Rix's Creek Mine - Rehabilitation Strategy

19-Aug-2015
Prepared for – Rix's Creek Pty Ltd – ABN: 25 003 824 244

Rix's Creek Mine - Rehabilitation Strategy

Client: Rix's Creek Pty Ltd

ABN: 25 003 824 244

Prepared by

AECOM Australia Pty Ltd
St Patrick's Commercial Centre, Queens Street, Singleton NSW 2330, Australia
T +61 2 6575 9000 F +61 2 6575 9099 www.aecom.com
ABN 20 093 846 925

19-Aug-2015

Job No.: 60289290

AECOM in Australia and New Zealand is certified to the latest version of ISO9001, ISO14001, AS/NZS4801 and OHSAS18001.

Quality Information

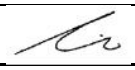
Document Rix's Creek Mine - Rehabilitation Strategy

Date 19-Aug-2015

Prepared by Dee Murdoch

Reviewed by Catherine Brady

Revision History

Revision	Revision Date	Details	Authorised	
			Name/Position	Signature
	29-Jun-2015	Specialist Report - Draft for peer review	Simon Murphy Project Manager	
	03-Aug-2015	Specialist Report - Draft - for client review	Simon Murphy Project Manager	
C	19-Aug-2015	Final - Consistency Review	Simon Murphy Project Manager	

This page has been left blank intentionally.

Table of Contents

List of Tables

List of Figures

1.0 Introduction

1.1 Project Background

1.1.1 Overview

Rix's Creek Mine (the Mine), is owned and operated by Bloomfield Collieries Pty Limited, a subsidiary of The Bloomfield Group (Bloomfield). The Mine is an open cut coal mine approximately 5km north-west of Singleton in the Hunter Valley Coalfields of NSW. The Mine currently produces approximately 1.5 million tonnes per annum (Mtpa) of product coal from its existing operations.

The Bloomfield Group is seeking approval for the Rix's Creek Continuation of Mining Project (the Project), which relates to the continued operation of the existing open cut coal mine. The Project would allow the Mine to continue to operate as an open cut mine, accessed via its existing infrastructure facilities.

The Project seeks to extend the life of the existing open cut mining operation until approximately 2037. The continuation of mining operations will extend in a north-westerly direction and require a modification to Mine Lease 1432 for an out of pit dump. The continuation of operations will utilise the existing mine access, Coal Handling and Preparation Plant (CHPP), coal stockpiling and rail facilities.

1.1.2 Proposed Development

The Project seeks to continue the existing mining operation at the Mine and to mine up to 4.5Mtpa ROM coal per year. Mining methods will be the same as those currently employed at the Mine, being multi-seam bench open cut techniques. Run of mine (ROM) coal will continue to be processed onsite at the existing CHPP which has capacity to accept the proposed increase in throughput. Product coal will then be transported by rail to the port of Newcastle. It is estimated that the Mine could yield a total of 32 million saleable tonnes of coal at an overburden ratio of approximately 10.5:1, before coal seams are exhausted.

The components of the proposed development comprise:

- The ongoing use of, and future additions to, the existing mine fleet;
- Use of the existing mine infrastructure facilities including the CHPP;
- Continuation of operating hours - 24 hours a day 7 days a week;
- Use of existing and new rejects and tailings emplacements;
- Rail transport of product coal to the port of Newcastle;
- Mine closure and rehabilitation; and
- Environmental management.

1.2 Project Area

The mine is located in the Upper Hunter Valley, within the Singleton local government area, approximately 1.5km northwest of Singleton. The site occupies an area of approximately 1,823 hectares (ha), and is dissected in half by the New England Highway. Refer **Figure 1** for the Project location and **Figure 2** for the layout of the existing Project area.

1.3 Purpose of the Report

1.3.1 Director-General's Requirements

The Rix's Creek Continuation of Mining Project Environmental Impact Statement has been prepared in accordance with Division 4.1, Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) which ensures that the potential environmental effects of a proposal are properly assessed and considered in the decision-making process.

In preparing this Rehabilitation Strategy, the Director–General's Requirements (DGRs) issued for the Rix's Creek Continuation of Mining Project (SSD 13_6300) on 3 March 2014 have been addressed as required by Clause 75F of the EP&A Act, whilst the Strategy also provides a platform for the rehabilitation program across the entire Mine.

The key matters raised by the Director-General for consideration in the Rehabilitation Strategy are outlined in **Table 1** along with a reference to where the requirements are addressed in the report.

Table 1 Director General Requirements Applicable to Rehabilitation Impact Assessment

Director Generals Requirement		Section Addressed
Rehabilitation	Rehabilitation – including the proposed rehabilitation strategy for the site (assuming closure of the mine upon completion of the proposed development), having regard to the key principles in the Strategic Framework for Mine Closure, including: - rehabilitation objectives, methodology, monitoring programs,	This document
	- performance standards and proposed completion criteria;	**Section 6.0**
	- nominated final land uses and land forms (including cross sections), having regard to any relevant strategic land use planning or resource management plans or policies;	**Sections 4.0** and **5.0**
	- justification for inclusion and proposed location of a final void, and consideration of alternatives; and	**Section 4.8**
	- the potential for integrating this strategy with adjacent mines.	**Section 5.7**

1.3.2 Rehabilitation Strategy Objectives

The aim of the rehabilitation program at the Mine is to reinstate the pre-mining land capability of grazing land, with the post mined lands being revegetated with pasture species and areas of trees over grass to provide enhanced habitat for both native animals and domesticated stock. The focus on the earthworks and rehabilitation program is to provide stable landforms, compatible with the surrounding landscape that will allow optimal post mining landuse in terms of current social and economic constraints.

The proposed final landform at the Mine will:

- Provide a post mining landscape which will be safe and non-polluting, with a stable drainage network;
- Not impact the area of Land and Soil Capability Class 2 lands (SLR Consulting Australia Pty Ltd, 10 June 2015) and **Table 4**;
- Provide slopes of less than or equal to 10º (18%) (Land and Soil Capability Class 4) over the majority (53.8%) of the site;
- Provide slopes between 10-18^{o} (Land and Soil Capability Class 5) over 34% of the site;
- Have 80.7ha of land below water in the final void; and
- Limit areas of greater than 18° (33%) slopes to 7.7% of the Project area i.e. the batters of the tunnels under the highway and sections of the batters of the final void (Land and Soil Capability Class 6), prior to the void filling with water.

The area of the open body of water (80.7ha or 4% of the Project area) that will comprise the final void, with the level as predicted as at 2042, has not been included in the assessment of percentages of slope across the site, as the open body of land has been deemed as not being relevant in terms of quantifying land and soil capability.

1.4 Report Structure

This report is structured as follows:

Section 1.0 Introduction – outlines the Project and presents the purpose of the report.

Section 2.0 History of land management at Rix's Creek Mine – includes rehabilitation goals and objectives.

Section 3.0 Stakeholder consultation.

Section 4.0 Proposed future use of disturbed areas.

Section 5.0 Phases in the Rehabilitation Strategy - Safeguards and management - provides a summary of environmental mitigation and management responsibilities in relation to rehabilitation and land management for the Project.

Section 6.0 Performance Criteria, Measures and Indicators.

Section 7.0 Rehabilitation monitoring and reporting.

Section 8.0 Bibliography.

Section 9.0 Acronyms.

This page has been left blank intentionally.

2.0 History of Land Management at Rix's Creek Mine

The Mine commenced operations in July 1990 following the granting of development consent on 19 October 1989. Since that time, the site has operated with a fleet of bulldozers, scrapers and more recently front end loaders and trucks to remove and manage overburden, topsoil and subsoil material with site currently occupying an area of approximately 1,823 ha and the project expansion for the continuation of mining with a final footprint of 2004.6 ha.

Historically voids from the mining operations have been used to manage tailings. Previous tailing emplacements have been dewatered and dried and the area covered with overburden material and rehabilitated with a pasture base plant community during the life of the Project. The success of recent trials linked to the drying of tailings from the CHPP will allow co-disposal of tailings with coarse reject, thus removing the need for additional tailings emplacements.

All carbonaceous and coarse reject materials is covered by a minimum of two metres of inert overburden material before the spoil area is shaped and rehabilitated. This mitigates any potential risk of spontaneous combustion and the stability of tip faces within the spoil area.

The rehabilitation program at the Mine is supported by over 75 year's company experience in mining and over 25 years in land management. The objective of the program is to reinstate the pre-mining land capability of grazing land, with stable landforms, compatible with the surrounding landscape, and allow for a range of possible post-mining land-uses. **Figure 3** shows the post mining landform as at 2042.

The key elements of the rehabilitation program have and will continue to include:

- Setting overall rehabilitation aims and objectives;
- Developing appropriate rehabilitation performance indicators and completion criteria;
- Implementing in a timely manner the land rehabilitation program;
- Developing, reviewing and implementing a rehabilitation assessment program;
- Integration of the rehabilitation program into the Mine Environmental Management System (EMS) and Environmental Management Plans (EMP). The EMS and EMP provide a framework for environmental standards and procedures that are followed during construction, operation and decommissioning of its mining operations;
- Conducting a number of audits and inspections throughout the year, including regular internal EMS and compliance audits and other less routine audits. Site based environmental personnel also conduct regular inspections of all work areas. These assessments are reported in the site Annual Environment al Management Report which compiles monitoring results and discusses trends, system changes and responses to any potential issues identified during monitoring. Targets and future initiatives are also identified;
- Environmental monitoring and reporting via the monthly and Annual Environment Management Reports (AEMR) which are disseminated via the Rix's Coal Mine Community Consultative Committee (CCC), engagement with regulators and the company website – www.bloomcoll.com.au; and
- A request for rehabilitation sign-off to regulators, supported by results of the monitoring and reporting initiative above.

2.1 Rehabilitation Goals

The following rehabilitation goals underpin this Rehabilitation Strategy:

- Land will be rehabilitated in accordance with relevant Division of Resources and Energy, within the Department of Trade & Investment, Regional Infrastructure and Services (DRE) standards applicable at the time of rehabilitation;
- Rehabilitated land will represent a minimal source of offsite environmental impacts, such as dust emissions, water pollution, impact on visual amenity and weed spread;
- Rehabilitated land will require ongoing management inputs no greater than similar adjacent land;

- A viable drainage network will be reinstated on the site which is hydrologically stable and incorporates erosion controls and sediment collection dams which isolate effectively the rehabilitated area from adjoining area;
- Successful design and rehabilitation of landforms will be carried out to ensure structural stability, revegetation success and containment of wastes; and
- Post-mining land use will be compatible with surrounding land uses and provide optimal environmental, economic and community benefits.

2.2 Rehabilitation Objectives

The Mine will provide rehabilitated land that meets the following objectives.

General:

- Rehabilitated land will represent a minimal source of offsite environmental impacts, such as dust emissions, water pollution, impact to visual amenity, weeds spread and odour.
- Rehabilitated land will require ongoing management inputs no greater than similar adjacent land.
- Rehabilitation will be compatible with the proposed post-mining land-use.

Landform:

- Rehabilitated land will be safe and stable.
- Land capability will be returned to a class similar to that existing prior to the commencement of mining.
- Mined land will be re-contoured to a landform compatible with the surrounding natural landscape.
- A stable drainage network will be reinstated.

Growing media:

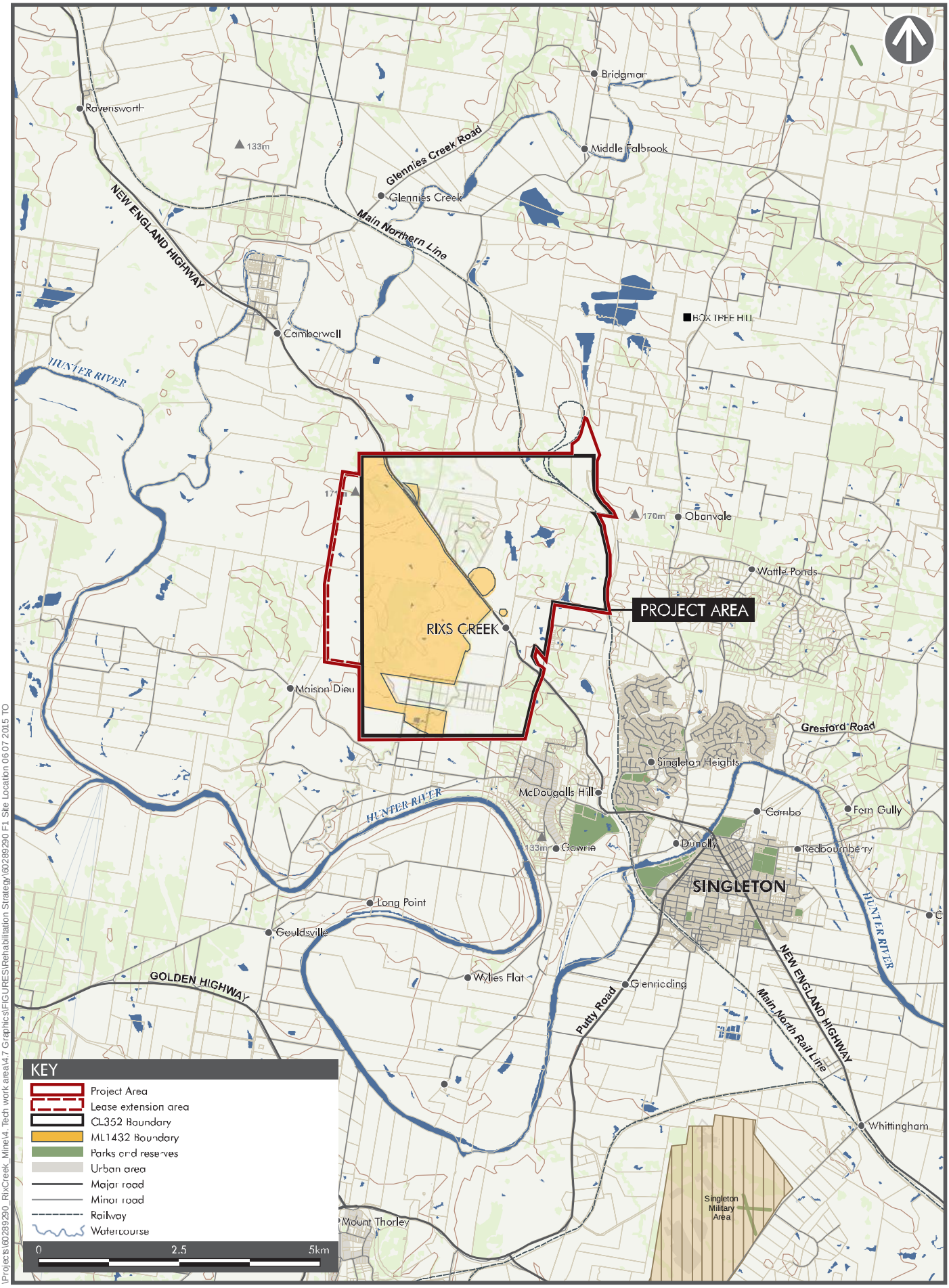
- A sustainable vegetation cover will be established on rehabilitated land (soils).

Vegetation:

- Rehabilitated land will be topsoiled, fertilised and sown with grass and/or native vegetation species.
- A sustainable vegetation cover will be established on rehabilitated land.
- Grazing areas will be established with a range of species suitable for pasture production in the area.
- Areas of trees over grass will be established with native species by either direct seeding or tubestock planting techniques.

Infrastructure which has no use post mining;

- All infrastructure, including roads, will be removed and rehabilitated.
- Footings will be removed to the existing ground level only, covered with a minimum of 0.5 metres of fill and rehabilitated.
- Electricity supply infrastructure (overhead lines, poles, substations, etc.) will be removed.
- The proposed and existing cut and cover tunnels under the New England Highway will be partially filled, allowing post mining access under the Highway for cattle.



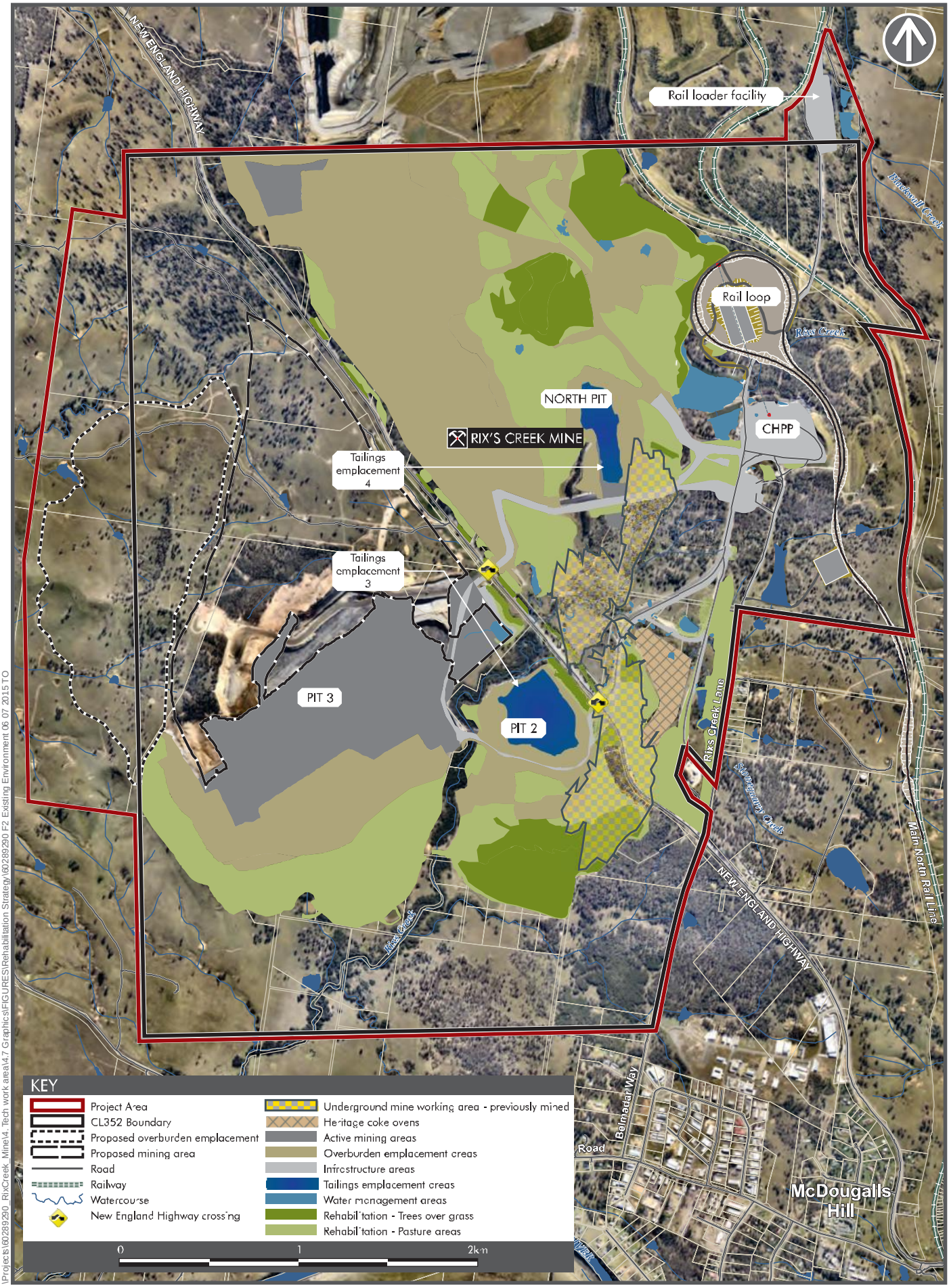
\Projects\60289290_RixCreek_Mine4_Tech work area\4.7 Graphics\FIGURES\Rehabilitation Strategy\60289290 F1 Site Location 06 07 2015 TO

AECOM

SITE LOCATION

Rix's Creek Continuation of Mining
Environmental Impact Statement

FIGURE 1



\Projects\60289290_RixCreek_Mine\4. Tech work area\4.7 Graphics\FIGURES\Rehabilitation Strategy\60289290 F2 Existing Environment 06 07 2015 TO

AECOM

EXISTING ENVIRONMENT

Rix's Creek Continuation of Mining
Environmental Impact Statement

FIGURE 2

\Projects\60289290_RixCreek_Mine\4. Tech work area\4.7 Graphics\FIGURES\Rehabilitation Strategy\60289290 F3 Post Mining Landform 18 08 2015 TO

AECOM

POST MINING LANDFORM

Rix's Creek Continuation of Mining
Environmental Impact Statement

FIGURE 3

This page has been left blank intentionally.

3.0 Stakeholder Consultation

Community engagement and consultation has been ongoing during the development of the land management and rehabilitation program at the Mine. This engagement has included:

- Provision of a community information phone line;
- Maintenance of a website providing up to date information on the operation; www.bloomcoll.com.au;
- Company Newsletters to all The Bloomfield Group employees;
- Newsletters to local businesses and residents;
- Site inspections and open days; and
- Six monthly CCC meetings with the committee consisting of three community representatives and chaired by a representative from Singleton Council. Other Government representatives are also invited to participate on the committee. NSW Department of Primary Industries (DPI) and NSW Planning and Environment (DP&E) officers have an open invitation to all meetings. The CCC provides a direct forum for the community to address environmental and operational concerns with site management and regulatory authorities.

Consultation specifically regarding the development of the Mine Operations Plan-Rix's Creek Mine, Mine Operations Plan (Rixs Creek Mine, March 2013) has been undertaken with:

- DRE;
- NSW Office of Water within the Department of Primary Industries (NOW);
- Singleton Shire Council; and
- The CCC.

To optimise the synergy between the Rehabilitation Strategy and the Mine Operations Plan in terms of landscape and land use, representatives of the Mine will continue to engage throughout the life of the Mine with neighbouring mining operations, agency and community stakeholders.

Base references that will be used throughout this engagement will be the range of plans and procedures under the EMS and *Strategic Framework for Mine Closure* (ANZMEC and MCA, 2000) and *Mine Closure and Completion – Leading Practice Sustainable Development Program for the Mining Industry* (Commonwealth of Australia).

This page has been left blank intentionally.

4.0 Proposed Future Use of Disturbed Areas

The aim of rehabilitation at the Mine is to reinstate the pre-mining land capability of grazing land, with stable landforms, compatible with the surrounding landscape, and allow for a range of possible post-mining land-uses.

To assist in defining the lands encompassed in the Mine Operations Plan and this Rehabilitation Strategy, the site has been divided into a range of differing domains based on final land use as described in the Mine Operations Plan. In accordance with the NSW Trade & Investment Environment Sustainability Unit -Mineral Resources – *ESG3 Mining Operations Plan Guidelines* (NSW Trade & Investment Environment Sustainability Unit - Mineral Resources, March 2013) the primary domains have been defined on the premise of land management units within the Mine site, usually with unique operational and functional purpose and therefore similar geophysical characteristics. Secondary domains are defined as land management units characterised by a similar post mining land use objective.

The primary and secondary domains are shown in **Table 2**.

Table 2 Primary and Secondary Domains

Primary Domains	Secondary Domains
Unmined land	Unmined land
Infrastructure Area	Infrastructure Area
Heritage Area	Heritage Area
Water Management Area	Water Management Area
Tailings Emplacement Area	Rehabilitated Lands – Pasture
Overburden Emplacement Area	Rehabilitated Lands – Trees over Grass
Rehabilitated Lands – Pasture	Final Void
Rehabilitated Lands – Tree over Grass	
Final Void	
Active Mining Area	

Further information on these domains and the key issues that pertain to their management is provided in the following sections. A pictorial representation of the final landform and land use is provided on **Figure 3**.

4.1 Active Mining Area

Active Mining Areas comprise areas where active mining activities will occur during the life of the approved mining operations. These activities include highwalls, lowwalls, active voids, spoils and ramps. This domain generally cannot be progressively rehabilitated as they are required up to the end of production for accessing coal and related infrastructure services

4.2 Heritage Area

The Heritage Area comprises the Rix's Creek Coke Ovens and associated works, which are heritage-listed items. The area is fenced, maintained and conserved in accordance with the *Rix's Creek Colliery Coke Ovens Conservation Plan* (Rixs Creek Mine, 2007).

4.3 Infrastructure Area

All surface infrastructure, where a post mining use cannot be identified, will be removed from the site. The following description of the decommissioning of the infrastructure areas is provided, pending alternate post mining land use for these areas. These descriptions do not account for additional material to remediate the site being sourced from areas outside the present planned operations of the Rix's Creek mine.

It is noted that following completion of the open cut mining proposed by the Project, there will remain a coal resource within the Mine Lease area that could be accessed by underground mining techniques, primarily bord and pillar mining. Any underground mining or mining beyond the life the Project would be subject to a separate environmental impact assessment and approval process at the time.

Where contaminated, carbonaceous or unsuitable material for rehabilitation is identified on hard stand areas, infrastructure areas or haul roads, it may be removed, disposed of in the final stages of capping of the tailings storage facility or covered in the floor of the final void. Any crossings (i.e. culverts) will, where practical, be removed and the pre-existing drainage line reinstated. All roadside markers (tyres and guideposts) and signs are also to be removed from within the area once mine closure activities have been completed.

A light vehicle access road is to be maintained to enable inspections of the site following closure of the Mine.

The proposed and existing cut and cover tunnels under the New England highway will be partially filled, allowing post mining access under the highway for domestic livestock and opportunistic movement of native fauna.

4.3.1 Clean Coal Stockpile

The carbonaceous material on the base of the ROM and product stockpile areas will be will be managed as discussed previously. Where possible, the material will be considered for reprocessing before the CHPP is

decommissioned. Once this has been completed, inert spoil will be placed over the tailings storage facility impoundment to maintain a cap, with a cap also placed over the former coal stockpile and infrastructure areas.

4.3.2 Coal Handling and Preparation Plant

The entire CHPP and infrastructure area will be bulldozer trimmed to facilitate the appropriate drainage of surface runoff from the site. Appropriate surface water management structures (contour banks, drains and settlement ponds) will also be constructed, where required. The final landform will allow water to flow away from the site via drainage lines.

4.3.3 Clean Coal Reclaim Aerial Stacker and Reclaim Tunnel and Train Loader Facility

The Rix's Creek Mine rail loading facility currently includes conveyors, a surge bin, train-loading bin, access roads, sediment dams, and laydown areas. During the decommissioning phase should contaminated, carbonaceous or material unsuitable for rehabilitation be identified in the areas of the Mine rail loading facility, it will be managed as discussed previously.

4.4 Water Management Areas

This domain includes components of the network of dams, pipes, pumps and drainage lines that compose the Mine water management system that is in place to control the movement of water around the site. These include sedimentation, diversion, mine water and water supply dams but exclude the tailings emplacement areas. **Figure 3** shows the configuration and drainage catchments of the final landform.

The water management system for the site during the life of the Mine requires water to be effectively sourced, captured, diverted, stored, monitored, used and reticulated across the site. This system is based on adherence to well established, best water management practices in the Australian mining industry. These principles are:

- Efficient use of water based on the concepts of 'reduce, re-use and recycle';
- Avoiding or minimising contamination of clean water streams and catchments; and
- Protecting downstream water quality for other beneficial uses such as agriculture and industry.

Water run-off from the rehabilitated landform is to be directed into ephemeral channels that flow into the existing drainage pattern around the Mine. The water run-off in the channels will vary in volume depending on local weather conditions and storm activity. Temporary sediment controls such as the use of gabions, geotextiles, hay bales, sediment control fencing techniques, and other techniques used during Mine life, may be integrated with vegetation and permanent engineering strategies to achieve stability in relevant areas.

Where appropriate water storage dams will be incorporated into the landscape with a view to supplying watering points for cattle. These dams will be revegetated with plant species (e.g. grass species and emergent reeds) suitable to ensure stability of the dam wall and batters. They will also provide potential localised habitat for native fauna with varying water depths, island refuges, large woody debris and/or rock stockpiles retained insitu.

Temporary sediment detention features may be designed into the channels during construction periods. These features will provide protection during construction to the receiving waters in terms of water quality. To achieve rapid stabilisation, particularly in high flow scenarios, quick establishing pasture species will be used. There has been extensive use of pasture species for this purpose on both the Mine and other mines, and techniques are well developed. Reconstructed drainage lines will be revegetated with species prevalent within the existing ephemeral water course. Vegetation established during rehabilitation will ensure long term channel stability.

The drainage pattern of the final landform will be designed to integrate with the surrounding catchments and will be revegetated to achieve long term stability and erosion control and also to harmonise with more general rehabilitation and revegetation strategies. Clean water diversion banks on overburden emplacements will be retained to divert water away from fill areas. Reconstructed drainage channels will be established where required in accordance with lead practice standards at the time of construction. In terms of future use, these areas will be protected from incompatible land use activities such as over grazing which may damage their integrity by strategic fencing and management of cattle grazing pressure.

4.5 Tailings Emplacement Area

Tailings disposal throughout the life of the Project will be in the form of a thickened paste disposal method. The tailings cake contains negligible free water; it is spreadable and quite easily handled. The dewatered tailings cake is disposed separately or mixed with coarse reject and disposed of in overburden emplacements using trucks.

Pit 1 tailings emplacement (tailings emplacement #4) is the only active tailings emplacement during the life of the Project. This area will be maintained for the purpose of backup for tailings management, even though co disposal will be the preferred disposal technique. The tailings emplacement areas will be allowed to dry following last disposal prior to rehabilitation. Post drying the tailings emplacement areas will be revegetated with a species mix aligned to the surrounding plant community i.e. grassland and tree over grass.

4.6 Overburden Emplacement Areas

Overburden is produced and managed within mined out sections of the open cut to create a final landform and would be placed in designated out of pit emplacement areas and/ or placed in the final void. Spoil dumping locations will be managed to maintain flexibility and productivity of the overburden haulage fleet while giving consideration to environmental conditions. In general the dumps will be constructed in reasonably flat layers incorporating rehabilitated edges where possible. The disturbed faces of the Overburden Emplacement Areas may be temporarily vegetated via aerial seeding of fast germinating and establishing plant species.

The aim of the overburden emplacement design will be to ensure that:

- Overburden emplacement capacity is balanced with final landform design in order to minimise areas of disturbance and create a stable landform with visual relief where possible;
- The visual impacts of the existing area adjacent to the New England Highway are reduced;
- Safety considerations have been included to mitigate the hazards that the site may pose to unauthorised people who access the area;
- Runoff water quality will be similar to undisturbed lands and will not degrade receiving stream channels;
- The rehabilitated landform will support vegetation species and composition diversity aligned to plant diversity in adjacent unmined lands;
- Land will support its designated post-mining uses; and
- The rehabilitated landform will be compatible with the surrounding landscape.

4.7 Rehabilitated Lands

The mined lands are to be rehabilitated back to pasture and areas of trees over grass. The proposed final landform at the Mine will be consistent with the surrounding landscape. The final adopted rehabilitation and management options for this domain will largely depend on the prevailing condition in terms of landscape and optimising landuse in terms of current social and economic constraints.

It should be noted that following completion of the open cut mining proposed by the Project, there will remain a coal resource within the Mine Lease area that could be accessed by underground mining techniques, primarily bord and pillar mining. The final landform design has been deigned to allow an underground portal to be left following the completion of the Project. This will provide access to the underground resources. Any underground mining or mining beyond the life the Project would be subject to a separate environmental impact assessment and approval process at the time.

4.7.1 BSAL Verification Assessment

The Biophysical Strategic Assessment Land (BSAL) Verification Assessment for the Mine was undertaken in April 2014 by SLR Consulting (SLR Consulting, July 2014). The assessment area was defined as the proposed Overburden Emplacement Area totalling approximately 170 ha in area, as well as the required 100m buffer, which resulted in a total 245.4 ha for the Assessment Area. Approximately 53.5 ha were greater than 10% slope and two distinct soil types were found: Subnatric Brown Sodosol (173.9 ha), Eutrophic Brown Chromosol (71.5 ha).

The Subnatric Brown Sodosol failed the fertility criteria within the BSAL protocol and was therefore considered non BSAL. The two detailed sites within the assessment area for the Eutrophic Brown Chromosol were excluded on the basis of being greater than 10% slope and depth to physical barrier < 0.75 m. However the areas of this

soil type within the 0 to 10% slope were considered to contain a deeper profile and therefore would satisfy the 12 criteria within the Interim protocol. These areas were isolated pockets of less than 20ha and therefore cannot be considered BSAL.

It has been concluded that there is no qualifying BSAL within the Assessment Area.

4.7.2 Agricultural Impact

The Agricultural Impact Assessment (Neil Nelson Agvice Pty Ltd, July 2015) that was completed for the 170ha of land that comprises the lease extension (Mine Lease Application 487) concluded the following in relation to the current and potential impact on agricultural production:

- Grazing will be continued on the land until the out of pit dump is formed (potentially 2017). Of the 170 ha lease extension area, 78 ha will be disturbed by the project and grazing excluded, while 92 ha will not be disturbed and will remain as native pasture (allowing potential continuance of grazing);
- Grazing will recommence on the sown rehabilitated land once the pastures have shown to be stable and approved for grazing;
- The economic impact from the loss of production from grazing during the period of disturbance and rehabilitation is relatively small;
- Rehabilitation of the disturbed land will re-instate the land to the same land and soil capability class as prior to disturbance; and
- Pasture will be sown on the rehabilitated land for a post mining land use of grazing. Current research undertaken examining beef cattle production on rehabilitated pastures compared to natural pastures, indicate that equivalent or higher production is possible on the rehabilitated sown pasture.

These conclusions are supported by the proven current land management practices at the Mine, together with the recent studies into the sustainability and profitability of grazing on mined lands in the Upper Hunter - ACARP Project No. 53259 and the Glencore grazing trials.

4.7.3 Land and Soil Capability

Land capability is the physical capacity of the land to sustain a range of land uses and management practices in the long term without degradation to soil, land, air and water resources.

The allocation of capability classes to the lands pre 2012 was undertaken following review of topography and soils information contained in the Environmental Impact Statement (EIS) that underpins the approval of the current mining operations (Enviros ciences Pty Limited, Nov 1994), together with a review of GIS based data related to slope and the proposed management of the known growing media resource. For the purpose of this comparison, the correlation of slope to Land and Soil Capability class has been used and is shown on **Table 3**. A diagrammatic representation of the project area showing the existing mining operation in context of Land Capability is provided **Figure 4**.

Table 3 Correlation of Slope to Land and Soil Capability Classes

Slope	Land and Soil Capability Class	Colours as per Figure 4
<10°	4	Green
10°	4	Red
10°-18°	5	Purple
>18°	6	Navy

An assessment of soils and land capability of the 339.5ha (the footprint of the Project) was undertaken as part of the technical specialist report *Soils and Land Impact Assessment* (SLR Consulting Australia Pty Ltd, 10 June 2015) with a summary of the assessment provided in **Table 4**.

Based on the soil types and their distribution across the Mine site, an assessment of the capability of the Mine was undertaken in accordance with the Office of Environment & Heritage (OEH) guideline *The Land and Soil Capability Assessment Scheme; Second approximation* (Office of Environment & Heritage, 2012) (referred to as the Land and Soil Capability Class Guideline).

Whilst it is recognised that the growing media will in part comprise shallow soils and the presence of sodic subsoils, the Mine land management program will ensure that there are no rocky outcrops. Proactive management of erosion (wind and water) will be carried out and cropping will not be included in the program. These measures together with the use of soil ameliorants including though not limited to biosolids, will enable the land to return to post mining Land and Soil Capability Classes comparable to that pre mining.

The area of each Land and Soil Capability Class pre and post mining for the entire Mine Lease area is shown in **Table 4** and includes consideration of the amelioration measures as discussed above.

Table 4 Land and Soil Capability Areas – Pre and Post Mining – Entire Mine Lease

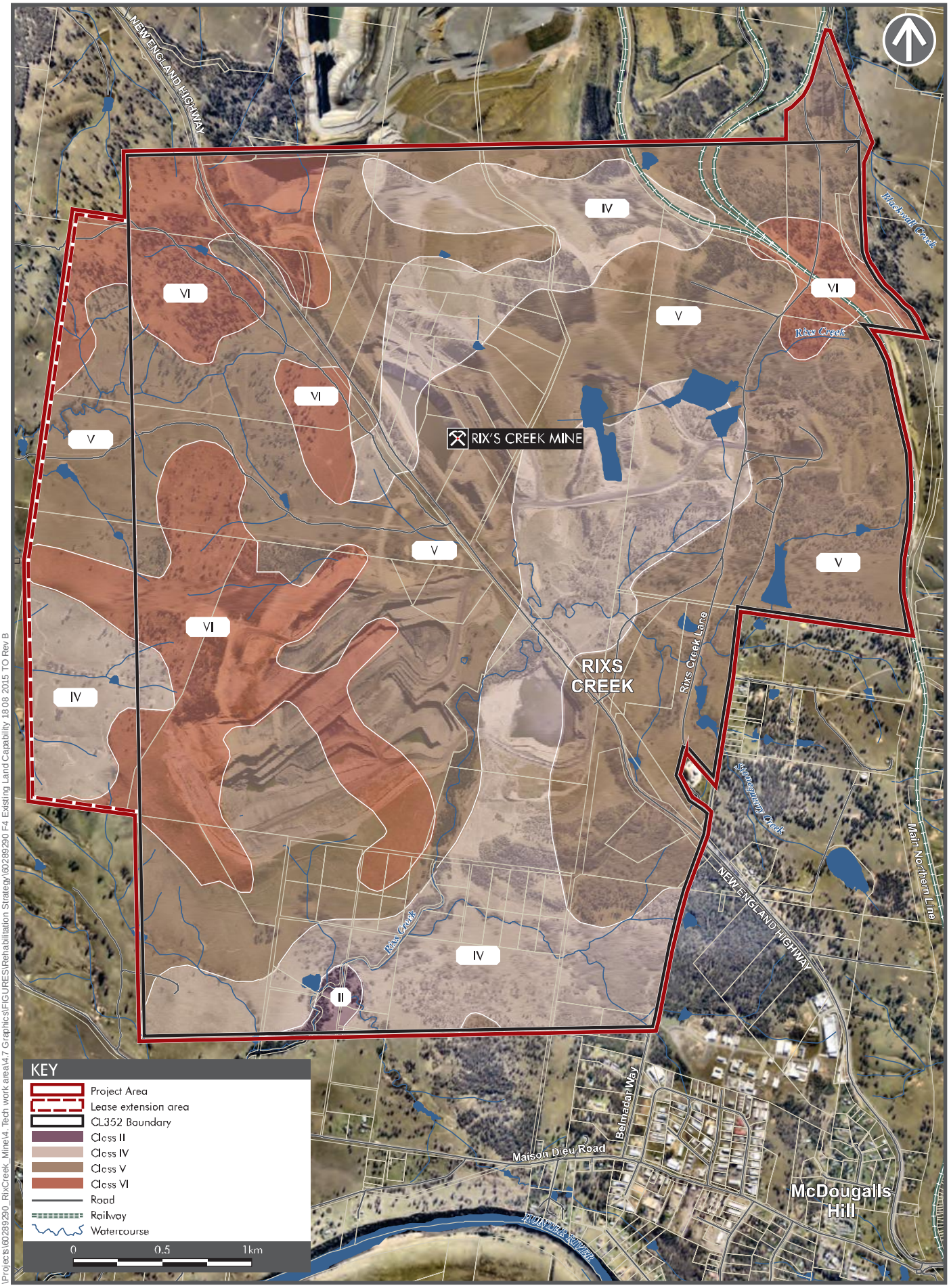
Pre Mining			Post Mining							
			Disturbed Area			Undisturbed Area		Post Mining Total		
Class	Area (ha)	%	Slope	Class	Area (ha)	Class	Area (ha)	Class	Area (ha)	%
2	9.6	0.5	<10°	4	549.9	2	9.6	2	9.6	0.5
4	496.4	25	10°	4	302	4	226.3	4	1078.2	53.8
5	1096.2	55	10°-18°	5	144.8	5	536.9	5	681.7	34
6	402.4	20	>18°	6	13	6	141.4	6	154.4	7.7
			Inundated	N/A	80.7	Inundated	0	N/A	80.7	4
Total	**2004.6**				**1090.4**		**914.2**		**2004.6**	

4.7.4 Final Landform

The proposed final landform at Rix's Creek will be consistent with the surrounding natural landscape and slope classes as shown in **Figure 3**. It will have:

- A post mining landscape which will be safe and non-polluting, with a stable drainage network;
- An area of Land and Soil Capability Class 2 lands not impacted by the operation;
- The majority (53.8%) of the site with slopes less than or equal to 10º (18%) (Land and Soil Capability Class 4);
- 34% of the site with slopes between 10-18^{o} (Land and Soil Capability Class 5) of which 80.6ha would be land below water in the final void; and
- Approximately 7.7% of the Project area with areas of greater than 18° (33%) slopes i.e. the batters of the tunnels under the highway and sections of the batters of the final void (Land and Soil Capability Class 6), prior to the void filling with water.

The area of the open body of water (80.7ha or 4% of the project area) that will comprise the final void, at the level as predicted as at 2042, has not been included in the assessment of percentages of slope across the site, as the open body of land is not deemed relevant in terms of quantifying land and soil capability.



\Projects\60289290_RixCreek_Mine\4. Tech work area\4.7 Graphics\FIGURES\Rehabilitation Strategy\60289290 F4 Existing Land Capability 18 08 2015 TO Rev B

AECOM

EXISTING LAND CAPABILITY

Rix's Creek Continuation of Mining
Environmental Impact Statement

DATA SOURCE: Soil Conservation Service (1986), OEH (2010)

FIGURE 4

4.8 Final Void

This domain includes the final highwall, void, lowwall, spoil and ramps of the void, the location of which is shown on **Figure 3**. The final void, lowwalls and ramps cannot be rehabilitated progressively over the Mine life as coal will continue to be accessed from the final void up to the end of production. All areas of the site, with the exception of the final void and its surrounding catchments, will be free draining. The aim is to maintain the effective catchment contribution and yield to the Hunter River following the cessation of mining.

The following key planning considerations have been incorporated into the design for this domain in context of future potential access (unauthorised and other).

- Create a final void of relatively low safety risk as the depression grades can be climbed safely by foot;
- Minimise out-of-pit dump and dump levels enhancing visual amenity; and
- Create a void depression that is not easily visible or recognisable improving the visual amenity of the Project area.

The low wall slopes of the final void landform will be designed with an overall slope of around 18 degrees. The final void landform will be rehabilitated with vegetation species and diversity that are appropriate for the surrounding landform. The highwall will also be rehabilitated using the best reasonable and feasible rehabilitation technologies available at the time and revegetated with species that are appropriate for its steepness, aspect, and water retention capabilities.

Design alternatives for the final void will continually be evaluated and will be prepared as part of the closure planning process. Regardless of the final design alternative selected, the location and use of the final void is outside the 100-year recurrence interval flood prone area of the Hunter River.

Groundwater studies have modelled the rate of filling of the final void both in context of water quantity and quality. The key issues that have been considered in context of the rehabilitation of the voids include:

- Salinity levels in the final void which result from the intrinsically saline groundwater;
- Ecosystem health in the water body of the void;
- Selection of plant communities that can be developed and sustained on the batters of the void, which as the water levels rise will aid in the development of aquatic ecosystems; and
- Access and safety for site users and animals – both domesticated and native. Appropriate measures will be used to limit access to steeper areas around the final void to restrict cattle, pedestrian and vehicle access. These measures may include large rock placement, landform shaping, or fencing as agreed with relevant government authorities close to closure.

During the operational phase of the Project, The Bloomfield Group will be committed to undertake further investigations in support of firming up residual void stability, hydrological behaviour and void rehabilitation strategies. These may include:

- More detailed hydrological (runoff quality and quantity) and geochemical assessment aimed at more accurately predicting long term void water levels and mechanisms that may be used to enable the void to self-regulate its salinity;
- Active liaison with DRE so that the regulator can more comprehensively understand the complex nature of final void issues and provide more strategic advice on its requirements for the rehabilitation outcome for large residual voids;
- Review of the potential littoral, limnetic, profundal and benthic zones and associated stratification, mixing (or lack thereof) and environments of the layers which may occur in the water in the final void and the potential issues that may occur should alterations to the predicted environment occur. Issues to consider may include temperature, salinity, depth, light and the deposition and accumulation of sediments and other materials; and
- Review of other open bodies of water where the layers of the water don't intermix i.e. the meromictic lakes or where mixing occurs at least once per year i.e. holomictic lakes.

It should be noted that the design contained in the Rehabilitation Strategy does not account for additional material to remediate the final pit void that may be sourced from areas outside the present planned operations of the Mine.

4.8.1 Future Underground Mine Located in the Northern Pit

The proposed final landform design in the Northern Pit is aligned to the potential future operation of an underground mine in this area that will access the deeper coal seams via the headwall. To ensure this resource can be safely accessed and planned for, the area will have:

- Coal seams capped where possible;
- A highwall slope angle of 50 degrees following blasting and dozing, or benching at 30m vertical incline and up to 25m horizontal incline, with part of the void filled;
- A lowwall slope angle of 10 degrees or up to 25 degrees; and
- A top batter at 27 degrees with a safety berm along the entire length of the remaining high walls. The safety berm is to provide an engineered barrier between the pit and the surrounding area. The trench and berm are to be constructed in such a way that it would physically stop vehicles.

4.9 Unmined Land

This domain includes all unmined lands owned by the Mine, within the Mining Lease, which are not used for purposes related to mining. Land uses which surround this domain are agricultural to the northwest, west and south west, mining (Integra Open Cut Mine) to the northeast and smaller agricultural holdings to the south and south east. To the immediate south east of the Mine Lease area is the McDougall's Hill Business park which contains a number of light industrial and bulky goods business.

The unmined or buffer lands are a valuable resource, providing:

- Analogue sites for establishing baseline criteria by which the rehabilitation objectives and success can be compared;
- Areas that can be incorporated with the rehabilitated lands to enable beef cattle production; and
- A potential for future development of non-agricultural based activities aligned to optimal post mining landuse.

The buffer lands are to be managed to enhance landuse values during and after the life of the Project. The management of these lands will require:

- Corridor management in the context of grazing and biodiversity;
- Fencing and access control;
- Weed and vertebrate pest species management and control;
- Track construction and maintenance;
- Strategic grazing and stock control; and
- Bushfire management.

5.0 Phases in the Rehabilitation Strategy

The Bloomfield Group has extensive and proven experience in achieving successful mine rehabilitation. Rehabilitated areas will continue to be established and managed in accordance with methods currently in place under the Mine EMS which includes commitments to progressive rehabilitation and monitoring.

The aim of rehabilitation at the Mine is to reinstate the pre-mining land capability suited to grazing land, with stable landforms, compatible with the surrounding landscape, and allow for a range of possible post-mining land-uses. Initial post-mining land use options identified for the mining lease included:

- Agriculture – cattle grazing;
- Open space – retention of areas as grassed and woodland open space;
- Native vegetation – including stands of native plant species and communities and corridors of vegetation connecting to stands of native vegetation on neighbour properties;
- Recreation – passive recreation in areas - subject to appropriate safety measures being implemented;
- Residential - subdivision of varying density for rural areas;
- Industrial – buildings and factories;
- Aquaculture based ventures or water for industry from the final void; and
- Commercial – sections along the New England Highway.

Various options were also considered for surrounding land owned by the Company. These holdings would be reviewed in unison with the strategic planning policy updates being undertaken by Singleton Council, which will identify potential higher uses of land surrounding the Mine given its proximity to Singleton and key transport and services infrastructure.

To the extent practicable, rehabilitation will be undertaken progressively during the life of the Mine. Progressive rehabilitation will minimise the area of exposed disturbance and reduce environmental impacts. Progressive rehabilitation will also enable significant economic advantages and efficiencies through better integration of equipment use during mining and rehabilitation, reduced earth moving costs and improved topsoil management. Ultimately, this practice will lead to enhanced rehabilitation outcomes.

Sufficient personnel and resources will be allocated during mining to enable progressive rehabilitation. Final rehabilitation will continue to be included in the Mine budget for the period of operation. Progressively rehabilitating mined land may also enable the progressive return of security bonds subsequent to successful rehabilitation of defined areas. Rehabilitation planning will consider the logical sequence of actions needed to achieve rehabilitation success.

The Bloomfield Group has and will continue to be involved in research projects focusing on the rehabilitation of open-cut mines. This work continues to be carried out either by company personnel or in conjunction with organisations such as ACARP, the University of Newcastle and the NSW Minerals Council. A number of techniques have been used and further developed including the use of biosolids, weed control, plant species selection and grazing and pasture assessment.

The ultimate rehabilitation objective will be achieved through a series of conceptual phases which are shown diagrammatically in **Figure 5** and described as:

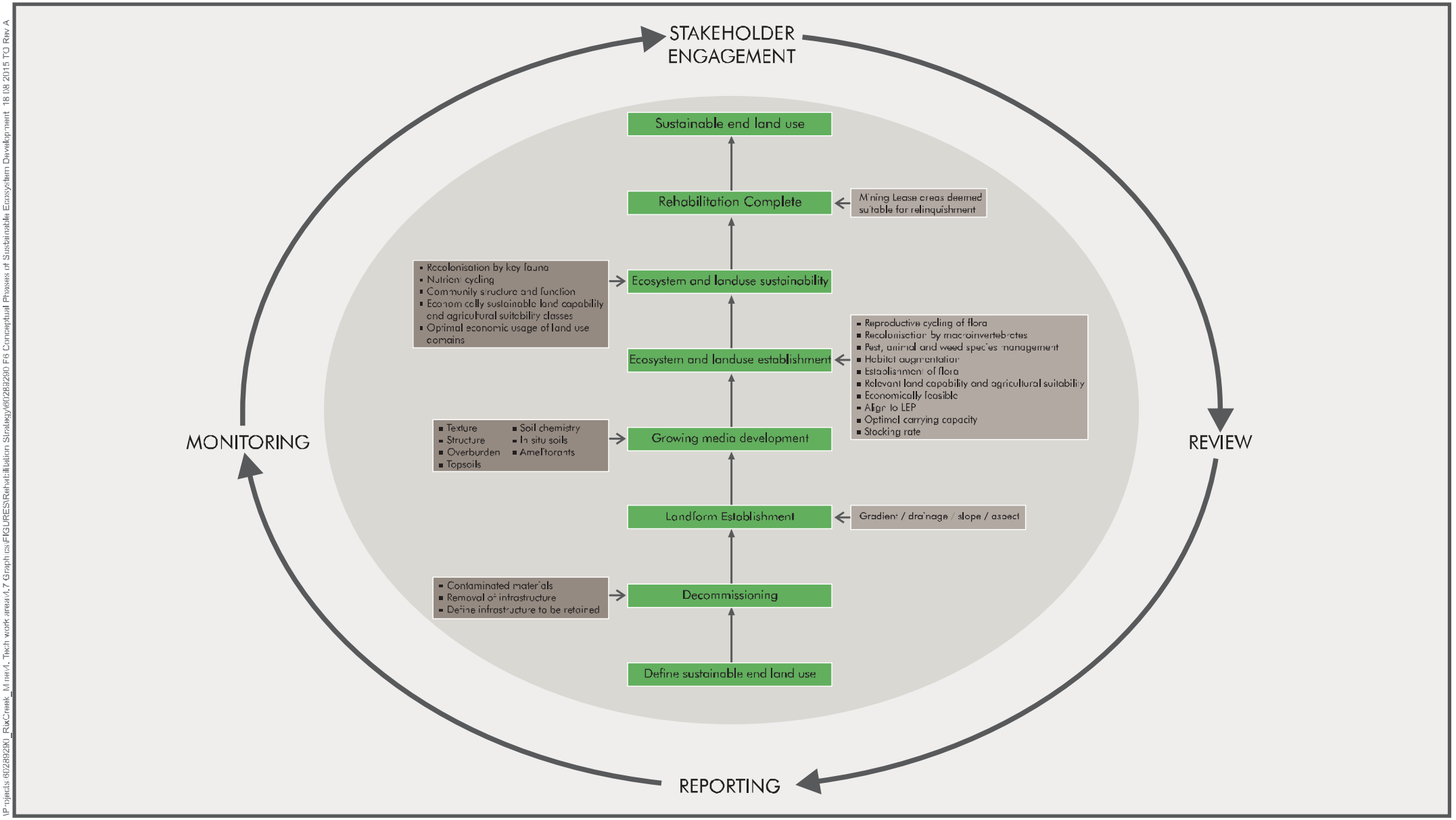
- **Phase 1**: Decommissioning – removal of hard stand areas, buildings, contaminated materials, hazardous materials;
- **Phase 2**: Landform Establishment – incorporates gradient, slope, aspect, drainage, substrate material characterisation and morphology;
- **Phase 3**: Growing Media Development – incorporates physical, chemical and biological components of the growing media and ameliorants that are used to optimise the potential of the media in terms of the preferred vegetative cover;
- **Phase 4**: Ecosystem and Landuse Establishment – incorporates revegetated lands and habitat augmentation; species selection, species presence and growth together with weed and pest animal control / management and establishment of flora;

- **Phase 5**: Ecosystem and Landuse Sustainability – incorporates components of floristic structure, nutrient cycling recruitment and recovery, community structure and function which are the key elements of a sustainable landscape; and
- **Phase 6**: Rehabilitation Complete – Landuse and landscape is deemed as suitable to be relinquished from the Mining Lease.

Table 5 shows the relevant rehabilitation phases for each domain, based on the post mining landuse and landscape, and the rehabilitation objectives to be achieved.

Table 5 Relevant Rehabilitation Phases for Each Domain

Domain / Rehabilitation Phase	Active Mining	Heritage Area	Infrastructure Area	Water Management Area	Tailings Emplacement Area	Overburden Emplacement Areas	Rehabilitated lands – Pasture	Rehabilitated Lands – Tree over Grass	Final Void	Unmined Land
Stage 1 – Decommissioning	N/A	N/A	✓	✓	✓					
Stage 2 – Landform Establishment	N/A	N/A	✓	✓	✓	✓	✓	✓	✓	
Stage 3 – Growing Media Development	N/A	N/A	✓	✓	✓		✓	✓	✓	
Stage 4 – Ecosystem and Landuse Establishment	N/A	N/A			✓		✓	✓	✓	
Stage 5 – Ecosystem and Landuse Sustainability	N/A	N/A			✓		✓	✓	✓	✓
Stage 6 – Rehabilitation Complete	N/A	N/A	✓	✓	✓	✓	✓	✓	✓	



AECOM

CONCEPTUAL PHASES OF SUSTAINABLE ECOSYSTEM DEVELOPMENT

Rix's Creek Continuation of Mining
Environmental Impact Statement

DATA SOURCE: DRE Mining Operations Plan (MOP) Guidelines, September 2013

FIGURE 5

5.1 Phase 1 Decommissioning

Phase 1 provides for the removal of hard stand areas, buildings, contaminated materials and hazardous materials.

The only decommissioning activities scheduled for the life of the current MOP (Rixs Creek Mine, March 2013), are the works associated with the tailings emplacement area #3 located in Pit 2 and covering an area of 19 ha. All decommissioning works will be undertaken in accordance with a Section 101 Approval once obtained from DTIRIS-DRE.

The objectives, criteria and performance indicators for Rix's Creek rehabilitation domains for the Decommissioning phase are provided in **Table 6**.

5.2 Phase 2 Landform Establishment

5.2.1 Surface Shaping

Reshaping principally involves re-contouring overburden emplacement areas into the designed shape for final rehabilitation. The bulk movement of overburden will usually be undertaken using bulldozers. Ideally, reshaping will result in a stable landform with slopes and drainage patterns which blend in with the surrounding natural topography. Slope stability is integral to rehabilitation design and slopes in excess of 10 degrees are not favoured. However, slopes steeper than 10 degrees may be necessary in some locations to ensure rehabilitation merges seamlessly with adjacent undisturbed land.

The final landform may change over time with the advent of new technologies or changes to the planning development framework for Singleton. Given the proximity of the Mine to Singleton, higher order land uses may be more appropriate for sections of the Lease area by the end of the Project life.

Any changes to the final landform which may evolve to accommodate a range of potential future would be subject to discussion with the relevant agencies (including DRE) and may require modifications to approvals over time.

5.2.2 Deep Ripping and Rock Raking / Removal

Once bulk reshaping is completed, the landform is deep-ripped and the final trim/rock raking is undertaken. The ripping loosens up any near surface strata within the landform that have been compacted during placement, aiding root penetration during vegetation establishment. The final trim smooths out any wash-outs and gullies, rough edges, temporary access tracks, local steep slopes and prepares the surface for revegetation.

Rock-raking is the final stage of reshaping and removes or buries exposed surface rock greater than 500 mm in diameter. Rocks are either buried within the spoil structure or may be left in groups on the surface as fauna habitat. This raking is usually done along the contour, leaving a cultivated surface that minimises the risk of erosion until vegetation can be established.

5.2.3 Drainage Establishment

Suitable drainage will be integrated into the rehabilitation design, to ensure the final landform can safely shed surface runoff without giving rise to erosion. Long or steep slopes are to be divided by the construction of contour banks to collect and divert water moving across the slopes. Contour banks would direct the surface water at a drop of no greater than 1 in 100 into a drainage line (via a sediment dam) or into some form of protected drop structure that will direct the water down the gradient in a controlled or protected manner.

5.3 Phase 3 Growing Media Development

Growing media development involves processes to achieve a soil which is capable of supporting a sustainable plant community. It includes consideration of the chemical, physical and biological properties of the media and takes into account issues such as specialist requirements (e.g. soil ameliorants) aligned to the revegetation of the disturbed areas, whilst also incorporating consideration of landuse both for grazing and biodiversity that may deviate from the traditional post mining landuse.

5.3.1 Overburden Characterisation

Overburden material varies in physical and geochemical properties, in accordance with the geology of the area and the extent of exposure to weathering. Chemical analyses of the spoil materials indicate that, in general, the overburden is slightly sodic and alkaline, but within acceptable ranges for use as a plant growth medium.

In order to fully understand the selective handling of materials, assessment of the characteristics of soil and overburden material will be undertaken throughout the life of the Mine as per the parameters listed in **Table 6**.

Overburden characterisation is important to:

- Identify material for use in the root zone which is capable of supporting sustainable vegetation establishment;
- Identify materials which limit plant growth or which may contaminate surface or ground water, and hence may require special handling, treatment or disposal; and
- Identify any propensity for spontaneous combustion.

Soil studies undertaken for the EIS (SLR Consulting Australia Pty Ltd, June 2015) mapped the soils, determined stripping depths and rehabilitation suitability. The specialist study defined two main soil types occurring across the Project area – Subnatric Brown Sodosols and Eutrophic Brown Chromosols. The Sodosols dominated the Project area and were located on the creeklines, flats, lower slopes, midslopes and on the ridgeline in the north. These soils varied in topsoil depth from 0.1m to 0.3m, with an abrupt to clear boundary to the clay subsoil. The Chromosols dominated the upper slopes and ridges. All soils have been assesses as suitable for stripping and reuse on the rehabilitated lands in accordance with the following considerations.

5.3.2 Topsoil and Subsoil Characterisation

During the life of the Project topsoil and subsoil characterisation will be undertaken in order to:

- Identify any physical or chemical deficiencies or limiting factors (particularly alkalinity, salinity and sodicity) which may affect such things as vegetation establishment, landform stability and propensity for spontaneous combustion; and
- Develop selective placement strategies and/or develop suitable amelioration techniques.

5.3.3 Soil Stripping

Topsoil is suitable for stripping across the assessment site, from a minimum depth of 0.10 m to a maximum depth of 0.40 m. For the majority of the land, topsoils can be used without treatment. Subsoils can also be widely stripped, including to a maximum depth of 1.10 m at locations at the base of slopes where material has accumulated.

5.3.4 Soil Stockpile Management

The following soil stockpile management practices will be used to increase the long term viability of the soil resources in stockpiles:

- Topsoil stockpiles will be located outside of proposed mining areas and away from slopes and drainage lines where possible;
- Stockpiles will be constructed with a “rough” surface condition to reduce the risk of erosion, improve drainage and promote revegetation;
- Stockpiles will be no higher than three metres in order to minimise issues with anaerobic conditions;
- Stockpiles will be fertilised and seeded to maintain soil structure, organic matter and microbial activity, whilst areas which are to be inactive for extended periods may be seeded with the final species mix;
- Stockpiles will be located to prevent runoff leaving the site;
- Where necessary soil ameliorants will be applied to dispersive soil stockpiles, at a rate commensurate with the findings of the soil assessment pertaining to sodicity and dispersion; and
- Weed control strategies will be implemented particularly for any noxious weeds. Immediate revegetation will provide vegetative competition to assist with control of undesirable plant species.

5.3.5 Soil Amelioration

Soil/spoil ameliorants will be spread and integrated into the surface layer to address soil sodicity and assist with soil structural properties. As the majority of subsoils are potentially sodic they are usually treated with ameliorants including gypsum at a rate of up to 200kg/ha, with these materials being ploughed into the top 30cm of the profile. In addition, sodic subsoils where exposed, will be managed with appropriate erosion and sediment control structures in place (contour banks, sediment retention ponds, rock armouring etc.).

5.3.6 Topdressing

Topsoil stripped ahead of mining will be is applied to the reshaped surface in an even layer generally not less than 100mm. Depending on the quality of the topdressing material, ameliorants may be integrated with topsoil at this stage. Topsoil will be used as a first priority but where topsoil has not been available in sufficient volumes, biosolids and biosolids/mulch mix have been successfully used to improve soil structure and act as a source of nutrients, improving establishment of vegetation especially in those areas returning to pasture. Biosolids are generally applied at a rate no greater than 100 t/ha (wet weight), using a tractor towed spreader trailer. A biosolids/mulch mix (1:1 ratio) has been shown to be a very successful topsoil supplement and is usually applied at a rate of 200 – 250 t/ha.

5.3.7 Integration

Once the material has been top-dressed, the surface will be contour disc or chisel ploughed to integrate the topdressing material. This assists in binding the topdressing material with the underlying spoil and is a requirement of the EPA guidelines *Use and Disposal of Biosolids Products* (NSW Environment Protection Authority, 2000). The area will then be contour cultivated to create seed entrapments and microclimates prior to sowing.

5.3.8 Land Management Practices

Land management practices that are implemented at the Mine relating to the handling of growing media include:

- Progressive rehabilitation of final landforms as soon as practicable after completion of mine-related disturbance activities;
- Weed management prior to stripping the area to be cleared (following a clearing permit) will be completed, alternatively after timber is cleared, if present, to allow access;
- Stripping of topsoil and subsoil material that is deemed as not requiring treatment to address issues such as sodicity using a bulldozer or grader – (preserving the top 50-100mm in tree area's to optimise the management of the topsoil seed bank) and removal using a front end loader and trucks. When the situation allows, this material will be placed directly onto final shaped overburden or stored in stockpiles not > 3m in height;
- Adding soil ameliorants (gypsum/lime) to subsoil material requiring treatment prior to stripping. Use of a bulldozer to strip subsoil material and a front end loader and trucks to move soil before being stored in stockpiles not > 3m in height;
- Seeding of all stockpiled materials with a seasonal dependant cover crop incorporating a mix of fast germinating and growing sterile species, together with a mix of pasture grass and legume species;
- Shaping of post mined lands to a landform as defined in **Figure 3**;
- Assessing stockpiled material prior to spreading of growing media on the post mined lands, in terms of suitability as a growing media and if required soils ameliorants (gypsum, lime, organic matter) will be added. Stockpiled material will also be assessed in terms of weed infestation and managed via the use of registered herbicides and / or scalping of weed infested material. Stockpiled material will be managed for weeds on a regular basis;
- Maintaining an inventory of available soil to ensure adequate topsoil materials are available for planned rehabilitation activities; and
- Restricting vehicular traffic on the soils to be stripped. Traffic will be excluded from soils that are sensitive to structural degradation.

5.3.9 Erosion and Sedimentation

Erosion and sedimentation at the Mine is controlled under the *Water Management Plan* (WMP) (Bloomfield Company Ltd, 2011) which includes an *Erosion and Sediment Control Plan* (ESCP) (JP Environmental, 2010) Prior to the disturbance of land associated with any construction activities at the site, appropriate erosion and sediment controls are established and approved by the Environmental Officer. All erosion and sediment management and related control structures are consistent with the specifications contained in *Managing urban stormwater – soils and construction, Volume 1*, 4th edition (Landcom, 2004) and particularly *Volume 2E Mines and Quarries* (DECC, 2008).

Where practicable, runoff from undisturbed catchments is diverted around the construction activities via diversion drains and banks which direct water into the natural watercourses. Runoff from disturbed areas is retained on site in sediment dams and allowed to settle prior to discharge into the natural system. Drains, diversion banks and channels are compacted and stabilised as they are constructed.

General measures in place at the Mine to minimise erosion and sediment mobilisation during operation include:

- Installing erosion and sediment controls prior to the disturbance of any land;
- Minimising the extent of disturbance to the extent that is practical;
- Reducing the rate of water flow across the ground particularly on exposed surfaces and in areas where water concentrates;
- Progressively rehabilitating disturbed land and constructing drainage controls to improve stability of rehabilitated land;
- Ripping of rehabilitation areas to promote infiltration;
- Use of fast germinating and establishing plant species to assist in surface stabilisation;
- Protecting natural drainage lines and watercourses by constructing erosion control devices which include sediment retention dams and diversion banks and channels. Steep gradients will require the installation of a rock riprap, geotextile fabric sediment filters or other suitable measures; and
- Restricting access to rehabilitated areas.

Erosion control on reshaped and rehabilitated areas is achieved by minimising the time taken to establish vegetation. Suitable drainage densities will be established with sediment detention basins being constructed in the flow lines. Sediment detention basins will be used along haul roads and around areas of disturbance. These structures will be de-silted as necessary.

5.4 Phase 4 Ecosystem and Landuse Establishment

5.4.1 Clearing and Reuse of Vegetation

This will be achieved by:

- Limiting the cleared width to that required to effectively operate the mine; and
- Programming the works so that only the areas which are scheduled for mining activities are cleared.

The proposed use of felled vegetation will follow current best practice and may include the collection of timber for fencing; incorporating ground cover, understorey species and saplings into stripped topsoil; and respreading large woody debris onto re-contoured land. Stag trees will be installed on to the post mining landscape as part of the rehabilitation program to optimise future potential habitat for arboreal and avian fauna including Squirrel Gliders. Where ever possible, dead trees will be retained on the non-mined ground in areas of open paddock to provide sheltering habitat for arboreal and avian fauna.

5.4.2 Fencing and Signage

Planning and design of the layout will be undertaken during this phase and will include consideration of fencing (materials and construction), delineation of paddocks, access to watering points, stock handling facilities and stock refuge areas.

5.4.3 Revegetation

The Bloomfield Group proposes to build on established revegetation techniques as the basis for the rehabilitation program. Review of the program will focus on:

- Potential variables impacting on rehabilitation programs and causes of failure;
- Suggested rehabilitation strategies for the successful reinstatement of pasture based plant communities on the site, including:
    - Establishing appropriate soil substrate: direct application of topsoil; stockpiled native topsoil; raw spoil plus addition of biosolids/organic growth medium; addition of other organic material;

- Establishing a grassy understorey: grass species suitable for mine rehabilitation; low and high photosynthetic pathway species; establishing herbs and forbs;
- Establishing the overstorey;
- Seeding of areas of scattered mid and overstorey native plant species will be seeded throughout the areas returning to pasture and in areas defined for shelterbelts/ habitat corridors;
- Supplementing vegetation in areas which have been seeded with tubestock of mid and over storey native plant species; and
- Distributing seed by various methods: hand-broadcasting; hydro-mulching; direct seeding; air seeding.

Onsite management measures designed to ameliorate the predicted visual, airborne dust and noise impacts using the overburden emplacement include:

- The integration of tree corridors on the overburden emplacement area as progressive rehabilitation occurs;
- Establishing visual and ecological planting patterns of native trees to achieve landscape patterns that complement the existing spatial distribution of tree and grass cover in a grazing landscape; and
- Minimising exposure of work areas to sensitive receivers where possible.

The main revegetation steps may include:

- Species selection;
- Sowing rates and species proportions;
- Tube stock densities;
- Consideration of habitat augmentation;
- Seed pre-treatment requirements;
- Seed spreading and planting techniques;
- Soil amelioration and fertilizer requirements;
- Use of temporary cover crops to assist soil stabilisation;
- Protection from vertebrate pest species, domesticated stock and unauthorised access; and
- Maintenance requirements.

5.4.4 Sowing / Fertilising

The area will be sown and fertilised with the selected grass and/or tree seed mixes shortly after spreading the topsoil to avoid loss in activity of pre-existing micro flora. It also minimises the loss of topsoil due to wind and rain action. Fertiliser is not usually required, where biosolids have been applied. Tubestock are planted in areas providing visual screens.

A typical species list sown, in approximate kilograms per hectare, for the establishment of pastures for a post-mining grazing landuse include:-

- Rhodes grass (1kg/ha), Couch grass (2kg/ha), Rye grass (4kg/ha), two sub. Clover (6kg/ha) varieties, Haifa white clover (2kg/ha), Woolly Pod Vetch (4kg/ha), green panic (5kg/ha), Sirosa phalaris (4kg/ha), Sephi Barrel Medic (4kg/ha), Lucerne (4kg/ha) and Kikuyu (1kg/ha).

The focus of this mix is to establish a vegetation cover that ensures surface stability, reduction in the risk of soil erosion whilst also providing a plant community suitable of sustaining beef cattle. During this phase of the rehabilitation program, cattle may be introduced, under a carefully managed program, to the rehabilitated lands with a purpose of enhancing nutrient cycling via consumption of grown feed and production of manure and the trampling and incorporation of plant material (green and dead) into the surface soil layer

A typical list of native species used in the revegetation program under direct seeding, all of which align to the tree species characteristic of the pre mining and surrounding plant communities include:-

- *Angophora floribunda, E.crebra, E. moluccana, E. sideroxylon, , E. tereticornis, E. albens, Corymbia maculata, Acacia concurrens, A. decora, A. decurrens, A. falcata, A. filicifolia, A. implexa, A. paradoxa, A. salicina, Hardenbergia violacea.*

A seed collection program aims to provide 75% of the seed as local provenance material, where available.

A typical list of native species, all of which align to the tree species characteristic of the pre mining and surrounding plant communities, used in the revegetation program under tubestock planting for visual screens and on bunds include:-

- *Angophora floribunda, E.crebra, , E. moluccana, E. sideroxylon, E. tereticornis, E. albens, Corymbia maculata, Acacia concurrens, A. decora, A. decurrens, A. falcata, A. filicifolia, A. implexa, A. paradoxa, A. salicina, Allocasuarina luehmannii, Casuarina glauca.*

5.4.5 Weed Management and Control

All noxious weeds will be managed and controlled as per the requirements of the *Noxious Weeds Act 1993*. Control of weeds will be undertaken in direct consultation with the Local Land Services, Singleton Council and Upper Hunter Weeds Authority staff using a combination of mechanical, biological and chemical controls.

Particular attention will be paid to the control of African Olive (*Olea europaea* L *subsp cuspidate*) across the site as the invasion of this species is listed as a potential key threatening process to the Central Hunter Grey Box-Ironbark Woodland and the Hunter Lowlands Redgum Forest both of which are listed under the *Threatened Species Conservation Act* 1995.

5.4.6 Vertebrate Pest Animal Management and Control

The Mine has in place an annual feral animal management and control program that will also be carried out for the life of the Mine. All work will be implemented in close liaison with the staff of the Local Land Services and in close communication with adjoining land users to ensure a coordinated approach to pest management.

5.4.7 Nesting Boxes

Nesting boxes for a range of arboreal and avian species will be established in older areas of rehabilitated lands once tree heights are adequate to support them and provide primary habitat for these species, as they recolonise these areas.

5.4.8 Carrying Capacity and/or Stocking Rates

The Agricultural Impact Assessment (Neil Nelson Agvice Pty Ltd, July 2015) states that the current stocking rate is 5 D.S.E. per hectare on the areas of existing pasture, though with good seasonal conditions and increased fertiliser application and seed sowings, this could increase to 7 D.S.E. per hectare for unmined lands. This is comparable to the carrying capacities estimated by NSW DPI for similar pasture types within the Hunter Region (NSW Dept. of Primary Industries, 2006).

Based on the assessment of the following parameters and the fact that the direct seeding species mix and land management practices that are currently used for the post mined lands returning to grazing at the Mine are similar to those used on other mines across the Hunter;

- Pasture quality (digestibility , crude protein and metabolisable energy;
- Cattle weight;
- Cattle health; and
- Carcass comparison.

Based on this data it is feasible to assume that the conclusion of the Glencore Grazing trial (NSW Minerals Council UHMD Presentation) which follow could be achieved at the Mine;

- Tropical pastures which are synonymous with rehabilitated lands generally have a higher feed quality and are more readily grazed that native grasses, resulting in enhanced cattle productivity performance.

This is further supported by recent unpublished studies undertaken by Mine environment staff to assess pasture growth on post mined lands where the growing media that has been treated with biosolids (current practice at the Mine) and two compost treatments used as post mined lands soil ameliorants. This study determined that the areas that had been treated with biosolids offered the highest potential stocking rates at 7.3DSE/ha at March 2015.

5.5 Phase 5 Ecosystem and Landuse Sustainability

Ecosystem and Landuse Sustainability involves the:

- Development of landuse and land capability which is consistent with the surrounding areas;
- Development of landuse options that provide optimal and sustainable social and economic benefit to the local community;
- Selection of species to achieve species diversity and abundance for both flora and fauna;
- Development of profiles in the growing media; and
- Use of vegetation communities capable of withstanding catastrophic events e.g. bushfire and extensive drought.

5.5.1 Maintenance revegetation works

As with all successful grazing based systems, maintenance works are required in terms of fertiliser and vegetation enhancement to ensure successful growth of cattle. Maintenance works to be implemented at this phase of the rehabilitation program may include:

- Soil sampling for the purpose of defining fertiliser and seeding regimes;
- Application of defined fertiliser – in terms of rates and mix; and
- Over sowing of pasture with legumes – species may include, sub. Clover (6kg/ha) varieties, Haifa white clover (2kg/ha), Woolly Pod Vetch (4kg/ha), green panic (5kg/ha), Sirosa phalaris (4kg/ha), Sephi Barrel Medic (4kg/ha) and Lucerne (4kg/ha).

5.5.2 Bushfire Management

A hazard reduction plan has been drawn up in consultation with the Rural Fire Service. The Rural Fire Service conduct hazard reduction activities on The Bloomfield Group managed lands surrounding the mining operation.

Bushfire risk is managed through ameliorative actions as well as management safeguards.

Ameliorative actions:

- Ensuring mining activities that have the potential to cause ignition such as sparks from vehicles, metal grinding, welding etc. are managed;
- Ensuring vegetation does not interfere with power lines;
- Creating firebreaks to ensure that bushfire does not spread from surrounding lands; and
- Grazing on older established rehabilitation areas if required to reduce fuel loads.

Management safeguards:

- The provision of firefighting equipment;
- Fire training for staff and on site fire-fighting team;
- Suppression of any bushfire outbreaks;
- Effective communication strategies to ensure all employees, contractors and service providers are aware of fire emergency policies and procedures as well as any NSW Rural Fire Services Fire Bans;
- Maintenance of appropriate fire breaks and perimeter trails; and
- Hazard reduction burns conducted when required by the local Darlington Bushfire Brigade.

5.6 Phase 6 Rehabilitation Complete

By this stage ongoing monitoring and implementation of maintenance works will demonstrate that the rehabilitation process has been successful.

Once a rehabilitated area is deemed to be potentially suitable for sign-off, a Sign-off Report will be submitted to the regulators. This report will include the following information for the proposed sign-off area:

- Survey Plan clearly showing the proposed area;
- Area size, disturbance and rehabilitation history;
- Monitoring data compared against rehabilitation aims, objectives and completion criteria;
- Final maintenance inspection findings;
- Photographs of the proposed area; and
- Analysis of rehabilitation development and sustainability.

At the completion of rehabilitation:

- The site would be safe, stable and non-polluting;
- With the exception of inputs related to the operation of a grazing property (e.g. fertiliser on areas of pasture) the site would be self-sustainable;
- The rehabilitation program would have been signed off by all parties;
- The Mine Lease (or a portion of a greater lease) would be relinquished, and the security bond returned; and
- The mine would have no further responsibility for these areas and the relevant Mine Operations Plan would provide details of relevant agency reviews and sign-offs.

5.7 Potential for Integrating this Strategy with Adjacent Mines

Where practical the post mining landform will be developed to align with that of the adjoining Integra Coal Operations and consistent with the landscape of the surrounding area. The revegetation program will review the rehabilitation planning framework of the Integra Coal Operations as defined in its Mine Operations Plan and recent AEMRs, in the context of the location of biodiversity areas, pathways to optimise pasture for beef cattle grazing and water storage features. The Statement of Commitments in the Integra Open Cut Environmental Assessment (URS, 2009), states that *the majority of the post-mine landform will be revegetated with a combination of native and improved pasture species with scattered tree lots and tree corridors linking the surrounding rehabilitated areas, proposed tree planting corridors and surrounding existing native vegetation*, which is in accordance with the rehabilitation objectives of the Mine.

A review of the seeding mixes (2013 AEMR) used at the Integra Coal Operations site reflect similarities between it and that used at the Mine.

The Rehabilitation Strategy for the Mine recognises that the Integra Coal Operations is currently under care and maintenance, however the operation has a current Project Approval that allows open cut operations to continue until 2023 and underground mining to occur until 2036 (Integra Coal Operations, March 2014). Should the mine become operative again, in this time frame, then discussions will be undertaken with the Integra Coal Operations team, with a focus of optimising the integration of the rehabilitation program between both mine sites.

6.0 Performance Criteria, Measures and Indicators

In accordance with the DRE Mine Operations Plan Guidelines (NSW Trade and Investment, Regional Infrastructure and Services – Division of Resources and Energy, Sept 2013) the performance criteria, measure and indicators have been defined for each domain in the context of the phase of the rehabilitation program. This includes the following:

- Nomination and justification of **performance measures**. Performance measures are used to quantify the rehabilitation and land management programme in terms of efficiency or effectiveness and establish the indicative timeframes for completion, and the standards of completion;
- Identification of **performance indicators** of the biophysical environment or where applicable; the built environment that can be reliably measured and audited over time using accepted scientific techniques and standards i.e. Australian Standards to demonstrate (and track) the progress of an aspect of rehabilitation towards a desired completions criteria; and
- Establishment of the **performance/completion criteria** for each indicator which quantitatively demonstrates rehabilitation. These are objective target levels or values and are usually in a numerical value.

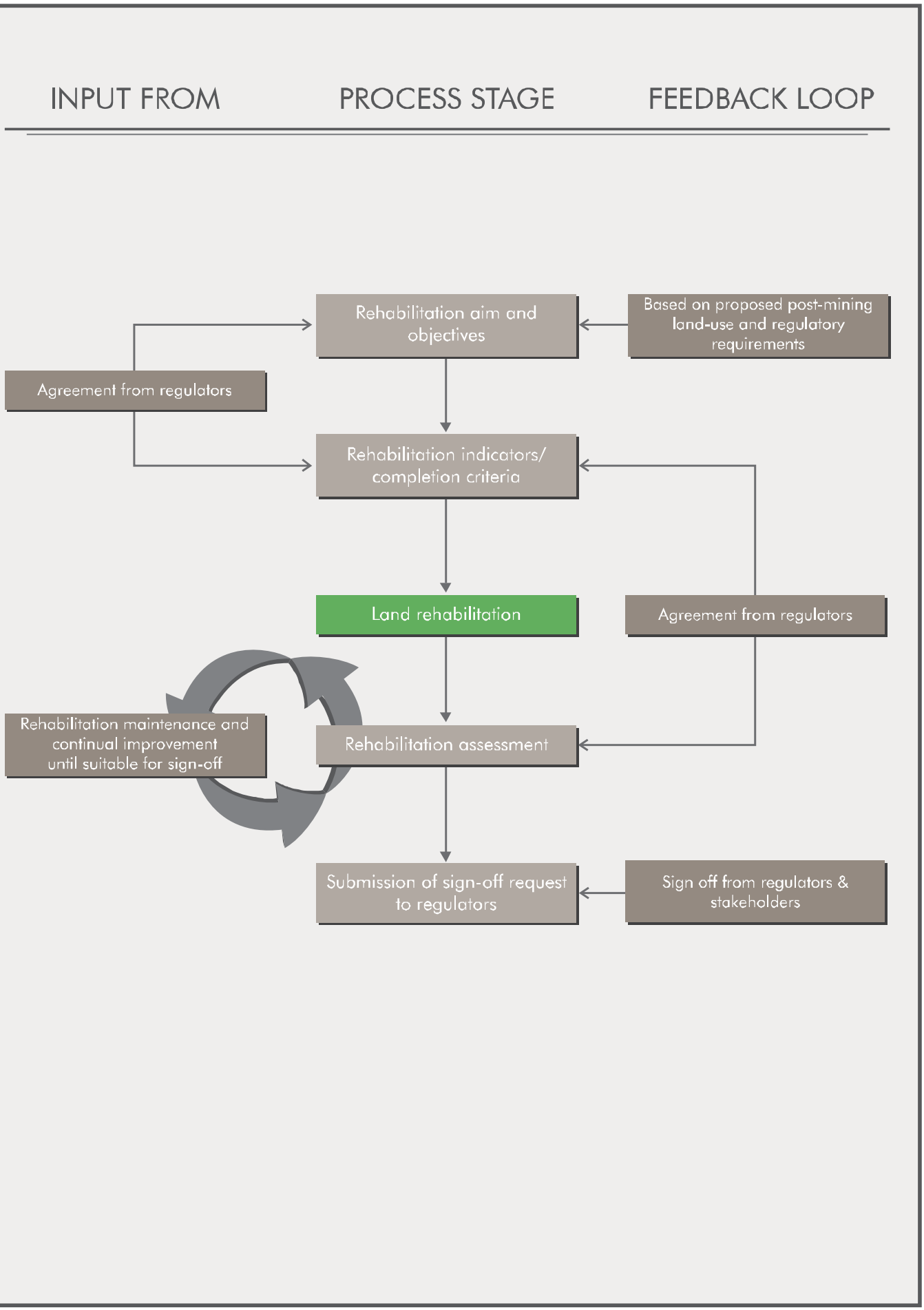
The criteria, measures and indicators which provide the framework for this Strategy are those that have been developed for the Mine Operations Plan and are underpinned by a range of documents which relate to land management and site rehabilitation. These include industry standards and Rix's Creek Mine Standards and Procedures. The ongoing development of these documents will provide the basis for the periodic review of the Mine Operations Plan with resultant amendments being recorded in the AEMR.

There is an element of risk attached to the development of performance criteria, in that it is impossible to predict all of the variables that might influence the recovery or otherwise of those lands which are rehabilitated. Many variables operate at catchment or regional scales, such as river flows and pest outbreaks. Other factors that operate at continental or even global level, include climatic influences (including droughts or floods brought about by La Niña and El Niño events). These factors may significantly influence the long-term sustainability of the vegetated lands at the Mine. To this end, the performance criteria and measures have been designed to provide an appropriate benchmark or guide against which to assess the management of Project lands and the resulting improvements.

The objectives, measures, performance indicators and criteria are designed to form the basis of the performance measure and provide the ability to track the development of sustainable ecosystems through the conceptual phases in **Figure 6**. This information is provided for all defined rehabilitation domains in **Table 6** and aligned to a pictorial representation in **Figure 5**.

The objectives, measures, performance indicators and criteria relating to the phase of Rehabilitation Complete will be defined in the mine closure MOP and as such are not described in **Table 6**.

Where required, these elements are completed with input and agreement from relevant external parties, such as landowners and regulators. A flowchart of the rehabilitation process is presented in **Figure 6**.



\Projects\60283290_RixCreek_Mine4...Tech work area\4.7 Graphics\FIGURES\Rehabilitation Strategy\60283230 F5 Bloomfield Group Rehabilitation Management Process 18.06.2015 TO Rev A

AECOM

BLOOMFIELD GROUP REHABILITATION MANAGEMENT PROCESS

Rix's Creek Continuation of Mining
Environmental Impact Statement

DATA SOURCE: DRE Mining Operations Plan (MOP) Guidelines, September 2013 (based on Nichols, 2005)

FIGURE 6

Table 6 Rehabilitation Objectives, Performance Indicators and Measures and Criteria

Objective	Performance Indicator	Performance Measure	Completion Criteria	Justification / Source
Phase 1 – Decommissioning				
Domain – Tailings Emplacement Area				
Removal of tailings infrastructure associated with tailings emplacement area	Removal of pipelines and pumps and related tailings infrastructure	Audit showing safe removal of all tailings infrastructure	Section 101 from DTIRIS-DRE	DRE Requirements
Successful capping of tailings emplacement area to ensure no contamination from buried tailings materials	Cover of inert material	- Engineering inspections / Tailings emplacements audits; and - Acceptable cover material for capping design documentation.	Third party audits and site inspections reports confirm successful achievement of final land use	DRE Requirements
Phase 2 – Landform Establishment				
All Domains except Final Void				
Rehabilitated land will: Be safe and stable; Be compatible with the surrounding natural landscape; and Incorporate a stable drainage network	- Year 1: Rehabilitated areas of greater than 10° slopes will be minimised during re-contouring; - Year 1: Appropriately designed water/sediment management structures (contour banks, drains and drop structures) incorporated into landform design and constructed during re-contouring; - Year 3: No evidence of slumping, settling or subsiding landform; - Year 3: Erosion rills stabilising, compared to Year 1 results; and - Year 5: No evidence of failed water management structures.	- Third party audit against safety regulations; - Slopes surveyed and reconciled against approved final slopes in the Final Mine Closure Plan; and - Rehabilitation monitoring results – rill surveys.	- No rehabilitated areas of greater than 18° slopes; - No evidence of failed sediment control structures (dams, drains and drops structures); - Surface tailings emplacement areas will be capped with 2m of overburden and rehabilitated; and - Erosion rills remaining stable. No significant increases in number and/or size of rills since last monitoring.	(DECC, 2008)

Objective	Performance Indicator	Performance Measure	Completion Criteria	Justification / Source
Phase 3 – Growing Media Development				
Domain – Rehabilitated Lands				
A sustainable vegetation cover will be established on rehabilitated land (soils)	- Year 3: pH, EC and nutrient levels moving towards completion criteria; and - Year 5: pH, EC and EAT at or near completion criteria. Nutrient levels acceptable.	Tests assessing the growing media's chemical properties – pH, EC, nutrient levels	Soils in the root zone should meet the following criteria: - EC <0.6 dS/m; - pH between 4.5 and 9; - EAT Class 3 – 8; and - Nutrient levels acceptable for pasture establishment.	Mine Operations Plan
Rehabilitated land will be topsoiled, fertilised and sown with grass and/or native vegetation species	Year 1: Biosolids applied in accordance with Environmental Guidelines: Use and Disposal of Biosolids Products ((NSW Environment Protection Authority, 2000))	GIS data sets with records of areas and application rates for biosolids use	Rehabilitation documented, indicating the required works completed	Mine Operations Plan
Phase 4 – Ecosystem and Landuse Establishment				
Domain – Rehabilitated Lands				
Land will be rehabilitated in accordance with relevant DRE standards applicable at the time of rehabilitation	Relinquishment reports and associated monitoring data	DRE rehabilitation audits	DPI-MR sign-off on land submitted for relinquishment	Mine Operations Plan
Land and soil capability will be returned to a class similar to that existing prior to the commencement of mining (generally Classes IV, V and VI)	Land and soil capability indicators met	- Rehabilitation monitoring results; and - GIS mapping of land and soil capability classes with relevant data collected during rehabilitation monitoring.	- Land meets land and soil capability classes as per final landuse design; and - Land and soils capability classes mapped on relinquishment plan.	(NSW Office of Environment & Heritage, Oct 2012)
Rehabilitated land will be topsoiled, fertilised and sown with pasture and/or native vegetation species	Year 3: 70 % vegetation cover, with evidence of tree establishment in tree lots	Rehabilitation monitoring results	Rehabilitation documented, indicating the required works completed	Mine Operations Plan

Objective	Performance Indicator	Performance Measure	Completion Criteria	Justification / Source
Property layout will be planned and designed for optimal use in terms of cattle management	Planning, design and layout undertaken including fencing (materials and construction), delineation of paddocks, access to watering points, stock handling facilities and stock refuge areas	- GIS data on fences, gates, access tracks and paddock layout; - Routine inspections of fences; and - Access tracks are inspected and maintained.	- GIS data sets; - All fences are intact and contain/ control cattle movement; and - Access tracks are accessible and fit for purpose.	Mine Operations Plan
A sustainable vegetation cover will be established on rehabilitated land	- Year 3: Evidence of litter layer developing; - Year 3: Tree plots indicating good tree growth; and - Year 5: Tree species displaying successful recruitment.	Rehabilitation monitoring results	- Achieve a vegetation cover of 70%, or combined live and litter cover of 70% in established tree belt areas; - Tree belts or plots established, with evidence of continued recruitment; and - Surface litter layer present at 75% of sites	Mine Operations Plan
	- Weed and pest animal control is implemented.	- GIS data on control programs; - GIS data on weed distribution and density; and - Records on implemented work including pesticide usage.	- Noxious weeds and pest animal species are controlled in accordance with legislative requirements.	Mine Operations Plan
Bushfire preparedness and risk mitigation.	Vegetation is managed to control fire	- Implementation of ameliorative actions and management safeguards; and - GIS data on areas where bushfires impact.	- Any bushfires starting on site are controlled; and - GIS data on bushfire footprint.	*Rural Fires Act 1997*

Objective	Performance Indicator	Performance Measure	Completion Criteria	Justification / Source
Phase 5 – Ecosystem and Landuse Sustainability				
Rehabilitated land will: - Represent a minimal source of offsite environmental impacts; - Require ongoing management inputs no greater than similar adjacent land; and - Be compatible with the proposed post-mining land-use.	All progress indicators regarding landform stability and vegetation cover met	Rehabilitation monitoring results	All completion criteria regarding landform stability and vegetation cover met	Mine Operations Plan
	Carrying capacity and stocking rates are comparable to that of surrounding lands	- Assessment of herbage mass and herbage composition; - Assessment of feed quality and potential carrying capacity; - Assessment of soil nutrient; and - Assessment of cattle weight.	Average weight gain for 350kg yearlings is >1.0kg/day	(NSW Dept. of Primary Industries, 2006)
	Weeds reported and treated during monitoring program	- Annual weed surveys; and - GIS records of weeds infestations and treatment areas.	No significant infestations of declared weeds	*Noxious Weeds Act 1993* TSC Act – Key Threatening Processes Australian and NSW Weed Strategies
	Water monitoring results within limits of the current Environment Protection Licence (EPL)	Ongoing monitoring and inspection of water management structures by appropriately qualified person	Water leaving site must meet current EPL criteria	Current EPL

7.0 Rehabilitation Monitoring and Reporting

7.1 Inspection

All rehabilitated areas will be inspected by site environment staff (or specialist consultants) to note any problem areas (such as bare patches, failed vegetation, drainage structure failure, significant erosion or significant weed infestation) requiring maintenance or further treatment. Remedial works will then be scheduled to address these areas. The assessment program is designed to collect sufficient data to compare the results of rehabilitation against the agreed completion criteria. The assessment program consists of three components:

- Annual maintenance inspections;
- Scheduled rehabilitation monitoring; and
- Review of inspection/measurement data over time to assess rehabilitation performance.

In the event that the inspection finds there are issues with the rehabilitation, further investigations should be undertaken to determine the possible causes and identify an appropriate remediation strategy. Factors to consider include:

- Nutrient levels;
- Soil limitations such as depth, pH, salinity;
- Insect attack, weeds or other pests;
- Species mix in revegetation programs;
- Drought or storm damage; and
- Excessive grazing.

Where appropriate, the rehabilitation procedures will be amended to improve the standard of rehabilitation.

7.2 Monitoring Sites

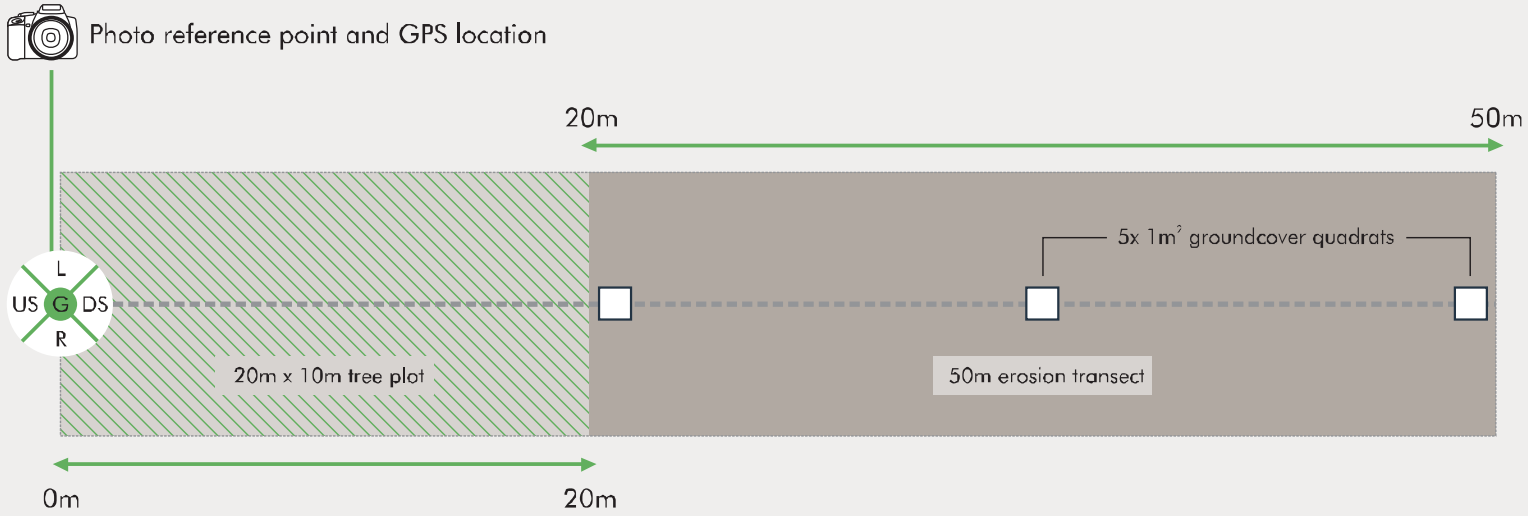
The monitoring sites will be permanently marked using steel pickets or similar. Representative monitoring sites will be established in newly rehabilitated areas at an average of one site per 10 ha of newly rehabilitated land, with monitoring plots being based on a 50m transect, positioned along the contour of the slope, and permanently marked using steel pickets. Each site will be monitored within 12 months of establishment and then every two years after. This will provide three sets of monitoring data in the first five years following rehabilitation.

The parameters to be assessed include:

- Landform:
  - average slop gradient; and
  - steepest slope gradient.
- Drainage:
  - Contour bank design – number interval and gradient;
  - Contour banks discharge point; and
  - Other drainage structures – dams, drop structures, diversions.
- Surface preparation:
  - Topsoil used – source, depth;
  - Ameliorants or supplements used – rate / ha; and
  - Ripping – depth / type.

- Vegetation establishment;
    - Method – direct seeding or tubestock;
    - Seed mix – species, rate, source;
    - Tubestock – species, density, source; and
    - Fertiliser – type, rate.
- Carrying capacity and stocking rates –
    - Assessment of herbage mass and herbage composition;
    - Assessment of feed quality and potential carrying capacity;
    - Assessment of soil nutrient; and
    - Assessment of cattle weight.
- Weeds – distribution, density and species;
- Fauna recolonising the area – in terms of species recorded and their indicators e.g. scats, tracks, nests;
- Vegetation – groundcover as percentage, groundcover species; species diversity; evidence of recruitment; plant health;
- Nutrient recycling – depth of litter; presence of cryptograms;
- Soils/surface condition;
- Land and soil capability;
- Erosion and stability; and
- A photo showing the general rehabilitation condition.

A standard monitoring plot design as shown in **Figure 7** will be used.



KEY	
L	Left
R	Right
US	Upslope
DS	Downslope
G	Ground

AECOM

STANDARD LAYOUT OF REHABILITATION MONITORING PLOT

Rix's Creek Continuation of Mining
Environmental Impact Statement

FIGURE 7

7.2.1 Soil Analysis

Soil analysis will be undertaken to confirm that growth media is not likely to inhibit the sustainable development of a vegetative cover. As well as field observations and tests made during monitoring, soils analysis will consist of:

- Collecting representative root zone soil samples during field monitoring;
- Sampling prior to application of biosolids to define the application rates that can be used as per the EPA guidelines (NSW Environment Protection Authority, 2000); and
- Testing for pH, EC and Emerson Aggregate Test (indication of erosion potential).

7.2.2 Pasture Productivity Assessment

In areas of with a post mining landuse aligned to pasture, pasture sampling will be undertaken in accordance with the collection technique guidelines – *Form Collect1-Version No.2-01/11/07 supplied by the NSW Department of Primary Industries* (DPI) (NSW Department of Primary Industries, 2007). Samples are to be sent to an accredited laboratory for analysis to determine the quality of feed available. Based on the testing results on the feed quality, pasture productivity will be calculated aligned to stocking rates and farm size assessment tools relevant for beef cattle in the Hunter Valley, which in turn determine sustainable carrying capacities.

7.2.3 Land and Soil Capability Assessment

As for disturbance monitoring, the survey area for this component of the monitoring program will not be limited to the transect/plot area, but rather will include the broader surrounding area containing the nominated transects/plots. The land and soil capability system is applied to the survey area in accordance with the guidelines *The Land and Soil Capability Assessment Scheme* (NSW Office of Environment & Heritage, Oct 2012).

Data will be collected on a range of hazards that are assessed to determine the land and soil capability of the land. These will include climate, soils, erosion and landform.

7.2.4 Photographic Monitoring

Photos will be taken from the permanent star pickets located at the start and end of the monitoring transect/plot, looking in the direction of the transect line. A ground to sky ratio of 5:1 is used where possible. Once the 50 m tape has been laid between the two star pickets, three digital photographs are to be taken as follows:

- A photograph is to be taken to the left of the tape (with the tape just in the frame in the far right);
- A photograph is to be taken with the tape (and star picket) in the centre of the frame; and
- A photograph is to be taken to the right of the tape (with the tape just in the frame in the far left).

Alternatively, and depending on the capability of the digital camera being used, a panoramic shot can be taken centred around the star picket.

7.3 Reporting

7.3.1 Mine Operations Plan

Under the *Mining Act 1992*, environmental protection and rehabilitation are regulated by conditions in all mining leases, including requirements for the submission of a Mine Operations Plan.

The Rix's Creek Mine Operations Plan (Rixs Creek Mine, March 2013) was prepared for the owner/operator of Rix's Creek - Bloomfield Collieries Pty Limited (BCL) for the specific purpose of satisfying the requirements of Mining Lease 1432 (ML 1432 – Clause 2) and Coal Lease 352 (CL352 – Clause 3). It was also been prepared in accordance with requirements of the DRE *Draft Mining Operations Plan Guidelines* (NSW Trade & Investment Environment Sustainability Unit - Mineral Resources, March 2013) for Level 1 mines.

7.3.2 Environmental Management System

The ongoing effectiveness and efficiency of the site Management System is monitored as part of the operation's day-to-day management. Feedback from this and other more formal reviews and/ or following special occurrences, form the basis for System improvement and re-design.

In general Management Systems are reviewed and up-dated as follows:

- Every three years; or
- Whenever there is a significant change to relevant legislation; or
- If required to do so by the Regulations; or
- Whenever there is a significant change to the operations; or
- If required (in writing) to do so by the Chief Inspector; or
- Whenever control measures are found to be ineffective either through:
- Changes to the working environment; or
- Changes to operating systems; or
- Subsequent risk assessments; or
- The findings of an audit; or
- Following a fatality or dangerous incident that could reasonably have been expected to result in a fatality; or
- Following an assessment of a related safety alert.

Continual Improvement

Operational activities will be subject to regular review to ensure conformance with commitments made in the EMS and subordinate plans and strategies.

Document Management

Copies of this document will be managed under the Group Document Management System. This document and other relevant documents are kept on site and are available to all employees.

The Bloomfield Group company directors will be responsible for the overall rehabilitation and environmental performance of the Mine. Senior Operational managers have direct responsibility for the rehabilitation process. The Senior Environmental Officer provides direction and advice to ensure site environmental compliance is maintained. The Senior Environmental Officer and Environmental Officer are responsible for the implementation of the works for the Mine. This involves insuring all aspects of the rehabilitation processes are followed and carried out.

7.3.3 Annual Environment Management Report

The Bloomfield Group prepares an Annual Environment Management Report (AEMR) as part of the Department of Primary Industries – Mineral Resources' Mining, Rehabilitation and Environmental Management Process framework. This report compiles monitoring results and discusses trends, system changes and responses to any potential issues identified during monitoring. Targets and future initiatives are also identified.

As required by its Development Consent, The Bloomfield Group will undertake an Annual Review of the environmental performance of the Project, which is reported in the AEMR. This review will include:

- Description of the works (including any rehabilitation) that were carried out during the previous calendar year, and the works that are proposed to be carried out over the current calendar year;
- A comprehensive review of the monitoring results and complaints records of the Project over the previous calendar year, which includes a comparison of these results against the:
    - relevant statutory requirements, limits or performance measures/criteria;
    - monitoring results of previous years; and
    - relevant predictions in the Environmental Assessments;
- Identification of any non-compliance over the previous calendar year, and description of actions which were (or are being) taken to ensure compliance;
- Identification of any trends in the monitoring data over the life of the project;
- Identification of any discrepancies between the predicted and actual impacts of the Project, and analysis of discrepancies;

- Identification of the potential cause of any significant discrepancies; and
- Description of measures which will be implemented over the current calendar year to improve the environmental performance of the project.

7.3.4 Relinquishment Reporting

Prior to submission of a sign-off proposal, the land proposed for signoff will be subjected to a final maintenance inspection. This inspection will cover the whole area proposed for sign-off. The outcome of the inspection will be a documented description and photographic record of the general condition of rehabilitation, highlighting any areas of potential concern. This report will be included in the submission to DRE.

Once a rehabilitated area is deemed to be potentially suitable for sign-off, a Sign-off Report will be submitted to the regulators. This report will include the following information for the proposed sign-off area:

- Survey Plan clearly showing the area proposed for relinquishment;
- Area size, disturbance and rehabilitation history;
- Monitoring data compared against rehabilitation aim, objectives and completion criteria;
- Final maintenance inspection findings;
- Photographs of the proposed area; and
- Monitoring data that demonstrates that the proposed area has reached the objectives, measures, performance indicators and criteria for Rehabilitation Complete as described in the MOP.

8.0 Bibliography

ANZMEC and MCA. (2000). *Strategic Framework for Mine Closure.*

Neil Nelson Agvice Pty Ltd. (July 2015). *Rix's Creek Continuation of Mining Project - Agricultural Impact Statement.*

NSW Trade & Investment Environment Sustainability Unit - Mineral Resources. (March 2013). *ESG3 Mining Operations Plan (MOP) Guidelines.*

Bloomfield Company Ltd. (2011). *Mining Operations (Rix's Creek Mine) – Water Management Plan, Site Water Management Plan Ver 2- 091111 Rix's.*

Commonwealth of Australia. (n.d.). *Mine Closure and Completion – Leading Practice Sustainable Development Program for the Mining Industry .*

DECC. (2008). *Managing urban stormwater – soils and construction, Volume 2E Mines and Quarries.*

Environmental, J. (Nov 2014). *Surface Water Study for Rixs Creek Continuation of Mining.*

Envirosciences Pty Limited. (Nov 1994). *Environmental Impact Statement for Proposed Modifications of Mining Operations - Rixs Creek Coal Mine.*

Integra Coal Operations. (March 2014). *Annual Review - 2013.*

JP Environmental. (2010). *Erosion and Sediment Control Plan.*

Landcom. (2004). *Managing urban stormwater – soils and construction, Volume 1, 4th edition.*

NSW Department of Primary Industries. (2007). *Collecting Feed Samples, Form collect 1 – version no.2 – 01/11/2007.* Wagga Wagga .

NSW Dept. of Primary Industries. (2006). *Beef stocking rates and farm size—Hunter Region.*

NSW Environment Protection Authority. (2000). *Use and Disposal of Biosolid Products.* Sydney.

NSW Minerals Council UHMD Presentation. (n.d.). Liddell Grazing Trial - Dec 2012 - June 2014 .

NSW Office of Environment & Heritage. (Oct 2012). *The Land and Soil Capability Assessment Scheme - 2nd Approximation.* Sydney.

NSW Trade and Investment, Regional Infrastructure and Services – Division of Resources and Energy. (Sept 2013). *Mining Operations Plan (MOP) Guidelines.*

NSW Trade and Investment, Regional Infrastructure and Services – Division of Resources and Energy. (Sept 2013). *Mining Operations Plan (MOP) Guidelines.*

Office of Environment & Heritage. (2012). *The Land and Soil Capability Assessment Scheme; Second approximation.*

Rixs Creek Mine. (2007). *Rix's Creek Colliery Coke Ovens Conservation Plan .*

Rixs Creek Mine. (March 2013). *Mining Operation Plan - Rixs Creek Mine.*

SLR Consulting Australia Pty Ltd. (10 June 2015). *Soils and Land Impact Assessment.*

SLR Consulting Australia Pty Ltd. (June 2015). *Soils and Land Impact Assessment - Rixs Creek Continuation of Mining Project.*

SLR Consulting. (July 2014). *Biophysical Strategic Agricultural Land Verification Assessment.*

URS. (2009). *Environmental Assessment, Integra Open Cut Project .*

This page has been left blank intentionally.

9.0 Acronyms

ACARP	Australian Coal Association Research Program
AEMR	Annual Environmental Management Report
BCL	Bloomfield Collieries Pty Limited
BSAL	Biophysical Strategic Assessment Land
CCC	Community Consultative Committee
CHPP	Coal Handling Preparation Plant
DGRs	Director–General's Requirements
DP&I	Department of Planning and Infrastructure
DPI	NSW Department of Primary Industries
DRE	Division of Resources and Energy, within the NSW Department Trade & Investment, Regional Infrastructure & Services
DTIRIS	NSW Department Trade & Investment, Regional Infrastructure & Services
EA	Environmental Assessment
EC	Electrical Conductivity
EMP	Environmental Management Plans
EMS	Environmental Management System
EPA	NSW Environmental Protection Agency
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPL	Environmental Protection Licence
ESCP	Erosion and Sediment Control Plan
GIS	Geographical Information System
ha	Hectare
ML	Mining Lease
Mtpa	Million tonnes per annum
OEH	Office of Environment and Heritage
REMP	Rehabilitation and Environmental Management Plan
ROM	Run Of Mine
TEA	Tailings emplacement areas
WMP	Water Management Plan