determine required amelioration and undertake amelioration as required.	Review material handling practices to confirm that non-dispersive spoil is selectively dumped at final RL where possible and /or dispersive spoils emplaced at surface are appropriately ameliorated. Ameliorate dispersive spoils (for example with coarse gypsum) to a depth of 300 mm. Re-vegetate if required.
	Soil biophysical and chemical characteristics	9	Trigger	Soil nitrogen, potassium and phosphorous levels are not in the range of analogue sites by Year 5	Soil physical, chemical and biological characteristics are not able to sustain the desired final land use.
			Response	Engage a consultant to recommend appropriate soil/spoil amelioration. Undertake amelioration and re-vegetation in accordance with the consultant recommendations.	Engage a consultant to recommend appropriate soil/spoil amelioration. Undertake amelioration and re-vegetation in accordance with the consultant recommendations.
	Topsoil Depth	10	Trigger	Topsoil is not reinstated to, at least, the minimum depth specified for the proposed final land use.	Sufficient suitable topsoil cannot be identified for reinstatement at the minimum specified depth for the proposed final land use
			Response	Top dress with additional suitable topsoil resource. If additional suitable material is not immediately available stabilise the area with cover crop until additional suitable topsoil is sourced and re-emplaced.	Undertake a review of the topsoil balance to confirm sufficient material to meet minimum depth requirements. Investigate suitable topsoil resource substitutes and introduce if required.
Biodiversity (native vegetation areas)	Ground cover percent	11	Trigger	Minimum of 60% ground cover is not present within six months of seeding initial pasture mix.	Vegetative cover is 50% or less at year 1.

Aspect/ Category	Key Element	Element Number	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.	Engage a suitably qualified specialist person to investigate causes for germination failure and recommend remedial actions. Implement appropriate management actions including revising rehabilitation procedures if required.
	Noxious weedPpresence	12	Trigger	Six months following seeding, species composition comprises <75% desired species mix.	Six months following revegetation, species composition comprises <50% desired species mix.
			Response	Engage weed management contractor to remove / spray introduced weed species.	Engage weed management contractor to remove introduced weed species. Investigate management measures to improve native plant establishment and weed suppression including additional soil amelioration, establishment and retention of cover crops until weed presence is at acceptable levels. Implement recommendations as appropriate.
	Vegetation Health	13	Trigger	Vegetation health index not in the range of analogue sites.	Long term declining trend in vegetation health index
			Response	Engage ecologist to undertake preliminary investigations.	Engage ecologist to undertake investigation to determine the cause of change. Prepare a site specific management plan and implement recommendation actions.
	Pest animal species presence	14	Trigger	Pest animal species presence and density increased in annual monitoring events	Significant numbers of pest animals causing widespread damage to rehabilitation

Aspect/ Category	Key Element	Element Number	Trigger Response	1st Level Trigger	2nd Level Trigger
			Response	Consult with Namoi LLS to recommend and implement appropriate pest animal control campaign.	Consult with Namoi LLS to recommend and implement appropriate pest animal control campaign. Engage a suitably qualified specialist to prepare a site management plan and implement recommendations such as augmenting pest animal exclusion fencing and re-vegetation.
	Native Fauna Presence	15	Trigger	Loss or deterioration of nest boxes, or pest animal species usage of nest boxes, (including ants and feral honeybees)	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 ants and honey bees	Engage ecologist to undertake investigation to determine the cause of change A site specific management report to be prepared and implemented where necessary that aligns with the RMP

Aspect/ Category	Key Element	Element Number	Trigger Response	1st Level Trigger	2nd Level Trigger
Landform stability	Slope gradient	1	Trigger	<70% of the rehabilitation area has slopes within the limits stipulated in the MOP.	<55% of the rehabilitation area has slopes within the limits stipulated in the MOP.
			Response	Undertake re-grading and revegetation of the area.	Undertake a review of the landform design, including survey if required. Undertake re-grading and revegetation of the area.

Aspect/ Category	Key Element	Element Number	Trigger Response	1st Level Trigger	2nd Level Trigger
	Erosion control	2	Trigger	Minor gully or tunnel erosion present and/or minor rilling (rilling up to 200 mm in depth or width).	Slumping and/or significant gully or tunnel erosion present and/or significant rilling, which is compromising landform.
			Response	An inspection of the site will be undertaken by a suitably trained person. Investigate opportunities to install water management infrastructure to address erosion. Remediate as appropriate.	Engage suitably qualified person(s) 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.
	Water management Structures	3	Trigger	Water management structures (sediment dams, channels, contour banks) minor erosion and/or scouring as determined by monitoring.	Water management structures fail or display significant scouring / erosion as determined by monitoring.
			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 a suitably qualified person to develop a site specific remediation plan and review water management structure design criteria. Provide for physical works on the basis of design review.
Soil/spoil Quality	Salinity	4	Trigger	Increasing trend in soil/water salinity levels	Presence of salt scalds
			Response	Undertake soil/spoil testing to verify EC and recommend further soil / spoil amelioration	Engage a specialist consultant suitably qualified person to develop a site specific management report to be implemented to remediate salinity scalds. Undertake works as required.
	Spoil surface layers chemical characteristics	5	Trigger	Increasing trend in soil dispersivity (EAT)	Soil are moderately to highly dispersive

Aspect/ Category	Key Element	Element Number	Trigger Response	1st Level Trigger	2nd Level Trigger
			Response	Undertake testing to determine required amelioration and undertake amelioration as required.	Review material handling practices to confirm that non-dispersive spoil is selectively dumped at final RL where possible and /or dispersive spoils emplaced at surface are appropriately ameliorated. Ameliorate dispersive spoils (for example with coarse gypsum) to a depth of 300 mm. Re-vegetate if required.
	Soil biophysical and chemical characteristics	6	Trigger	Soil nitrogen, potassium and phosphorous levels are not in the range of analogue sites by Year 5	Soil physical, chemical and biological characteristics are not able to sustain the desired final land use.
			Response	Engage a consultant to recommend appropriate soil/spoil amelioration. Undertake amelioration and re-vegetation in accordance with the consultant recommendations.	Engage a consultant to recommend appropriate soil/spoil amelioration. Undertake amelioration and re-vegetation in accordance with the consultant recommendations.
	Topsoil Depth	7	Trigger	Topsoil is not reinstated to, at least, the minimum depth specified for the proposed final land use.	Sufficient suitable topsoil cannot be identified for reinstatement at the minimum specified depth for the proposed final land use ie 1.5m (agriculture areas), 0.2m (other disturbance areas).
			Response	Top dress with additional suitable topsoil resource. If additional suitable material is not immediately available stabilise the area with cover crop until additional suitable topsoil is sourced and re-emplaced.	Undertake a review of the topsoil balance to confirm sufficient material to meet minimum depth requirements. Investigate suitable topsoil resource substitutes and introduce if required.
	Native Species Richness	8	Trigger	Less than 50% of species sown recorded.	Less than 25% of species sown recorded.

Aspect/ Category	Key Element	Element Number	Trigger Response	1st Level Trigger	2nd Level Trigger
Biodiversity (native vegetation areas)			Response	Undertake a field survey to identify which species not present in revegetation areas. Re-seed or maintenance planting of revegetation areas with unsatisfactory species richness.	Engage a suitably qualified person to investigate causes for revegetation failure and recommend remedial actions. Implement appropriate management actions including revising rehabilitation procedures if required.
	Native Groundcover	9	Trigger	Less than 50% of groundcover species sown recorded.	Less than 25% of groundcover species sown recorded.
			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.	Engage a suitably qualified person to investigate causes for germination failure and recommend remedial actions. Implement appropriate management actions including revising rehabilitation procedures if required.
	Exotic Plant Cover (Weeds)	10	Trigger	Increasing number and cover of exotic species and/or occurrence of newly identified exotic species.	More than 10% of domain area and/or significant weed invasions.
			Response	Engage weed management contractor to remove / spray introduced weed species.	Engage weed management contractor to remove introduced weed species. Investigate management measures to improve native plant establishment and weed suppression including additional soil amelioration, establishment and retention of cover crops until weed presence is at acceptable levels. Implement recommendations as appropriate.
Water Quality	Water quality	11	Trigger	Water quality exceeds baseline values	Long term trend outside ANZECC quality guideline limits values

Aspect/ Category	Key Element	Element Number	Trigger Response	1st Level Trigger	2nd Level Trigger
			Response	Review and investigation of water quality monitoring and management where appropriate. Implement relevant remedial measures where required.	Hydrologist (or similar specialist) to review sampling and climate data and review likely cause(s). If mine related, undertake assessment to identify sources of water quality degradation and recommend remedial actions Implement specialist recommendations
	Discharge water quality at licence discharge points	12	Trigger	Sediment basin discharge exceeds EPL criteria for pH, TSS and/or oil/grease	Long term trend outside ANZECC quality guideline limits
			Response	Re-sampling will be undertaken during the next discharge event to confirm results exceed limits, and investigate potential causes.	Review sediment basin maintenance and discharge procedures, and sediment basin capacity requirements. Undertake required corrective actions.
Soil	Topsoil Depth	13	Trigger	Topsoil is not reinstated to, at least, the minimum depth specified for the proposed final land use.	Sufficient suitable topsoil cannot be identified for reinstatement at the minimum specified depth for the proposed final land use ie 1.5m (agriculture areas), 0.2m (other disturbance areas).
			Response	Top dress with additional suitable topsoil resource. If additional suitable material is not immediately available stabilise the area with cover crop until additional suitable topsoil is sourced and re-emplaced.	Undertake a review of the topsoil balance to confirm sufficient material to meet minimum depth requirements. Investigate suitable topsoil resource substitutes and introduce if required.
REA - Landform Stability	Reshaping of coarse rejects stockpile with dozers	14	Trigger	Material becomes wet/soft resulting in possible loss of traction or bogging	N/A
			Response	Based on investigation, remediate area if possible or determine alternate course of action in consultation with MEM.	N/A

Aspect/ Category	Key Element	Element Number	Trigger Response	1st Level Trigger	2nd Level Trigger
			Trigger	Surveyor/OCE identifies non-compliance with design surface.	N/A
			Response	OCE/MEM/Surveyor to investigate reason for non-compliance and make any necessary adjustments to implementation process.	N/A
			Trigger	Hot zone exposed by dozer.	N/A
			Response	Determine possible extent of hot zone and remediation plan. A JHA must be performed in conjunction with remediation plan.	N/A
	Dumping of inert Overburden Material over reshaped rejects	15	Trigger	Cracks appear on live tip head	N/A
			Response	Determine if cracking likely to deteriorate and extend to the 5m offset rear dump windrow. If so, cut this section of dump down with dozer and re-establish tip-head. If not, continue to monitor by dozer operator.	N/A
			Trigger	Rejects stockpile toe slumps.	N/A
			Response	Establish survey monitoring of slumped area and monitor for movement. MEM to contact a geotechnical expert to undertake investigation and determination of remedial actions.	N/A
REA – Monitoring of Landform	Monitoring of initial landform (prior to life of	16	Trigger	Movement of overburden capping is detected through monthly survey monitoring.	N/A

Aspect/ Category	Key Element	Element Number	Trigger Response	1st Level Trigger	2nd Level Trigger
	mine landform establishment)		Response	Based on survey monitoring results, MEM to determine course of action which may involve advice from geotechnical expert.	N/A
			Trigger	Cracking is detected on surface of overburden capping	N/A
			Response	Based on monitoring results, MEM to determine course of action which may involve advice from geotechnical expert.	N/A
			Trigger	Presence of spontaneous combustion evident in encapsulation area (smoke/odour)	N/A
			Response	Based on investigation, MEM to determine remedial actions to arrest and control spontaneous combustion source.	N/A
	Monitoring of final landform (mine still active)	17	Trigger	Slumping/Cracking occurs exposing coarse rejects stockpile to oxygen source	N/A
			Response	MEM to investigate severity of cracking and remediation works required	N/A
			Trigger	Presence of spontaneous combustion evident in encapsulation area (smoke/odour)	N/A
			Response	MEM to investigate severity of spontaneous combustion and remediation works required	N/A
		18	Trigger	Slumping/Cracking occurs exposing coarse rejects stockpile to oxygen source	N/A

Aspect/ Category	Key Element	Element Number	Trigger Response	1st Level Trigger	2nd Level Trigger
	Monitoring of final landform (after mine closure)		Response	Group Manager – Environment to investigate and determine remediation works required. (MEM to be included in process if mine still under his/her statutory control)	N/A
			Trigger	Failure of rehabilitation ie vegetative cover less than 70%	N/A
			Response	Group Manager – Environment to investigate and determine remediation works required. (MEM to be included in process if mine still under his/her statutory control)	N/A
			Trigger	Presence of spontaneous combustion evident in encapsulation area (smoke/odour)	N/A
			Response	Group Manager – Environment to investigate and determine remediation works required. (MEM to be included in process if mine still under his/her statutory control)	N/A

10 REPORTING

Results of rehabilitation monitoring will be reported in the ~~AEMR/~~Annual Review. The ~~AEMR/~~Annual Review will record monitoring results and discuss rehabilitation performance against key performance measures/indicators; compliance with regulatory requirements and TCPL commitments. The ~~AEMR/~~Annual Review will also discuss identified trends and instances where potential rehabilitation failure has been identified triggering intervention in accordance with a Rehabilitation TARP (**Section 9.2**).

The ~~AEMR/~~Annual Review, along with any independent audits undertaken, will be submitted to relevant government agencies and made publically available via the Whitehaven website.

11 REVIEW AND IMPLEMENTATION OF THE MOP

11.1 Review of the MOP

The MOP may be revised in the event of the following:

- Deficiencies being identified;
- Changes to environmental requirements due to (for example) changed legislation or regulatory requirements;
- Changes in the activities described in this MOP; and
- Where risk assessment identifies the requirement to alter the MOP.

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.~~

11.2 Implementation

Whitehaven personnel are responsible for monitoring, review and implementation of this MOP, as listed in **Table ~~27~~20**.

Table 20 - Responsibilities for MOP Implementation

Position	Responsibility
General Manager	• Overall site-based responsibility for all activities and all personnel at the mine-site, including their compliance with all applicable laws, regulations, licences, approvals, the conditions of consent and achievement of the desired environmental outcomes, the responsibility of the Mine Manager and/or Area Manager.
~~Mine Manager/Area Manager~~ Operations Manager	• Ensuring all contractors, sub-contractors and service-personnel are appropriately qualified and/or licenced to undertake the required work and have a good environmental performance record; • Ensuring all operations are undertaken in accordance with relevant environmental legislation; • Providing the final sign-off and/or authorising distribution of, all environmental reports / management plans etc.; • Workforce induction/training; and • Communication with statutory authorities and the community.
~~Group Manager Environment~~	~~• Assist and advise management with the requirements of the relevant environmental laws and regulations, consents, licences, approvals and environmental management systems and plans;~~ ~~• Assist with the implementation, monitoring and review of programs and procedures associated with this plan; and~~ ~~• Consult with regulatory authorities as required.~~

Position	Responsibility
Environment~~al personnel~~Superintendent	• Provide support to the ~~Group Manager – Environment~~ Operations Manager for MOP implementation as required; • Undertake site based actions to implement this plan in cooperation with the Operations Manager; and • Report the progress of rehabilitation and biodiversity monitoring in the ~~AEMR~~ Annual Review.

12 REFERENCES

Australian and New Zealand Environment and Conservation Council (ANZECC) (1992) *Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites.*

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Whitehaven Coal Mining Pty Ltd (2013b) *Pollution Incident Response Management Plan*

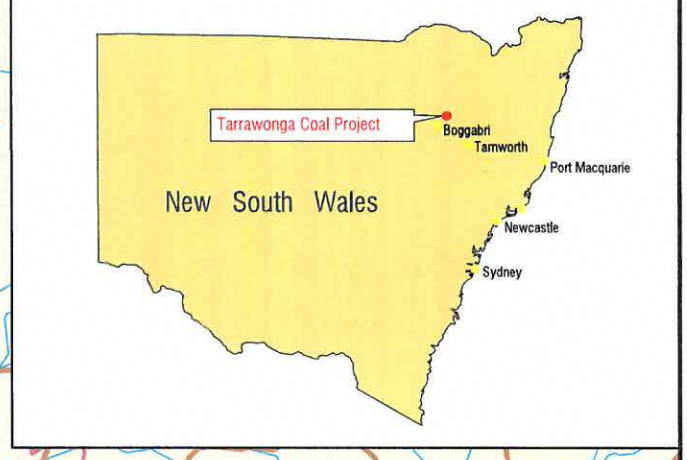
Whitehaven Coal Mining Pty Ltd (2013c) *Waste Management Plan*

Whitehaven Coal Mining Pty Ltd (2014a) *Heritage Management Plan*

Whitehaven Coal Mining Pty Ltd (2014b) *Noise Management Plan*

Whitehaven Coal Mining Pty Ltd (2015a) *Air Quality and Greenhouse Gas Management Plan*

Whitehaven Coal Mining Pty Ltd (2015b) *Stage 1 Biodiversity Management Plan*



CL 375

Maules Creek Coal Mine

LEARD STATE FOREST

Boggabri Coal Mine

CL 368

Merriown Mountain

ML 1685

Goonbri Mountain

ML 1579

ML 1693

ML 1693

Tarrawonga Coal Mine

Goonbri Road

ML 1693

Boggabri – Manilla Road

Boggabri – Manilla Road

BluevaleRoad

BOGGABRI

NARRABRI SHIRE COUNCIL

Bluevale Road

Mount Surprise

NAMOI

Kamilaroi

ML 1471

Canyon Coal Mine (under closure)

VICKERY STATE FOREST

ML 1620

RIVER

Vickery Coal Project

Bluevale Road

Rocglen Coal Mine

KELVIN STATE FOREST

Highway

CL 316

Shannon Harbour Road

Kelvin Road

Mount Bindlong

Bald Hill

Werris Creek

Mungindi Railway

GUNNEDAH SHIRE COUNCIL

Whitehaven Coal Handling and Preparation Plant

Sunnyside Coal Mine (under Care and Mainentance)

ML 1624

Highway

Oxley

GUNNEDAH

LEGEND:

- Road
- Railway
- Watercourse
- Land Subject to Inundation
- Local Government Area boundary
- Mining Lease boundary (ML / CL)
- Exploration Licence boundary (EL)
- Project Disturbance Boundary
- Project Approval Boundary

I, A. Meredith, the Mine Manager, certify that the information on this plan is a true indication of the proposed development.

Mine Manager

17/11/16

Date

Date:	18/06/2015
Drawn:	LH
Scale:	1:50000
Coordinate System:	MGA_ZONE56
Sheet Size:	A3

0.0 1.25 2.5km

WHITEHAVEN COAL

Prepared by: SLR Consulting Australia

Whitehaven Coal Limited

TARRAWONGA COAL MINE - MINING OPERATIONS PLAN

Project Locality

PLAN 1A

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BOGGABRI COAL MINE

CL0368
ML1595

LEARD STATE FOREST

ML1679

BOGGABRI COAL MINE
SURFACE DEVELOPMENT

CL0368
EL5967

CL0368
ML1693

ML1679

ML1679
EL5967

AUTH0339 CL0368
EL7435

Goonbri Tunnel

Transport Route to Gunnedah

Goonbri Road

Dripping Rock Road

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Legend

- Project Disturbance Boundary (Offset for Clarity)
- Project Approval Boundary
- Mining Lease Boundary
- NSW State Forest
- Watercourse
- Contour (2m)
- 1 in 100 Year Flood Limit
- Indicative 100 Year ARI Flood Limit
- Fenceline

Pre-mining Land Use

- Cropping/ Grazing

Vegetation Communities

1. White Cypress Pine - Narrow-leaved Ironbark Shrubby Open Forest
2. White Box - White Cypress Pine Scrubby Woodland
3. White Box - White Cypress Pine Grassy Woodland
4. Narrow-leaved Grey Box - Poplar Box - White Cypress Pine Grassy Open Woodland
5. Bracteate Honeymyrtle Low Riparian Forest
6. Cleared Farmland

Note: Each community may be mapped as:

- a White Box
- b Semicleared and regenerating
- c Derived Native Grassland

I, A. Mangelsdorf, the Mine Manager, certify that the information on this plan is a true indication of the proposed development.

Mine Manager: A. Mangelsdorf

Date: 17/11/16

Tarrawonga Coal Mine
Mining Operations Plan

Pre Mining Environment - Natural Environment
Plan 1B

WHITEHAVEN COAL

N

Date: 25/08/2015 Sheet size: A0

Drawn by: LH Approved: AH

Scale: 1:6,000

0 0.1 0.2 0.4 0.6
Kilometers

Prepared by SLR Consulting Australia Pty Ltd

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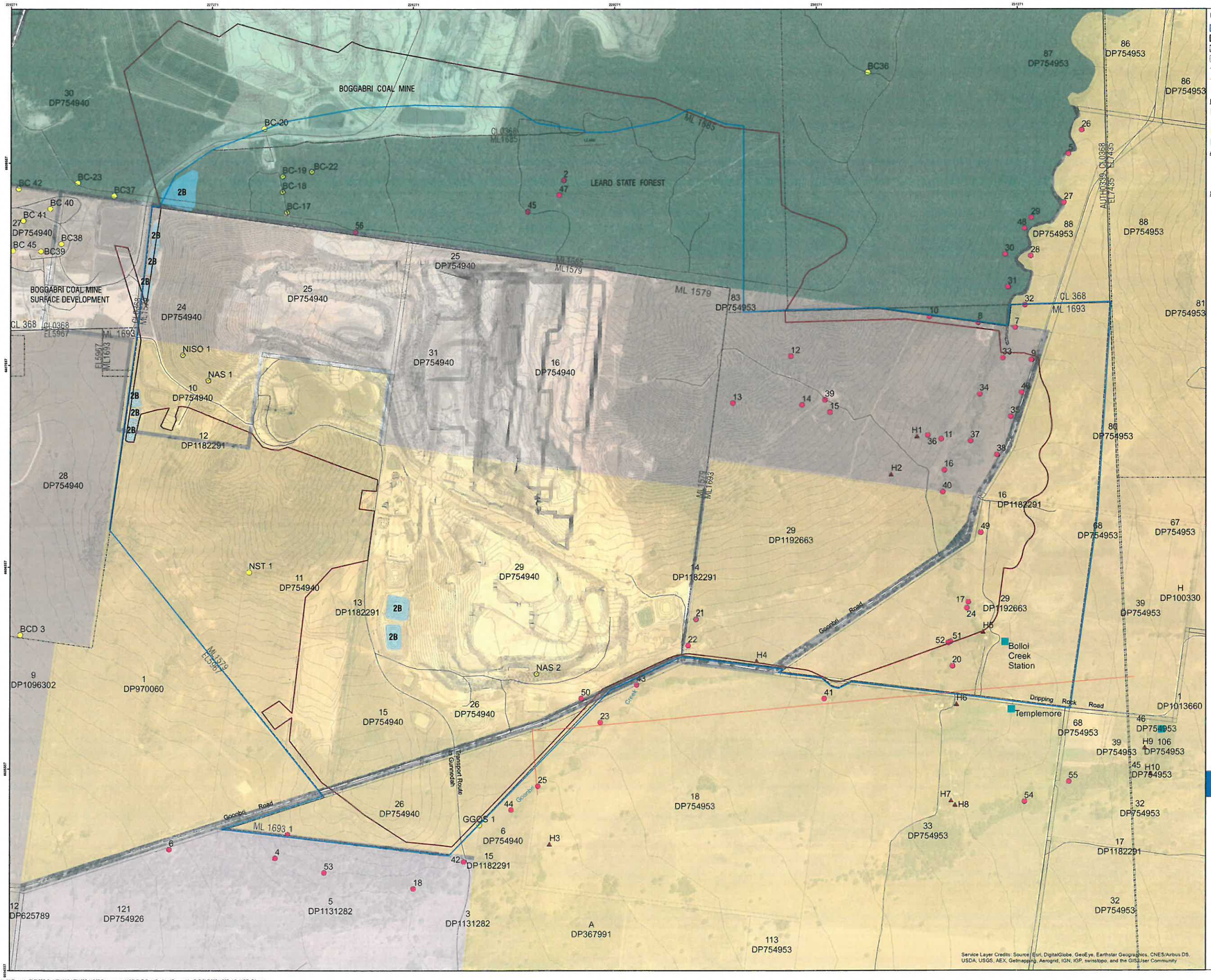

I, ... the Mine Manager, certify that the information on this plan is a true indication of the proposed development.

Mine Manager ..... Date 17/11/16

Tarrawonga Coal Mine
Mining Operations Plan
Pre-mining Environment - Built Environment
Plan 1C

WHITEHAVEN COAL

N

Date: 21/08/2015 Sheet size: A0
Drawn by: LH Approved: AH
Scale: 1:6,000

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Kilometers

Prepared by SLR Consulting Australia Pty Ltd

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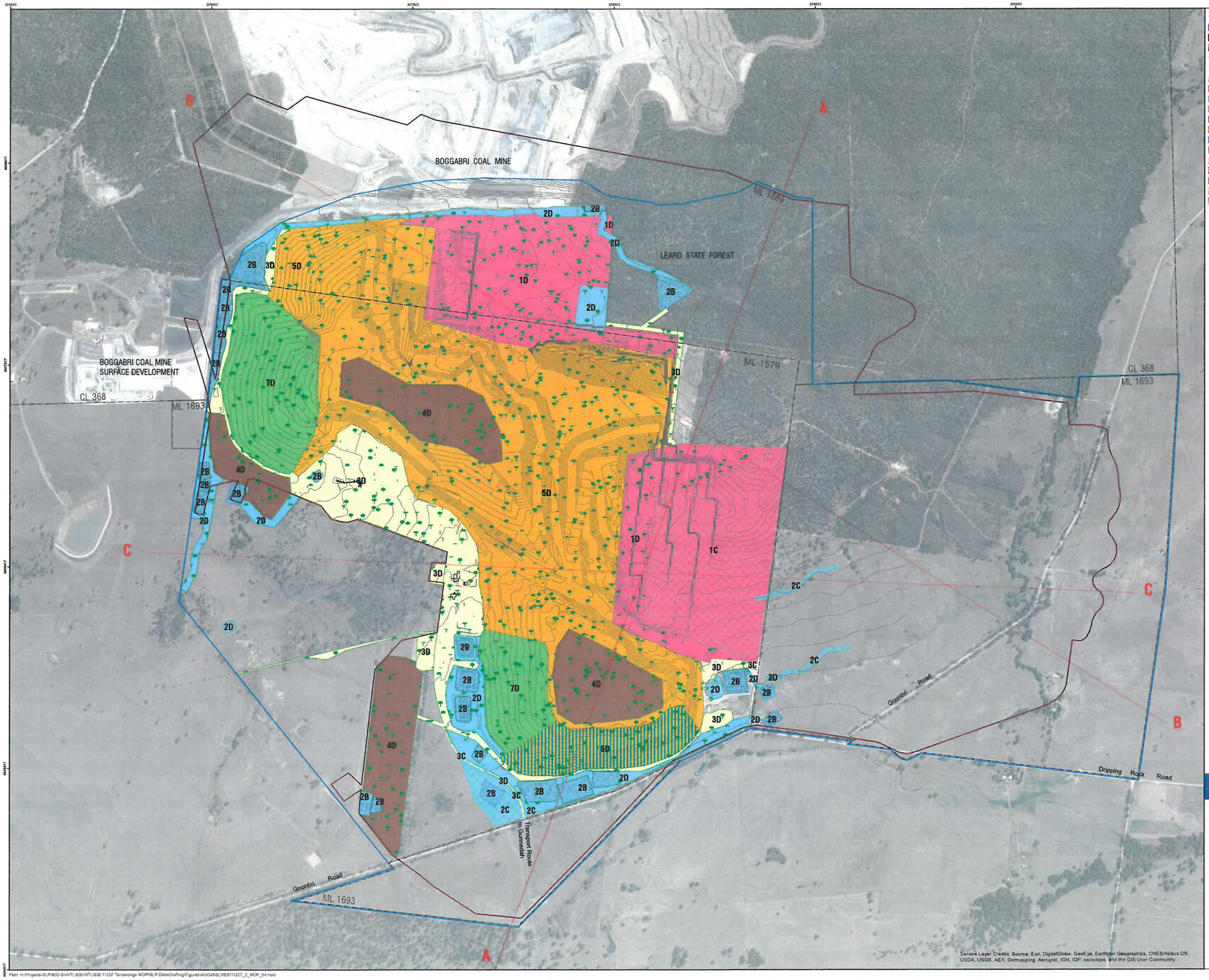

Legend

- Project Disturbance Boundary (Offset for Clarity)
- Project Approval Boundary
- Mining Lease Boundary
- Contour 2015 (5m)
- Cross Sections

Primary Domains

- 1 - Final Void / Active Mining
- 2 - Water Management Area
- 3 - Infrastructure Area
- 4 - Topsoil Stockpile Area
- 5 - Overburden Emplacement
- 6 - Temporary Rehabilitation
- 7 - Rehabilitation

Secondary Domains

- A - Final Void
- B - Water Management Area
- C - Agricultural Rehabilitation Area
- D - Woodland Rehabilitation Area

I, A. Knights, the Mine Manager, certify that the information on this plan is a true indication of the proposed development.

Mine Manager ..... Date 17/11/16

Tarrawonga Coal Mine
Mining Operations Plan

Mine Domains at Commencement of MOP Plan 2

WHITEHAVEN COAL

N

Date: 24/09/2015 Sheet size: A0

Drawn by: LH Approved: AH

Scale: 1:6,000

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Kilometers

Prepared by SLR Consulting Australia Pty Ltd

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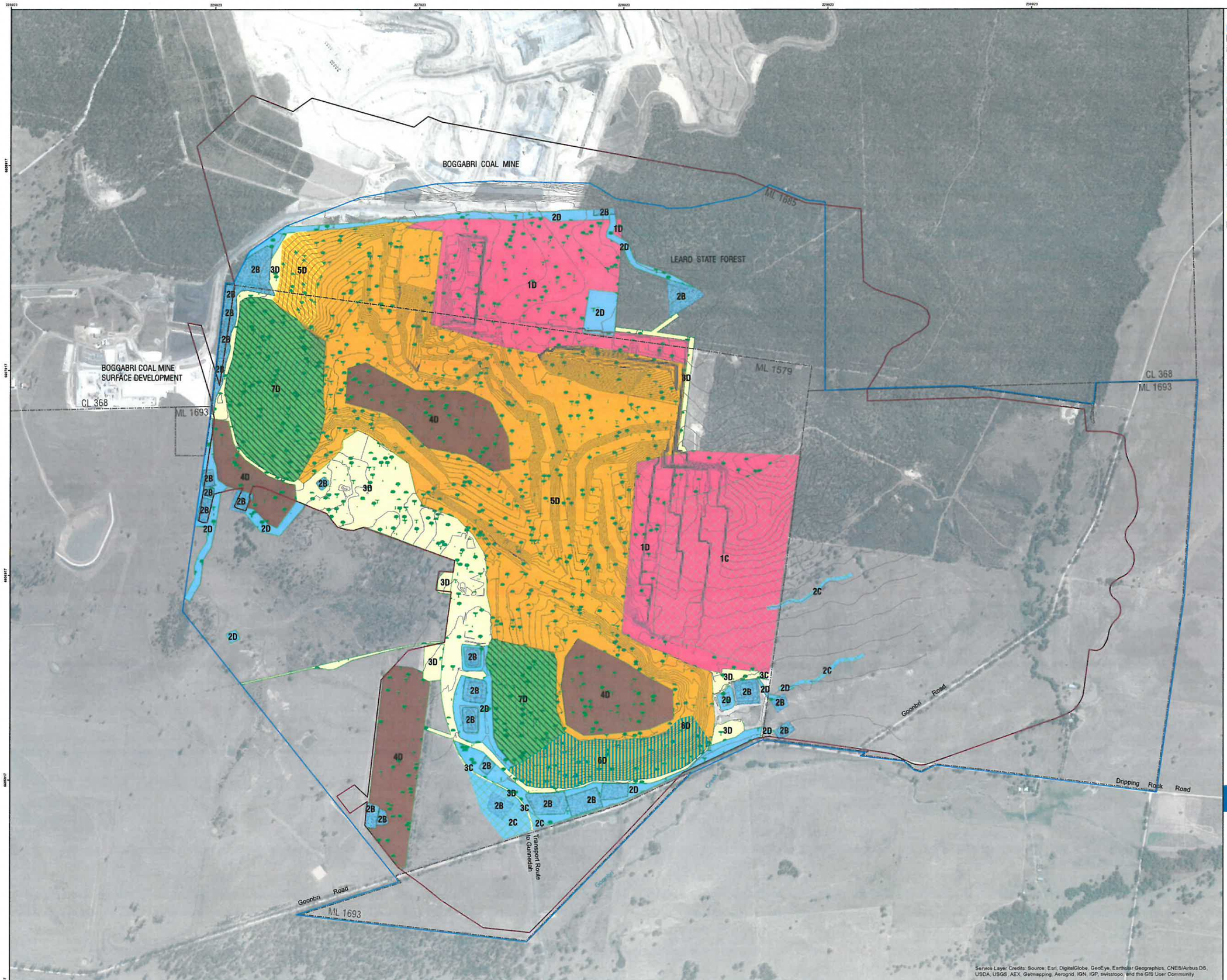

Legend

- Project Disturbance Boundary (Offset for Clarity)
- Project Approval Boundary
- Mining Lease Boundary
- Contour 2015 (5m)

Primary Domains

- 1 - Final Void / Active Mining
- 2 - Water Management Area
- 3 - Infrastructure Area
- 4 - Topsoil Stockpile Area
- 5 - Overburden Emplacement
- 6 - Temporary Rehabilitation
- 7 - Rehabilitation

Secondary Domains

- A - Final Void
- B - Water Management Area
- C - Agricultural Rehabilitation Area
- D - Woodland Rehabilitation Area

Rehabilitation Phases

- Landform Establishment
- Ecosystem Establishment

I, A. Magelli, the Mine Manager, certify that the information on this plan is a true indication of the proposed development.

Mine Manager ..... Date 19/11/16

Tarrawonga Coal Mine
Mining Operations Plan

Mining and Rehabilitation Plan 3A (Nov 2015 - Dec 2015)

WHITEHAVEN COAL

N

Date: 24/09/2015 Sheet size: A0

Drawn by: LH Approved: AH

Scale: 1:6,000

0 0.1 0.2 0.4 0.6
Kilometers

Prepared by SLR Consulting Australia Pty Ltd

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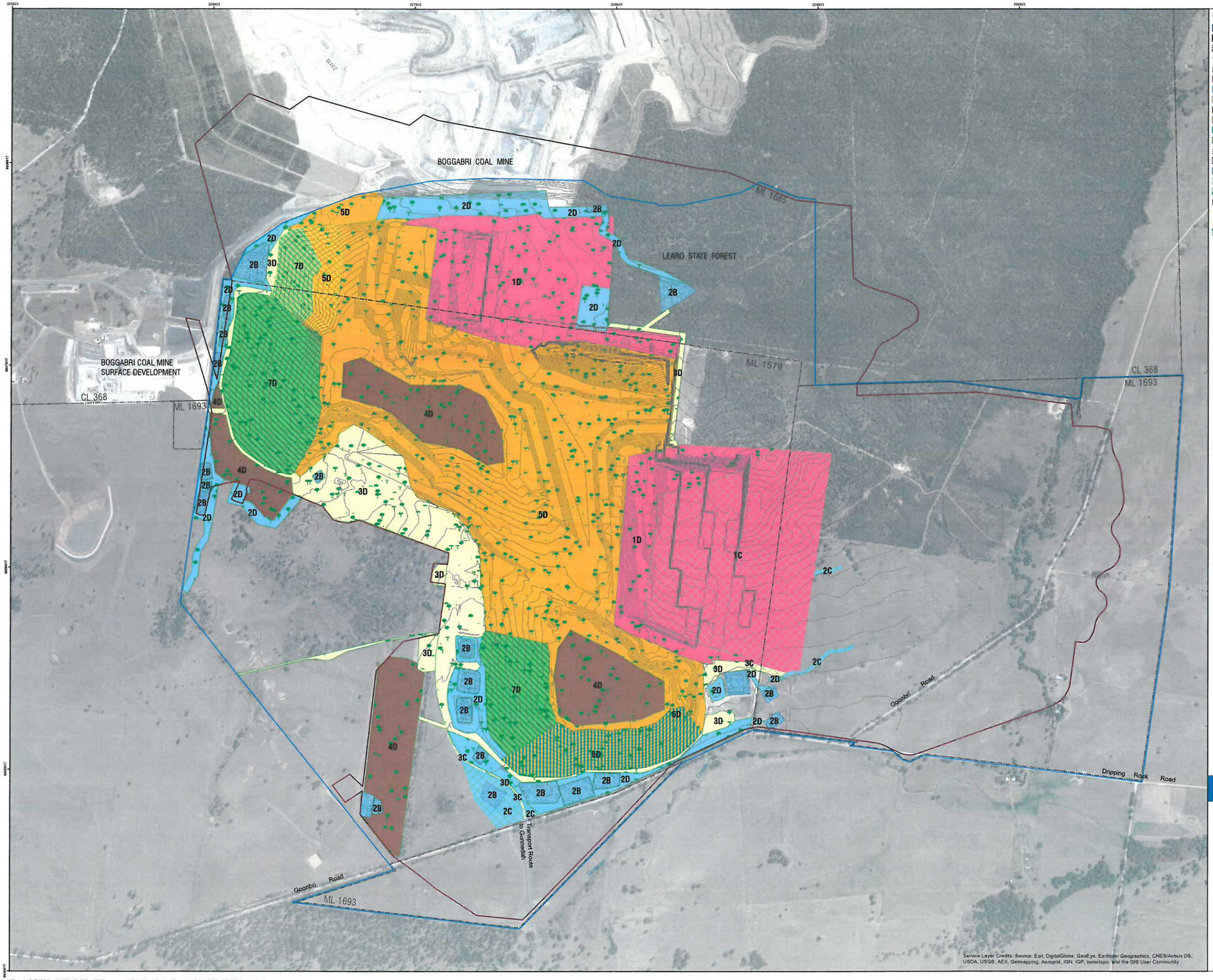

Legend

- Project Disturbance Boundary
- Project Approval Boundary
- Mining Lease Boundary
- Contour 2016 (5m)

Primary Domains

- 1 - Final Void / Active Mining
- 2 - Water Management Area
- 3 - Infrastructure Area
- 4 - Topsoil Stockpile Area
- 5 - Overburden Emplacement
- 6 - Temporary Rehabilitation
- 7 - Rehabilitation

Secondary Domains

- A - Final Void
- B - Water Management Area
- C - Agricultural Rehabilitation Area
- D - Woodland Rehabilitation Area

Rehabilitation Phases

- Landform Establishment
- Growth Medium Development
- Ecosystem Establishment

I, L. Meyrick, the Mine Manager, certify that the information on this plan is a true indication of the proposed development.

Mine Manager ..... Date 17/11/16

Tarrawonga Coal Mine
Mining Operations Plan

Mining and Rehabilitation
Plan 3B (Jan 2016 - Dec 2016)

WHITEHAVEN COAL

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Date: 24/09/2015 Sheet size: A0
Drawn by: LH Approved: AH
Scale: 1:6,000

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Kilometers

Prepared by SLR Consulting Australia Pty Ltd

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225924 226924 227924 228924 229924 230924

6629917 6628917 6627917 6626917

BOGGABRI COAL MINE

BOGGABRI COAL MINE SURFACE DEVELOPMENT

LEARD STATE FOREST

ML 1685

ML 1579

CL 368

ML 1693

Goonbri Road

Dripping Rocks Road

Transport Route to Gamsdah

Gwyder

1D 1C 2B 2C 2D 3B 3C 3D 4D 5C 5D 6D 7D

Legend

- Project Disturbance Boundary (Offset for Clarity)
- Project Approval Boundary
- Mining Lease Boundary
- Contour 2017 (5m)

Primary Domains

- 1 - Final Void / Active Mining
- 2 - Water Management Area
- 3 - Infrastructure Area
- 4 - Topsoil Stockpile Area
- 5 - Overburden Emplacement
- 6 - Temporary Rehabilitation
- 7 - Rehabilitation

Secondary Domains

- A - Final Void
- B - Water Management Area
- C - Agricultural Rehabilitation Area
- D - Woodland Rehabilitation Area

Rehabilitation Phases

- Landform Establishment
- Growth Medium Development
- Ecosystem Establishment

I, Blair Meyers, the Mine Manager, certify that the information on this plan is a true indication of the proposed development.

Mine Manager ..... Date 27/6/17

Tarrawonga Coal Mine
Mining Operations Plan
Mining and Rehabilitation Plan 3C (Jan 2017 - Dec 2017)

WHITEHAVEN COAL

N

Date: 26/06/2017 Sheet size: A0

Drawn by: LH Approved: AH

Scale: 1:6,000

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Prepared by SLR Consulting Australia Pty Ltd

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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LEARD STATE FOREST

Native Forest And Woodland

Native Forest And Woodland

Native Forest And Woodland

Native Forest And Woodland

White Box - Yellow Box - Blakey's Redgum Grassy Woodland and Derived Native Grassland (13ha)

ML 1749
ML 1685
ML 1579
ML 1693

Proposed Goonbri Creek Permanent Realignment

Goonbri Road

Dripping Rock Road

Tarrawonga Road

Gunnidon

Legend

- Project Disturbance Boundary (Offset for Clarity)
- Project Approval Boundary
- Contour 2018 (5m)

Primary Domains

- 1 - Infrastructure Area
- 3 - Water Management Area
- 4 - Overburden Emplacement Area
- 5 - Stockpiled Material
- 6 - Final Void / Active Mining
- 7 - Rehabilitation Area

Secondary Domains

- B - Water Management Area
- D - Rehabilitation Area - Pasture
- E - Rehabilitation Area - Woodland
- I - Final Void

Phase

- Landform Establishment
- Growth Medium Development
- Ecosystem Establishment

Temporary Rehabilitation

- Temporary Rehabilitation

I, Blair Meyers, the Mine Manager, certify that the information on this plan is a true indication of the proposed development.

Mine Manager

Date 9 March 2018

Tarrawonga Coal Mine
Mining Operations Plan

Mining and Rehabilitation Plan 3D (Jan 2018 - Dec 2018)

WHITEHAVEN COAL

N

Date: 8/03/2018 Sheet size: A0

Drawn by: DC Approved: BM

Scale: 1:6,000

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Kilometers

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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LEARD STATE FOREST

Native Forest And Woodland

Native Forest And Woodland

Native Forest And Woodland

Native Forest And Woodland

White Box - Yellow Box - Blakey's Redgum Grassy Woodland and Derived Native Grassland (13ha)

ML 1749
ML 1685
ML 1686
ML 1579
ML 1693

Proposed Goonbri Creek Permanent Realignment

Goonbri Road

Dripping Rock Road

Legend

- Project Disturbance Boundary (Offset for Clarity)
- Project Approval Boundary
- Contour 2019 (5m)

Primary Domains

- 1 - Infrastructure Area
- 3 - Water Management Area
- 4 - Overburden Emplacement Area
- 5 - Stockpiled Material
- 6 - Void (Open Cut Void)
- 7 - Rehabilitation Area

Secondary Domains

- B - Waler Management Area
- D - Rehabilitation Area - Pasture
- E - Rehabilitation Area - Woodland
- I - Final Void

Phase

- Landform Establishment
- Growth Medium Development
- Ecosystem Establishment

Temporary Rehabilitation

- Temporary Rehabilitation

I, Blair Meyer, the Mine Manager, certify that the information on this plan is a true indication of the proposed development.

Mine Manager

Date 8 March 2018

Tarrawonga Coal Mine
Mining Operations Plan

Mining and Rehabilitation
Plan 3E (Jan 2019 - Dec 2019)

WHITEHAVEN COAL

N

Date: 8/03/2018 Sheet size: A0

Drawn by: DC Approved: BM

Scale: 1:6,000

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Kilometers

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LEARD STATE FOREST

Native Forest And Woodland

Native Forest And Woodland

Native Forest And Woodland

Native Forest And Woodland

White Box - Yellow Box - Blakey's Redgum Grassy Woodland and Derived Native Grassland (13ha)

ML 1749
ML 1685
ML 1579
ML 1693

Goonbri Road
Dripping Rock Road
Transport Route to Gunnedah

Legend

- Project Disturbance Boundary (Offset for Clarity)
- Project Approval Boundary
- Contour 2020 (5m)

Primary Domains

- 1 - Infrastructure Area
- 3 - Water Management Area
- 4 - Overburden Emplacement Area
- 5 - Stockpiled Material
- 6 - Final Void / Active Mining
- 7 - Rehabilitation Area

Secondary Domains

- B - Water Management Area
- D - Rehabilitation Area - Pasture
- E - Rehabilitation Area - Woodland
- I - Final Void

Phase

- Landform Establishment
- Growth Medium Development
- Ecosystem Establishment

Temporary Rehabilitation

- Temporary Rehabiliatation

I, Blair Meyers, the Mine Manager, certify that the information on this plan is a true indication of the proposed development.

Mine Manager ..... Date 9 March 2018

Tarrawonga Coal Mine
Mining Operations Plan

Mining and Rehabilitation
Plan 3F (Jan 2020 - Dec 2020)

WHITEHAVEN COAL

Date: 8/03/2018 Sheet size: A0
Drawn by: DC Approved: BM
Scale: 1:5,000

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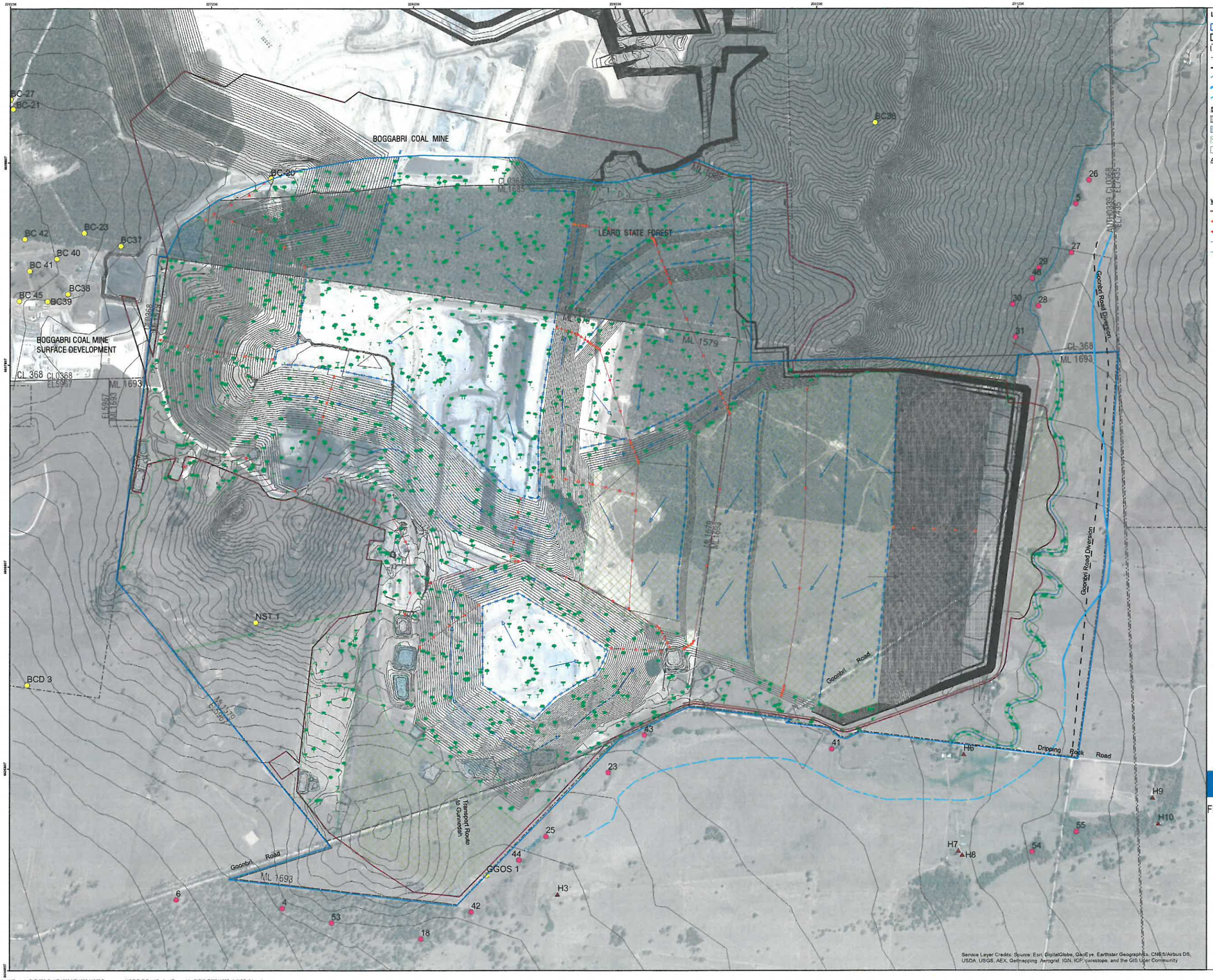

Legend

- Project Disturbance Boundary (Offset for Clarity)
- Project Approval Boundary
- Mining Lease Boundary
- Contour (2m)
- Goonbri Road Diversion
- Goonbri Creek Realignment
- 100 Year ARI Flood Limit
- Indicative 100 Year ARI Flood Limit

Secondary Domains

- A - Final Void
- B - Water Management Area
- C - Agricultural Rehabilitation Area (Class III)
- D - Woodland Rehabilitation Area

Archaeological Sites

- Aboriginal Heritage Site (March 2011 Survey)
- Aboriginal Heritage Site (AHIMS Database)
- Non-Aboriginal Heritage Item

Water Management

- Earth Bund
- Drop Structure
- Drainage Line
- Flow Direction
- Drainage Berm

I ..... the Mine Manager, certify that the information on this plan is a true indication of the proposed development.

Mine Manager ..... Date 7/11/16

Tarrawonga Coal Mine
Mining Operations Plan

Final Rehabilitation and Post Mining Land Use Plan 4

WHITEHAVEN COAL

N

Date: 25/08/2015 Sheet size: A0

Drawn by: LH Approved: AH

Scale: 1:6,000

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Kilometers

Prepared by SLR Consulting Australia Pty Ltd

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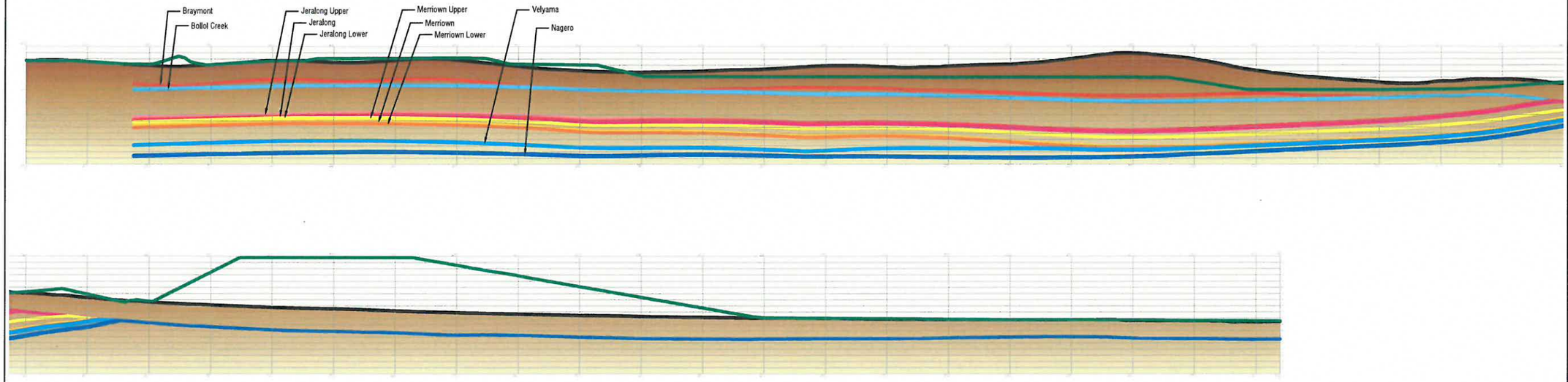

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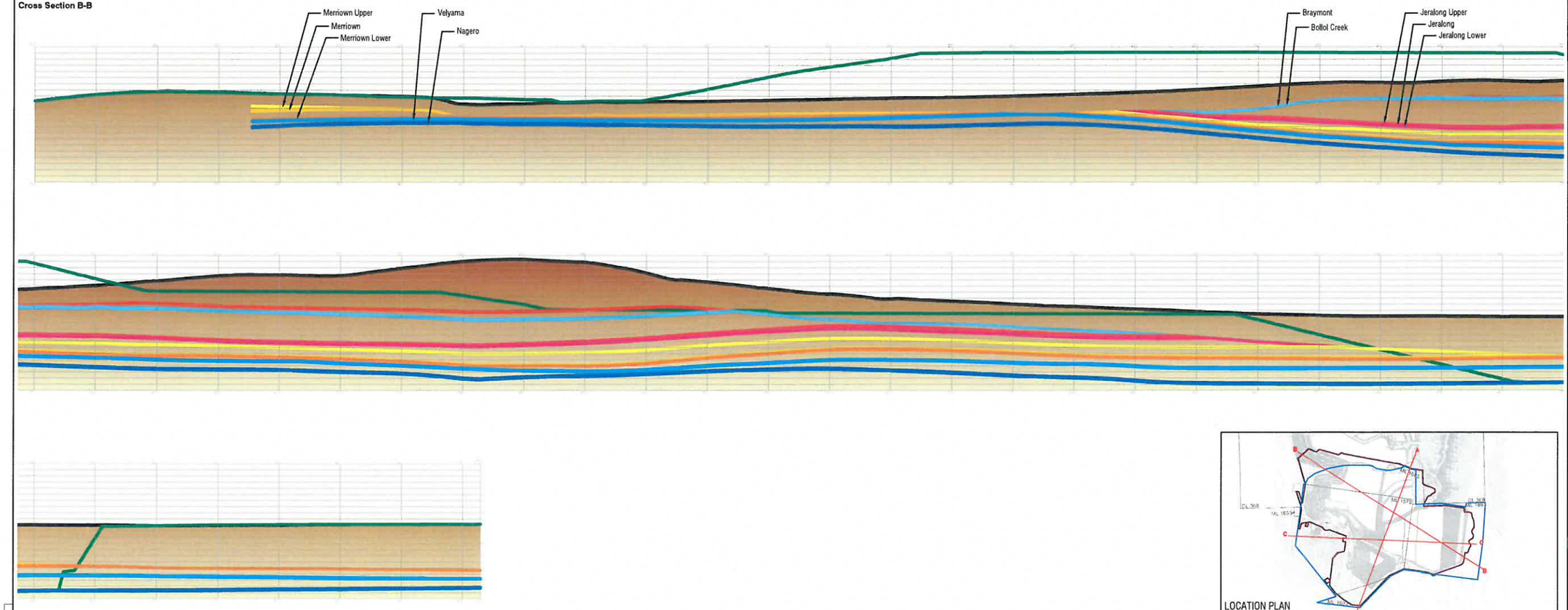
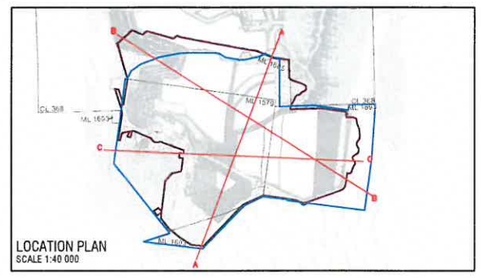




LEGEND:

- Project Disturbance Boundary *(Offset for Clarity)*
- Project Approval Boundary
- Mining Lease Boundary
- Final Landform Contours
- Geological Cross Section
- Existing Mine Pit Surface
- Final Landform

Geological Seams

- Braymont
- Bollol Creek
- Jeralong Upper
- Jeralong
- Jeralong Lower
- Merriown Upper
- Merriown
- Merriown Lower
- Velyama
- Nagero

I, [signature], the Mine Manager, certify that the information on this plan is a true indication of the proposed development.

Mine Manager [signature] Date 17/11/16

Whitehaven Coal Limited

TARRAWONGA COAL MINE - MINING OPERATIONS PLAN

Cross Sections

PLAN 5A

WHITEHAVEN COAL

Date:	13/08/2015	Sheet Size:	A0
Drawn by:	LH	Approved:	AH
Scale:	1:2500		

0 63 123m

Prepared by: GSSE (a Division of SLR Consulting Australia)

SLR20111207_5_MOP_03.dwg

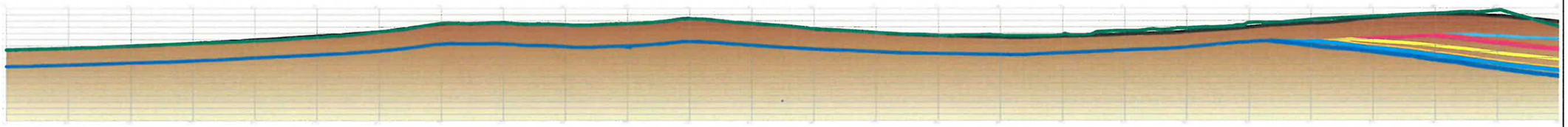
LEGEND:

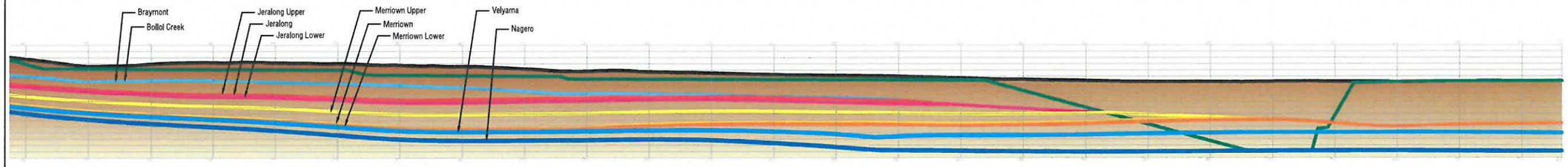
- Project Disturbance Boundary *(Offset for Clarity)*
- Project Approval Boundary
- Mining Lease Boundary
- Final Landform Contours
- Geological Cross Section
- Existing Mine Pit Surface
- Final Landform

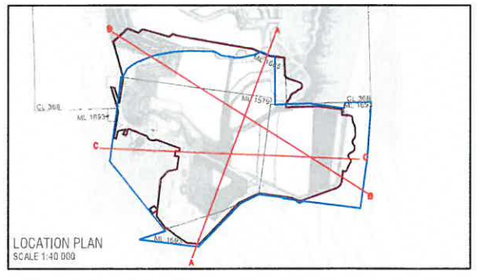
Geological Seams

- Braymont
- Bollol Creek
- Jeralong Upper
- Jeralong
- Jeralong Lower
- Merriown Upper
- Merriown
- Merriown Lower
- Velyama
- Nagero

Cross Section C-C







LOCATION PLAN
SCALE 1:40 000

I, [signature], Site Mine Manager, certify that the information on this plan is a true indication of the proposed development.

Mine Manager — Date 12/11/16

Whitehaven Coal Limited

TARRAWONGA COAL MINE - MINING OPERATIONS PLAN

Cross Sections

PLAN 5B

WHITEHAVEN COAL

N

Date:	13/08/2015	Sheet Size:	A0
Drawn by:	LH	Approved:	AH
Scale:	1:2500		

0 60 120m

Prepared by: GSSE (a Division of SLR Consulting Australia)

SLR\501\307.5_MOP_03.dwg

REFERENCE No.	LANDHOLDER	REFERENCE No.	LANDHOLDER
1	Whitehaven Coal Mining Pty Limited	62	I. and B. Doshen
2	Boggabri Coal Pty Limited	65	T.R. Hall and A.I. Myers Johnson
4	The State of New South Wales	66	M.G. and F.J. Farquhar
6	Narrabri Shire Council	67	R.L. and K.A. Penrose
7	The Council of the Shire of Namoi	68	P.G. and I.L. Capel
13	Aston Coal 2 Pty Ltd	69	B.G. and K.M. Bomford
22	C.D. and C.A. Baldwin	70	D.W. and A.M. Keys
25	Riverway Boggabri Pty Ltd	71	R.A. and C.M. Collyer
26	Bresrow Pty Ltd	72	R.W. and E.J. Kemp
27	J.A. Bastardo	73	L.W. and M.D. Hunt
28	D.B. Hudson	78	J.M. and N.M. McKechnie
29	P.J. Watson and G. Parkin	79	K.D. Gillham
30	M.F., S.T. and S.L. Hart and P.F. Rice	80	A.D. Watson Holdings Pty Ltd
31	Estate: Perpetual Lease M.J. and M.L. Nott	81	K.L. Grover
32	State Forests of NSW	82	E.C. and J.E. Clarke
34	R.W., A. and R.W. Grover	83	R.P. McGregor
35	Aston Coal 2 Pty Ltd and Boggabri Coal Pty Ltd	85	Kilmarnock (Boggabri) Pty Ltd
36	G.P., L.F. and W.P. Clarke	86	Peter J Watson Holdings Pty Ltd
37	R.J. and E.J. Browning	87	D.S. Riley
38	R.J. Heiler	88	M.J. and J.H. Maunder
39	D.V. Gillham	89	K.A. and C. Blanch
40	D.V. and R.J. Gillham	92	I. Macleod Hall
41	L.E. James and K.E. Woodward	93	G.A. and M.E. Geddes
42	K.R. and K.A. Pryor	112	N.P. and S.A. Jackson
43	G., L.S. and J.A. Suey	113	J.R. and K.L. Fletcher
44	R.R. and P.L. Crosby	114	L.P. and T.G. Mainey
45	R.P. and R.D. McGregor	115	R.D. Mitchell and C.T. Palmer
46	H.J. Lynch	116	C.R. and C.P. Stewart Investments Pty Limited
47	B.J. Crosby	117	J.L. and K. Davis
49	P. and A.C. Laird	118	A.D. Watson
53	V.P. and S.M. McAuliffe	120	Nambarloo Pty Limited
54	P.A. Devine	121	D.M. and C.A. Kirkbride
55	P.J. Brien and D.M. Austin	122	Nandewar Pty Limited
56	F. Agsten	123	Primeag Australia Limited
57	P.N. Bet	190	L.E. Christie-Rockliff
59	P.M. and M.I. Mainey	207	J. and T. Milosevski
60	J.E. and R.J. Picton	217	F.J. Maunder
61	P.W.J. Pritchard and M.E. McDonald Pritchard	218	P.A. Maunder

Source: LPI (2010 & 2011)

TARRAWONGA COAL PROJECT

FIGURE 1-2b

Relevant Land Ownership List

Resource Strategies

Tarrawonga Coal Pty Ltd

Tarrawonga Coal Mine, June 2015

Key Element	Issue	Caused By	Consequence	Current Controls *(are in place)*	Risk Control Effectiveness	Consequence Category	Expected Risk Consequence	Risk Likelihood	Current Risk Rating	Proposed Additional Controls/Actions	Task Owner	Approval Required	Due Date	% Complete
Erosion and Sediment Control	Erosion and sediment on disturbed areas Uncontrolled discharge offsite of sediment laden water.	Failure to enhance progressive rehab Failure of existing rehab areas LTA of water management system and/or design	Impact on rehab Pollution	Erosion and Sediment Control Plan (part of Water Management Plan)	Satisfactory	Financial	4	D	L					
Acid Mine Drainage	Failure to achieve the rehabilitation outcome prescribed in the MOP	LTA knowledge of material that may result in AMD.	Inability to reach closure and relinquishment of the lease. Requirement to treat water long term. Impact on environment.	Soil Management Protocol (part of Biodiversity Management Plan) Water Management Plan Water quality monitoring	Requires Improvement	Financial	4	C	L	Conduct further material testing during soil stripping campaigns				
Spontaneous Combustion	Spon com impedes rehabilitation	Poor management of materials with propensity for spon com.	Inability to complete rehab. Impact on established rehab. Cost of managing spon com outbreak.	No history of spon comm No evidence of carb material on the site Regular inspections Training	Satisfactory	Financial	4	E	L					
Geotechnical	Failure of highwall or slumping of dumps around final void	Geotechnical failure Flooding	Inability to reach closure and relinquishment of the lease. Additional costs for rework. Safety concerns.	Original Landform design	Satisfactory	Financial	5	D	L					
Soil Type(s) and Suitability	Inadequate volume of topsoil to achieve the rehabilitation outcome prescribed in the MOP	Inadequate topsoil available No additional stripping opportunities due to full disturbance footprint	Inability to reach closure and relinquishment of the lease. Cost of sourcing ameliorants and alternates	Topsoil mass balance estimate (stockpile quantities generally known and material ahead of operations is estimated) Conservative estimate of in situ topsoil reserves	Satisfactory	Financial	4	C	L					
Flora	Failure to achieve the rehabilitation outcome prescribed in the MOP	Not considering requirements in rehab planning (correct species) Failure to manage weeds	Inability to reach closure and relinquish lease	Biodiversity Management Plan	Requires Improvement	Legal and Compliance	4	C	L	Weed Monitoring and ongoing maintenance				
Fauna	Failure to achieve the rehabilitation outcome prescribed in the MOP	Failure to manage pests	Inability to reach closure and relinquish lease	Biodiversity Management Plan	Satisfactory	Community/Reputation	5	B	L					
Bushfire	Damage to rehab	Bushfire	Loss of established rehabilitation Additional costs for rework of rehab Exposed areas (erosion, sediment, dust)	Water truck Rural Fire Service	Satisfactory	Financial	5	D	L					
Contaminated Land	Contaminated land occurring on the site at closure	Long term use of the site Spills, leaks etc.	Impact on environment Constraint for future land use	Pollution Incident Response Management Plan Waste Management Plan Emergency Management System Contractor Management Standard	Satisfactory	Environment	5	D	L					
Other Risks														
Air Quality	Increased air borne dust resulting in complaints	Dust created from intense earthworks during rehabilitation	Complaints Prosecution and fines	Land owned by Whitehaven	Satisfactory	Community/Reputation	5	E	L					
Blasting	Blast impacts	Blasting to achieve final landform	Complaints	Blast Management Plan Noise Management Plan Current operational procedures	Satisfactory	Community/Reputation	5	D	L					
Noise	Increased noise resulting in complaints	Intensive earthworks during rehabilitation	Complaints Prosecution and fines	Noise Management Plan Current operational procedures	Satisfactory	Community/Reputation	5	D	L					
Visual Amenity	Rehab and closure works visible to private landowners	Lighting plant visible during bulk earthworks. Exposed areas visible	Complaints	Current operational procedures Complaints procedure Progressive rehabilitation	Satisfactory	Community/Reputation	5	E	L					
Aboriginal Cultural Heritage	Disturbance of known Aboriginal site	Unintended interaction with Aboriginal site due to lack of awareness	Prosecution Loss of culturally significant site	Already disturbed site Heritage Management Plan	Satisfactory	Legal and Compliance	3	D	L					
European Heritage	No registered European heritage sites however site has a long mining history	Closure or rehabilitation activities	Loss of historic site/s	Already disturbed site	Satisfactory	Legal and Compliance	5	E	L					
Agricultural Resources	Loss of agricultural resources	Mining disturbance Possible soil contamination Erosion and sedimentation	Reduced amount of land available suitable for agricultural production	Minimisation of disturbance where possible Management of soil resources Inclusion of agricultural lands in the Rehabilitation Strategy	Satisfactory	Community/Reputation	5	E	L					
Groundwater	No additional issues identified (see above Geochem, ESC and AMD)													
Surface Water	No additional issues identified (see above Geochem, ESC and AMD)													