Appendix J

Preliminary Biophysical Strategic Agricultural Land Rehabilitation Strategy

Bylong Coal Project

Gateway Certificate Application
Supporting Document

global environmental solutions

Bylong Coal Project

Preliminary BSAL Rehabilitation Strategy

Report Number Han01.005

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Bylong Coal Project

Preliminary BSAL Rehabilitation Strategy

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APPENDIX

1 INTRODUCTION

Hansen Bailey Pty Limited (HB) engaged SLR Consulting Australia Pty Ltd (formerly GSS Environmental) on behalf of Cockatoo Coal Limited (CCL) to undertake a Preliminary BSAL Rehabilitation Strategy for the Bylong Coal Project (the Project), which is owned by KEPCO Bylong Australia Pty Ltd (KEPCO). CCL have been engaged by KEPCO to manage the exploration, mine planning, and environmental approvals aspects of the Project.

This Preliminary BSAL Rehabilitation Strategy provides supporting documentation for the Project's Gateway Application to address the requirements of the New South Wales (NSW) Government's Strategic Regional Land Use Policy (the Policy) ((Department of Planning Department of Planning & Infrastructure(DP&I)).

Under the Policy, State Significant Development (SSD) proposals related to mining that are likely to impact on areas of Strategic Agricultural Land (SAL), both Biophysical Strategic Agricultural Land (BSAL) or Critical Industry Cluster (CIC) areas are subject to a new Gateway process. The Gateway process has been implemented through an amendment to, inter alia, *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007* (Mining SEPP) and the *Environmental Planning and Assessment Regulation 2000*.

Any SSD proposal related to mining which is likely to impact on BSAL, must address Clause 17H(4a) of the Mining SEPP. Appropriate supporting documentation addressing this clause is then issued to the Gateway Panel for review.

At the completion of its review, the Gateway Panel issues a Gateway Certificate, which is either unconditional or conditional. A conditional certificate provides recommendations as to how the proposal can satisfy the criteria as part of the Development Application (DA) process. Once the applicant has been issued a Gateway Certificate, lodgement of a DA can proceed.

1.1 Project Background

The Project is located wholly within Authorisation (A) 287 and A342 which both fall within the Mid – Western Regional Council Local Government Area (**Figure 1.1**). The closest regional centre is Mudgee located approximately 55 kilometres (km) west-south-west of the Project. The small settlement of Bylong Village is located within A287. The land to which the Project applies is within the Project Boundary and comprises the existing A287 and A342 covering approximately 10,317 hectares (ha) of land.

The proponent seeks the grant of a Development Consent for State Significant Development under Division 4.1 of Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) for the construction and operation of an open cut and underground coal mining operation for a period of approximately 29 years (each to operate for approximately 8 and 22 years respectively). The Project will facilitate the recovery of approximately 121 Million tonnes (Mt) of Run of Mine (ROM) coal from the Illawarra Coal Measures at a maximum rate of up to 6 Million tonnes per annum (Mtpa) ROM coal.

The total Project mine life is anticipated to be approximately 29 years, comprising a two year construction period and a 27 year operational period, with underground mining operations commencing in approximately Year 7. Various rehabilitation and decommissioning activities will be undertaken following the 29 years of the Project.

The Project, as illustrated on **Figure 1.2**, generally comprises:

- The initial development of two open cut mining areas with associated haul roads and Overburden Emplacement Areas (OEAs), utilising a mining fleet of excavators and trucks and supporting ancillary equipment;
- The two open cut mining areas will be developed and operated 24 hours a day, 7 days a week over an approximate 8 year period and will ultimately provide for the storage of coal processing waste products from the longer term underground mining activities;
- Construction and operation of an underground coal mine operating 24 hours a day, 7 days a week for a 22 year period, commencing in around year 7 of the Project;
- An extraction rate of up to 6 Mtpa of ROM coal;
- Underground mining operations utilising longwall mining techniques with primary access provided via drifts constructed adjacent to the rail loop and Coal Handling and Preparation Plant (CHPP);
- The construction and operation of a CHPP with a throughput of approximately 6 Mtpa of ROM coal;
- The construction and operation of Surface Facilities to support underground mining operations including (at least) the main personnel access to the mine, main ventilation facilities, workshop, offices and employee amenities, water and gas management facilities;
- A workforce of up to approximately 1,000 full-time equivalent employees during construction and 550 full-time equivalent employees during operation of the Project at full production;
- The dewatering of tailings through belt press filters within the CHPP, and the co-disposal of dewatered tailings and coarse rejects within OEAs and final open cut voids;
- The construction and operation of a rail loop and associated rail loading facility and connection to the Sandy Hollow-Gulgong Railway Line to facilitate the transport of product coal;
- The upgrade of Upper Bylong Road and the construction and operation of a Mine Access Road to provide access to the site facilities;
- Relocation of sections of some existing public roads to enable alternate access routes for landholders surrounding the Project, whilst privately owned;
- The construction and operation of administration, workshop and other mining related facilities;
- The construction and operation of surface and groundwater management and water reticulation infrastructure including pipelines, pumping stations and associated infrastructure for access to water from the neighbouring groundwater aquifers;
- The installation of communications and electricity reticulation infrastructure;

- Construction and operation of a Temporary Workers Accommodation Facility and associated access road from Bylong Valley Way; and

- Progressive rehabilitation of all disturbed areas and the decommissioning of Project infrastructure and rehabilitation of the land at the completion of mining operations.

1.2 Purpose of this Report

This Preliminary BSAL Rehabilitation Strategy provides supporting documentation for the Gateway Application that is being prepared for the Project. It establishes objectives and strategies for the rehabilitation of land that will be disturbed by the Project, with a particular focus on BSAL. It should be read in conjunction with the *Soils Assessment and Site Verification* (SLR, 2013) that has been prepared to describe the extent of BSAL within the Project Boundary as verified according to the *Interim Protocol for Site Verification and Mapping of Biophysical Strategic Agricultural Land* (Interim Protocol) (OEH & OAS&FS, 2013).

Given the Project is a SSD related to mining and will impact verified BSAL, Clause 17H of the Mining SEPP requires the following to be addressed during Gateway process:

> (4) The relevant criteria are as follows:
>
> > (a) in relation to biophysical strategic agricultural land – that the proposed development will not significantly reduce the agricultural productivity of any biophysical strategic agricultural land, based on a consideration of the following:
> >
> > > (i) any impacts on the land through surface area disturbance and subsidence,
> > >
> > > (ii) any impacts on soil fertility, effective rooting depth or soil drainage,
> > >
> > > (iii) increases in land surface microrelief, soil salinity, rock outcrop, slope and surface rockiness or significant changes to soil pH,
> > >
> > > (iv) any impacts on highly productive groundwater (within the meaning of the Aquifer Interference Policy),
> > >
> > > (v) any fragmentation of agricultural land uses,
> > >
> > > (vi) any reduction in the area of biophysical strategic agricultural land.

This Preliminary BSAL Rehabilitation Strategy addresses Clause 17H (4a), specifically items (i), (ii), (iii) and (vi). Items (iv) and (v) of Clause 17H(4a) are addressed in the Groundwater Impact Assessment (AGE, 2013) and Agricultural Impact Statement (Scot Barnett & Associates, 2013) prepared to support the Gateway Application for the Project.

A detailed Rehabilitation Strategy for the broader Project will be prepared as a component of the Environmental Impact Statement (EIS) once proceeding to the DA stage.

1.3 Guidelines and Standards

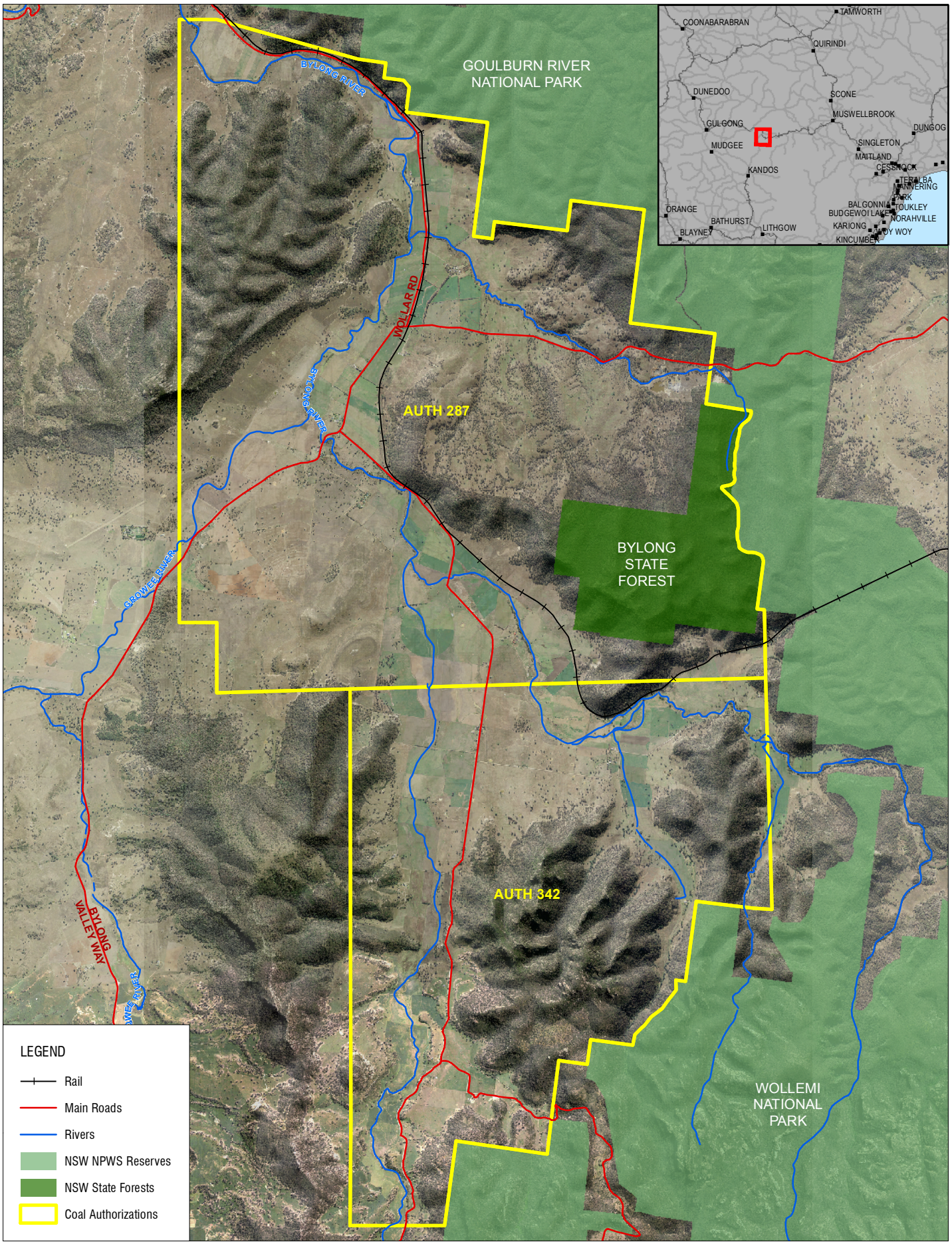
This report has prepared generally in accordance with the requirements of the following relevant strategic land use planning and resource management plans and policies:

- *Strategic Framework for Mine Closure* (ANZMEC, 2000)
- *Strategic Regional Land Use Policy: Guidelines for Gateway Applications* ((Department of Planning and Infrastructure (DP&I), 2013)
- *ESG3: Mining Operations Plan (MOP) Guidelines* ((Industry & Investment (I&I, 2013); hereafter referred to as the MOP Guideline
- *Interim Protocol for Site Verification and Mapping of Biophysical Strategic Agricultural Land* ((Office of Environment & Heritage (OEH) and Department of Primary Industries - Office of Agricultural Sustainability and Food Security (DPI-OASFS), 2013)), hereafter referred to as the Interim Protocol for BSAL Verification.

1.4 Key Project Members

The key authors of this Preliminary BSAL Rehabilitation Strategy and their relevant qualifications are detailed below.

Project Director	*Rod Masters*
	MSc, DipGeo, DipAppSc (Agric), CPSS III
	Executive
Project Manager	*Adele Calandra*
	BSc, MSc (Hons), CPSS II
	Snr Environmental Scientist



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Projection:	GDA 1994 MGA Zone 56

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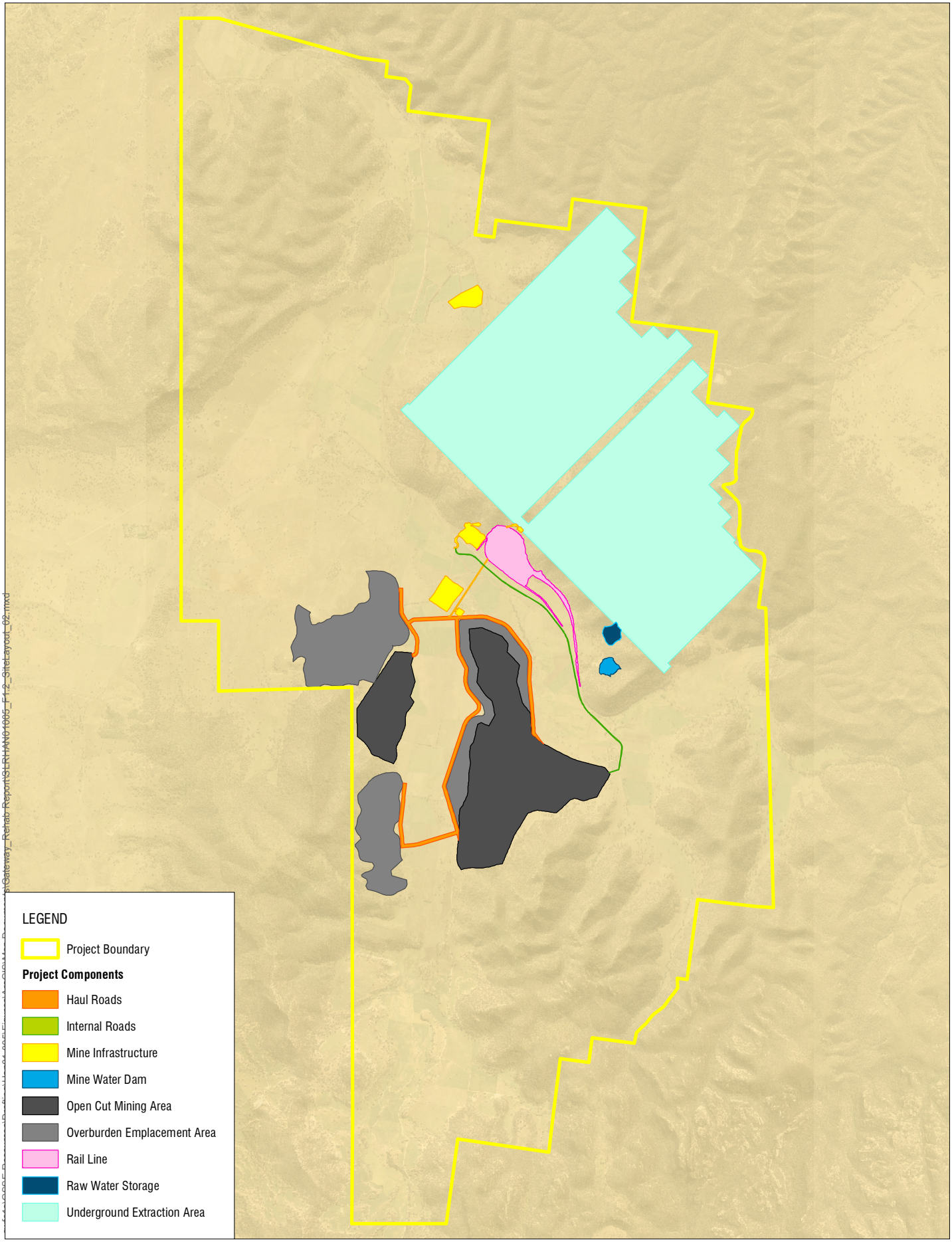
Preliminary BSAL Rehabilitation Strategy

Locality

FIGURE 1.1



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Preliminary BSAL Rehabilitation Strategy

Site Layout

FIGURE 1.2

2 REHABILITATION OBJECTIVES

2.1 Overview

Mine rehabilitation is an ongoing program designed to restore the physical, chemical and biological environment disturbed by mining to a state acceptable to stakeholders, including post-mining landholders.

The emphasis for management of rehabilitation is progressing into "*planning for closure*". Mine closure is a continuous series of activities that begins with pre-planning prior to a project's design and construction and resulting in the achievement of long-term site stability and the establishment of a self-sustaining final land use.

The concepts and standards underlying mine rehabilitation reflect stakeholder expectations and environmental imperatives. KEPCO accepts the concept and responsibility of mine site rehabilitation activities which will lead onto successful mine closure. This is demonstrated by means of the rehabilitation objectives and associated works program provided in the following sections.

2.2 Objectives

2.2.1 Overarching

The overarching rehabilitation objectives for the Project are to:

- Develop rehabilitation areas which are safe, stable, non-polluting and sustainable;
- Appropriately recover, store and re-handle suitable soil resources for future rehabilitation;
- Undertake progressive rehabilitation as soon as areas become available;
- Establish healthy and self-sustaining soil profiles and vegetation cover for future land use (e.g. agriculture) on both re-contoured (rehabilitated) and undisturbed lands (i.e. area dedicated for reinstatement of BSAL);
- Implement assisted natural regeneration methods on undisturbed areas to increase the integrity of land dedicated for reinstatement of BSAL;
- Create a post-mining landform which enables agricultural land uses and other environmental aspects;
- Develop a landscape that reduces the requirement for long term monitoring and management;
- Conduct maintenance (e.g. weed control, follow-up fertiliser, reseeding, erosion repair etc.) until rehabilitation is sustainable; and
- Monitor and manage rehabilitation areas to facilitate the process of achieving sign-off on pre-determined success criteria.

2.2.2 Project Components

The Project disturbance footprint covers approximately 2,666.6 ha of land within the Project Boundary and comprises seven major components, including:

- Open Cut Mining Areas;
- OEAs;
- Mine Infrastructure;
- Rail Loop;
- Roads (internal and haul roads);
- Water Storage Facilities (raw water storage and mine water dam); and
- Underground Extraction Area.

Table 2.1 provides the specific rehabilitation objectives for each Project component.

Table 2.1 – Preliminary Rehabilitation Objectives by Project Component

Project Component		Rehabilitation Objectives
1	Open Cut Mining Area	Shape overburden to provide a stable landform consistent with the surrounding environment and proposed post-mining land use. Any carbonaceous material emplaced within the Open Cut Mining Areas will be capped with suitable inert material.
		Final void within the Eastern Open Cut Mining Area will be progressively backfilled with the southern end remaining open for tailings and reject emplacement for the remaining mine life. Following closure of the mine, the area will be capped and rehabilitated as per the conceptual final landform.
2	OEA	Shape overburden to provide a stable landform consistent with the surrounding environment and proposed post-mining land use and minimise final void areas.
3	Mine Infrastructure	Remove all aboveground infrastructure and seal and recover underground infrastructure. Regrade embankments and cuttings where required and reshape landform to be similar to pre-mining landform. Drift to be rehabilitated by emplacement of a concentre plug with topdressing material for rehabilitation.
4	Rail Loop	Remove all aboveground infrastructure and cap and cover underground infrastructure. Regrade embankments and cuttings where required and reshape landform to be similar to pre-mining landform.
5	Roads:	
	Haul roads	Haul roads will have fill and road base material removed. Roads will be re-shaped to blend with the surrounding landform and revegetated with appropriate species. Buffer of 50 m
	Internal roads	Internal roads will be removed and rehabilitated, unless a post-mining use is available
6	Water Storage Facilities	
	Raw water storage dam	Dams will be drained and de-silted with dam walls re-shaped to blend

Project Component		Rehabilitation Objectives
	Mine water dam	in with surrounding environment
7	Underground Extraction Area	Monitor erosion, ponding and surface cracking during operations and post closure.

3 PRELIMINARY IMPACT ASSESSMENT

3.1 Risk Assessment

A risk assessment, in accordance with the *Interim Protocol for Site Verification and Mapping of Biophysical Strategic Agricultural Land – V7* (DPI-OAS&FS, 2013b), was undertaken by SLR during the BSAL verification survey work (SLR, 2013). This assessment assigned each Project component with a rating from low to high based on the soil disturbance. Further to this, rehabilitation objectives have been considered to assess the long-term impact (**Table 3.1)**:

- indirect and temporary,
- direct and temporary; or
- direct and permanent.

Table 3.1 – Preliminary Project Impact Category by Project Component

Project Component		Long-term Impact Category
1	Open Cut Mining Area	Direct and permanent
2	OEAs	Direct and permanent
3	Mine Infrastructure: - Employee & materials drift; - CHPP; - Overland Conveyor; - ROM coal pad; - Main access; - Administration buildings; and - Accommodation village	Direct and temporary
4	Rail Loop	Direct and temporary
5	Roads: haul roads and internal roads	Direct and temporary
6	Water Storages: raw water storage and mine water dam	Direct and temporary
7	Underground Extraction Area	Indirect and temporary

3.2 Entire Project Footprint

The amount of land in each impact category is summarised in **Table 3.3** and the key findings are:

- Indirect and temporary impacts cover 1,716.6 ha and comprise 64.3% of the Project footprint. This area is entirely covered by the Underground Extraction Area.
- Direct and temporary impacts cover 152.7 ha and comprise 5.8% of the Project footprint. This area is largely covered by the Rail Loop, Haul Roads and Mine Infrastructure area; however, also includes minor Project components such as the Internal Roads and Water Storage Facilities.

- Direct and permanent impacts cover 797.3 ha and comprise 29.9% of the Project footprint. This area is impacted upon by the Open Cut Mining Area and the OEAs.

Table 3.2 – Impact Category: Entire Footprint

Impact Category by Project Component	Area (ha)	Percentage (%)
Indirect and Temporary Impacts	**1,716.6**	**64.3**
Underground Extraction Area	1,716.6	64.3
Direct and Temporary Impacts	**152.7**	**5.8**
Mine Infrastructure	37.6	1.4
Rail Loop	50.2	1.9
Roads:		
Haul roads	48.4	1.8
Internal roads	4.4	0.2
Water Storage Facilities:		
Mine water dam	5.7	0.2
Raw water storage	6.4	0.3
Direct and Permanent Impacts	**797.3**	**29.9**
Open Cut Mining Area	439.2	16.5
OEAs	358.1	13.5
Total	**2,666.6**	**100.0**

3.3 Biophysical Strategic Agricultural Land within Project Footprint

3.3.1 Impact Category

The Soils Assessment and Site Verification (SLR, 2013) determined that there is approximately 401.3 ha of verified BSAL mapped in the Project disturbance footprint. Based on the above impact categories, the amount of verified BSAL and its associated soil type, within the Project disturbance footprint has been quantified. **Table 3.3** provides a summary and the key findings are:

- 46.2% (185.6 ha) of the verified BSAL within the Project disturbance footprint will be indirectly and temporarily impacted by the underground extraction area;

- 5.3% (21.3 ha) of the verified BSAL within the Project disturbance footprint will be directly; however, temporarily impacted by the development of internal road networks; and

- 48.4% (194.4 ha) of the verified BSAL within the Project disturbance footprint will be directly and permanently impacted by open cut mining areas and OEAs.

There are no impacts on verified BSAL resulting from the onsite Water Storage Facilities or the Rail Loop.

Table 3.3 – Impact Category : Biophysical Strategic Agricultural Land

Project Component and Soil Type	Area (ha)	Percentage (%)
Indirect and Temporary Impacts	**185.6**	**46.2**
Underground Extraction Area	185.6	46.2
Direct and Temporary Impacts	**21.3**	**5.3**
Road: haul roads	16.6	4.1
Road: internal roads	1.5	0.4
Mine Infrastructure	3.2	0.8
Direct and Permanent Impacts	**194.4**	**48.4**
Open Cut Mining Area	101.9	25.4
OEA	92.5	23.1
Total	**401.3**	**100.0**

3.3.2 Soil Units

The Soils Assessment and Site Verification (SLR, 2013) determined the BSAL to be impacted upon is underlain by eight soil units. This is largely comprised of three soil units; two from the Bald Hill Soil Unit (which covers 70.7% of the Project disturbance footprint) and one from the Growee Soil Landscape Unit (which covers 26.4% of the Project disturbance footprint) (**Table 3.4**). Collectively, these soil units account for 97.1% of the Project disturbance footprint. The remaining five soil units are largely associated with the Bylong Soil Landscape Unit.

The soils associated with the Bylong Soil Landscape Unit are alluvial influenced soils and are considered to have the highest productivity, relative to other soil types assessed as BSAL, due to high inherent fertility and availability of water resources within alluvial groundwater. The Project will impact 11.4 ha of the Bylong soil units. The impact is largely direct and temporary through the development of the Mine Infrastructure and haul roads. However, approximately 1 ha of the Bylong Soil Landscape Unit is located within the OEA, which is associated with a direct and permanent impact. Where practical, this land will be avoided as during mining operations.

The soils associated with the Bald Hill Soil Landscape Unit are igneous influenced and are considered to be the second most productive category of soil assessed as BSAL due to moderately high inherent fertility and good soil profile characteristics. The Project will impact 287 ha of the Bald Hill soil units. Of this a large proportion, 185.6 ha, will be indirectly and temporarily impacted upon by the Underground Extraction Area. The remaining 98.1 ha will largely be directly and permanently impacted upon by Open Cut Mining Areas and OEAs.

The sedimentary derived soils from the Growee Soil Landscape Unit are considered to be the least productive of the soil units assessed as BSAL. Inherent fertility for Soil Unit G05 is considered borderline due to low to moderate cation exchange capacity (SLR, 2013). The Project will impact 105.9 ha of the Growee soil unit, which is made up of Soil Unit G05 with a minor contribution of Soil Unit G012 (0.3 ha). A large proportion (98.8 ha) will be directly and permanently impacted upon by Open Cut Mining Area and OEAs with the remaining indirectly and temporarily impacted upon by the road network and Mine Infrastructure.

Table 3.4 – Soil Unit by Impact Category

Soil Unit by Impact Category	Area (ha)	Percentage (%)
Bald Hill Soil Landscape Unit	**283.7**	**70.7**
BH1	**98.1**	**24.4**
Direct and Permanent Impacts	*94.6*	*23.6*
Open Cut Mining Area	15.8	3.9
OEA	78.8	19.6
Direct and Temporary Impacts	*3.5*	*0.9*
Roads: haul roads	3.5	0.9
BH2	**185.6**	**46.2**
Indirect and Temporary Impacts	*185.6*	*46.2*
Underground Extraction Area	185.6	46.2
Bylong Soil Landscape Unit	**11.4**	**2.8**
B01	**2.1**	**0.5**
Direct and Permanent Impacts	*<0.1*	*<0.1*
OEA	<0.1	<0.1
Direct and Temporary Impacts	*2.1*	*0.5*
Roads: haul roads	1.2	0.3
Roads: internal roads	0.9	0.2
B02	**<0.1**	**<0.1**
Direct and Temporary Impacts	*<0.1*	*<0.1*
Roads: internal roads	<0.1	<0.1
B06	**8.3**	**2.1**
Direct and Permanent Impacts	*1*	*0.2*
OEA	1	0.2
Direct and Temporary Impacts	*7.3*	*1.8*
Roads: haul roads	7.3	1.8
B08	**1**	**0.2**
Direct and Temporary Impacts	*1*	*0.2*
Roads: haul roads	1	0.2
Growee Soil Landscape Unit	**106.2**	**26.5**
G05	**105.9**	**26.4**
Direct and Permanent Impacts	*98.8*	*24.6*
Open Cut Mining Area	86.1	21.5
OEA	12.7	3.2
Direct and Temporary Impacts	*7.1*	*1.8*
Roads: haul roads	3.6	0.9
Roads: internal roads	0.3	0.1
Mine Infrastructure	3.2	0.8
G12	**0.3**	**0.1**
Direct and Temporary Impacts	*0.3*	*0.1*
Roads: internal roads	0.3	0.1
Total	**401.3**	**100.0**

3.3.3 Land and Soil Capability Classification

The Soils Assessment and Site Verification (SLR, 2013) determined that of the BSAL to be impacted upon, approximately 73.6% is Land and Soil Capability (LSC) Class 3 land and the reminder (26.4%) is LSC Class 5 land. All soil units, within the Project disturbance footprint and associated with BSAL, are LSC Class 3 with the exclusion of Soil Unit G05 (Class 5) and Soil Unit B02 (LSC Class 4). Class 4 land represents less than 0.1 ha and is not discussed further in this strategy.

Class 3 lands are capable of high intensity land uses and are suitable for a range of agricultural uses including high-impact land uses such as cropping with cultivation. Class 5 land is moderate-low capable land that is largely restricted to grazing, some horticulture and forestry. Based on the previously defined impact categories, the type of LSC within each Project component has been quantified. **Table 3.5** provides a summary and the key findings are:

- 46.2% of the verified BSAL that will be indirectly and temporarily impacted by the Underground Extraction Area is LSC Class 3 land (185.6 ha);
- 5.3% of the verified BSAL that will be directly; however, temporarily impacted by the development of road networks and Mine Infrastructure area is partly LSC Class 3 (14.2 ha) and Class 5 land (7.1 ha); and
- 48.4% of the verified BSAL that will be directly and permanently impacted by Open Cut Mining Areas and OEAs is LSC Class 3 (95.6 ha) land and Class 5 land (98.8 ha).

Table 3.5 – Land and Soil Capability Class by Impact Category

Impact Category and LSC Class	Area (ha)	Percentage (%)
Indirect and Temporary Impacts	**185.6**	**46.2**
Class 3	**185.6**	**46.2**
Underground Extraction Area	185.6	46.2
Direct and Temporary Impacts	**21.3**	**5.3**
Class 3	**14.2**	**3.5**
Roads: haul roads	13	3.2
Roads: internal roads	1.2	0.3
Class 4	**<0.1**	**<0.1**
Roads: internal roads	<0.1	<0.1
Class 5	**7.1**	**1.8**
Roads: haul roads	3.6	0.9
Roads: internal roads	0.3	0.1
Mine Infrastructure	3.2	0.8
Direct and Permanent Impacts	**194.4**	**48.4**
Class 3	**95.6**	**23.8**
Open Cut Mining Area	15.8	3.9
OEA	79.8	19.9
Class 5	**98.8**	**24.6**
Open Cut Mining Area	86.1	21.5
OEA	12.7	3.2
Total	**401.3**	**100.0**

3.3.3.1 Incongruence of BSAL and Land and Soil Capability Class 5 Land Definition

The BSAL assessed in accordance with the Interim Protocol includes some LSC Class 5 land, which is moderate to low capability land. An investigation was undertaken by SLR on behalf of KEPCO to assess the incongruence between the definition of BSAL as defined by the Policy, which is a "*rare combination of natural resources and is considered highly suitable for agriculture*" and the definition of LSC Class 5 land, which is "*Land has high limitations for high –impact land uses; is restricted to grazing, some horticulture (orchards), forestry and nature conservation*".

The investigation determined that the anomaly was due to (a) the relative fertility ranking assigned to the Red and Brown Chromosol Australian Soil Classification (ASC) soil order by the Interim Protocol which is inconsistent with the existing soil literature, and (b) the application of the base status formula to determine the ASC great group for Chromosols. A letter with these findings has been lodged by KEPOC to the DP&I in November, 2013 (SLR, 2013b).

One of the letter's recommendations is to include a cross reference to the soil unit's LSC classification. This will ensure that low to moderately capable land (i.e. LSC Class 4,5+) is excluded from being assessed as BSAL and that the BSAL assessment is consistent with the Policy's definition of BSAL. Should this recommendation be taken on board, there are approximately 564 ha of BSAL within the Project Boundary that is either LSC Class 4 or Class 5 lands, which may be excluded from being classified as BSAL. Of this, approximately a quarter (106 ha) is situated within the Project footprint reducing the impact on BSAL from approximately 401.3 ha to 295.3 ha. Further, of this, approximately 99 ha is associated with Project components that will have a direct and permanent impact. Should the recommendation be taken on board, the quantity of land to be permanently impacted upon will reduce by 50% to 95.4 ha.

3.3.4 Soil Fertility

The Soils Assessment and Site Verification (SLR, 2013) determined that of the BSAL to be impacted upon, approximately 97.3% has moderately high relative fertility. The remainder of the land has high relative fertility. The soil units that have high relative soil fertility, within the Project disturbance footprint and associated with BSAL are Soil Units B01, B06 and G12.

Based on the previously defined impact categories, the type of relative soil fertility within each Project component has been quantified. **Table 3.6** provides a summary and the key findings are:

- All land to be indirectly and temporarily impacted upon is comprised of soil units with moderately high relative soil fertility;
- Land to be directly and temporarily impacted upon is comprised of soil units with moderately high relative soil fertility (11.6 ha) as well as soil with high fertility (9.7 ha). Within both soil fertility classes, haul roads is the largest component that will be impacting upon this soil fertility class.
- The majority of the land to be indirectly and temporarily impacted upon has moderately high relative soil fertility. A minor amount of high fertility soil (1 ha) is also in this footprint; however, this land will be avoided as is practicable during the construction of the Eastern OEA.

Table 3.6 – Relative Soil Fertility by Impact Category

Impact Category and Fertility Class	Area (ha)	Percentage (%)
Indirect and Temporary Impacts	**185.6**	**46.2**
Moderately High Soil Fertility	**185.6**	**46.2**
Underground Extraction Area	185.6	46.2
Direct and Temporary Impacts	**21.3**	**5.3**
High Soil Fertility	**9.7**	**2.4**
Roads: haul roads	8.5	2.1
Roads: internal roads	1.2	0.3
Moderately High Soil Fertility	**11.6**	**2.9**
Roads: haul roads	8.1	2.0
Roads: internal roads	0.3	0.1
Mine Infrastructure	3.2	0.8
Direct and Permanent Impacts	**194.4**	**48.4**
High Soil Fertility	**1**	**0.2**
OEA	1	0.2
Moderately High Soil Fertility	**193.4**	**48.2**
Open Cut Mining Area	101.9	25.4
OEA	91.5	22.8
Total	**401.3**	**100.0**

3.3.4.1 Incongruence of BSAL and Inherent Soil Fertility Ranking

As discussed in **Section 3.3.3**, a review was undertaken by SLR on behalf of KEPCO to investigate some of the BSAL findings where the resulting BSAL classification was not consistent with either field survey results or LSC classification. The investigation found that some of the anomalies were due to how the first approximation in the Interim Protocol assigned fertility rankings to ASC orders.

The review found that BSAL assessed in accordance with the Interim Protocol includes some land, which has traditionally been assessed in the soils literature as having an inherent fertility of moderate. Soil fertility for each ASC class has been derived from the known relationship of GSG and soil fertility. The Interim Protocol has placed most Red and Brown Chromosols in the moderately high soil fertility group, which is inconsistent with the referenced literature that ranks these soils as having moderate fertility. Red and Brown Chromosols encompass the GSGs of Red-Brown Earths, Red Podzolic Soils and Non-calcic Brown Soils.

One of the letter's recommendations was to revise the Red and Brown Chromosol relative fertility ranking to include the influence of parent material since the fertility of soil units is reliant upon parent materials. For example, Red and Brown Chromosols on more fertile rocks (intermediate and basic parent material) are recommended to have a moderately high fertility ranking. Whereas chromosols derived from sedimentary parent material are recommended to have a moderate fertility ranking.

Should this recommendation be taken on board, there are approximately 410 ha of BSAL within the Project Boundary that would have moderate inherent fertility and be associated with a slope incline of greater than 5%. This land would therefore not be considered BSAL. Of this, approximately 43 ha is situated within the Project disturbance footprint reducing the impact on BSAL from approximately 401.3 ha to 358.3 ha.

3.4 Discussion

3.4.1 Indirect and Temporary Impacts

A total area of 1,716.6 ha within the Project disturbance footprint will be indirectly and temporarily impacted by operations in the Underground Extraction Area. Of this area, 185.6 ha is verified BSAL. The BSAL has been assessed as LSC Class 3 with moderately high relative soil fertility and is comprised of the Bald Hill Soil Unit, BH2.

Following coal extraction and progression of the longwall panels the overlying landform will subside. Subsidence may result in surface cracking, topographical depressions and drainage line re-alignment. Based on a preliminary Subsidence Constraints Study, subsidence is expected to vary between less than 0.5 m and approximately 3.5 m (MSEC, 2013).

Surface cracking is predicted to be minor (50 mm to 100 mm) on the flat to gently inclined land with localised cracking of up to 200 mm associated with steeper slopes (MSEC, 2013). Given, BSAL to be impacted upon is located on gently inclined land (3-10%), surface cracking is expected to be minor and within the scale that is able to be effectively managed through surface remediation works. The potential impact of surface cracking on BSAL is therefore considered minimal.

Topographical depressions of up to 1 m are predicted to occur; however, these are associated with Dry Creek which is located external to the BSAL area (MSEC, 2013). Some shallow topographical depressions occur within the BSAL area and may impact micro-relief in localised areas. As the change in micro-relief is predicted to be of a minor nature and able to be managed through surface remediation works the potential impact on BSAL is considered minimal.

Drainage re-alignment is significant in two places associated with Dry Creek with all other drainage alignment changes considered to be of a minor nature (MSEC, 2013). The significant drainage re-alignments are located external to the BSAL area and are downstream of the BSAL area and therefore the potential impact on BSAL is considered minimal.

Further investigations will be undertaken in a detailed Subsidence Impact Assessment to be developed for the EIS. Should any significant impacts be predicted, remediation will be investigated for infilling, re-grading and/or compaction of the surface.

3.4.2 Direct and Temporary Impacts

A total area of 152.7 ha within the Project disturbance footprint will be directly; however, temporarily impacted through surface disturbance to facilitate the Mine Infrastructure and roads network. Of this area, approximately 21.3 ha is verified BSAL. The BSAL has been assessed as being a combination of LSC Class 3 (14.2 ha) and Class 5 land (7.1 ha). All soil units, within the Project disturbance footprint, associated with BSAL are LSC Class 3 with the exclusion of Soil Unit G05, which is Class 5. Soil units associated with this impact type are predominately Soil Units G05, B06, B01 and BH1. Relative soil fertility ranges from moderately high to high.

Mine Infrastructure (3.2 ha) will disturb the topsoil associated with the sedimentary-derived Red Chromosol of the Growee Soil Landscape Unit (G05). This soil unit has sandy topsoil, moderate soil depth of 0.9 m, moderately high relative sol fertility and has been assessed as LSC Class 5 land. The stockpiled topsoil will require amelioration with organic amendments to maintain integrity of structure. The subsoil, which is strong clay, will require ripping during rehabilitation to reduce compaction.

Internal roads (1.5 ha) will disturb (to a minor extent) soil units associated with the Bylong and Growee Soil Landscape Units. Internal roads will subject the land to limited surface disturbance. The limiting factor for rehabilitation will be localised compaction. Deep ripping of sub-grade materials and scarification of the topsoil prior to re-seeding will reduce compaction and create a suitable seedbed for successful rehabilitation.

Haul roads (16.6 ha) will disturb soil units associated with the Bylong, Bald Hill and Growee Soil Landscape Units. Approximately 8.5 ha of the alluvial-influenced Bylong soil will be disturbed. These soils are moderately structured Dermosols overlying weak sandy loam soil strata. Subsoils will be prone to compaction effects due to inherently weak structure. The remaining 3.5 ha is comprised of the soil units associated with the Bald Hill and Growee Soil Landscape Units. Both have a strong profile structure and an inherent resilience to compaction impacts.

The 21.3 ha of BSAL directly; however, temporarily impacted will be rehabilitated to pre-mining condition in accordance with a detailed BSAL Reinstatement Plan (**Section 5**). This plan will be developed upon grant of Project Approval and prior to construction.

3.4.3 Direct and Permanent Impacts

A total area of 797.3 ha within the Project disturbance footprint will be directly and permanently impacted through surface disturbance to facilitate the development of the Open Cut Mining Areas and OEAs. Of this area, 194.4 ha is land that has been verified as BSAL. The BSAL has been assessed as LSC Class 3 (23.8%) and Class 5 (24.6%). LSC Class 3 is associated with the Bald Hill and Bylong soil units whereas Class 5 is associated with the Growee Soil Unit G05. The footprint currently includes approximately 1 ha of Bylong soil units B01 and B06; however; this land will be avoided where practicable, to limit impacts. All soil is considered to have moderately high relative fertility with the exception of 1 ha of the Bylong soil units.

In summary:

- Open Cut Mining Areas cover 101.9 ha and will disturb land associated with the Bald Hill (15.8 ha) and Growee soil units (86.1 ha); and
- OEAs cover 92.5 ha and will disturb land associated with the Bald Hill (78.8 ha), Growee (12.7 ha) and Bylong (1 ha) soil units.

The Project mine plan has been designed in strong consideration of avoiding direct and permanent impacts on verified BSAL that is hydraulically linked as far as practical (without causing harm to other environmental aspects).

During the life of the Project and upon mine closure, Open Cut Mining Areas and OEAs will be progressively shaped and rehabilitated as areas become practically available. To compensate for the direct and permanent impact of the Project on BSAL, KEPCO has committed to utilising the soil resources from these direct and permanently disturbed BSAL to recreate BSAL elsewhere within the Project Boundary (refer **Section 5**).

4 PRELIMINARY BSAL POST-MINING GOALS

4.1 Overview

One of the post-mining goals for the Project is to limit impacts on BSAL and minimise the total quantity of BSAL foregone within the Project Boundary. To achieve this, hydrological alluvial influenced BSAL have been avoided as part of the Project design, as far as practical without causing harm to other environmental aspects. Secondly, KEPCO has committed to the salvage and treatment of suitable soil resources for re-use at closure for land directly and temporarily impacted by mining related activities. Thirdly, BSAL impacted upon by direct and permanent activities will be reinstated on less capable land.

Table 4.1 summarises the proposed post-mining goal for each Project component.

Table 4.1 – Preliminary Post-mining Goal: Biophysical Strategic Agricultural Land

Project Component	Post-mining Goal
Indirect and Temporary Impact	
Underground Extraction Area	Maintain: - Pre-mining land use - Pre-mining LSC Class - Pre-mining soil and landscape characteristics
Direct and Temporary Impact	
Mine Infrastructure Roads (haul roads and internal roads)	Return to: - Pre-mining Land use - Pre-mining LSC Class - Pre-mining soil and landscape characteristics
Direct and Permanent Impact	
Open Cut Mining Area OEA	Return to: - Pre-mining land use Instate: - LSC Class 4 land. This will change from a pre-mining mix of Class 3 and Class 5. - Soil and landscape characteristics to be commensurate with LSC Class 4 hazard criteria - Relative soil fertility will be reduced from Moderately High to Moderate. Reinstate: - Re-instate equivalent quantity of BSAL with a target LSC of Class 3 within Project Boundary to offset the impact on BSAL. - Soil and landscape characteristics to be commensurate with the BSAL criteria and where appropriate the LSC Class 3 hazard criteria.

4.2 Post-mining Soil and Landscape Characteristics

The key BSAL soil and landscape characteristics are slope, surface rockiness, land surface micro-relief, soil fertility, effective rooting depth, soil drainage, and soil pH and soil salinity. KEPCO's post-mining rehabilitation goals commit to minimising the impacts on soil and landscape characteristics, in particular that associated with BSAL.

The following sub-sections assess the impact of each Project component on BSAL soil and landscape characteristics holistically and describes the subsequent post-mining landscape.

4.2.1 Indirect and Temporary Impacts

Land indirectly impacted temporarily by the Underground Extraction Area will experience localised short-term changes in soil and landscape characteristics by means of minor surface cracking and localised topographical depressions. Minor cracks may facilitate erosion whereas depressions may result in ponding and the development of an anaerobic environment, which, depending on the period of ponding, affect chemical characteristics (e.g. soil pH) and physical characteristics (e.g. drainage). Where such issues may occur surface remediation (refer **Section 3.4.1**) will be investigated to ensure BSAL and its soil and landscape characteristics are not significantly impacted from its pre-mining condition.

4.2.2 Direct and Temporary Impacts

Land directly impacted temporarily by Mine Infrastructure and roads will experience a short-term change in soil and landscape characteristics as a result of the removal of topsoil, subsoil compaction from the operation of Project components, and from the re-grading of localised slopes to engineer stable Project components.

Post-mining, or during the operational phase as is appropriate, the impacted land will be rehabilitated to pre-mining condition, which includes all key soil and landscape characteristics. This will be undertaken through the (i) careful stockpiling and management of soil resources during the operational period to maintain soil integrity, (ii) re-grading of slopes commensurate with pre-mining condition, and (iii) execution of an approved BSAL Reinstatement Plan to ensure that key soil and landscape characteristics specific to the soil unit are reinstated (refer **Section 5**). In this regard, BSAL soil and landscape characteristics will not be significantly impacted in the long-term as a result of the Project's operations.

4.2.3 Direct and Permanent Impacts

Land directly and permanently impacted (194.4 ha) by the Open Cut Mining Area and OEAs will experience a long-term change in soil and landscape characteristics as a result of the complete removal of the soil profile and underlying rock strata during coal extraction activities.

Impacts will be mitigated and offset through:

- Instatement of LSC Class 4 land on land permanently impacted upon. This will replace the existing LSC Class 3 and Class 5 land; and
- Reinstatement of an equivalent amount of impacted BSAL within the Project Boundary.

LSC Class 4 Development

Land to be rehabilitated to LSC Class 4 will contain a different mix of soil and landscape characteristics to the pre-mining landform. Rehabilitation works will reshape the land to have characteristics commensurate with the target LSC of Class 4. This includes grading slopes to no greater than 10^{o}, backfilling and capping the final void and returning the land to a state suitable for moderate impact land uses. The rehabilitated landform will be suitable for grazing with some cultivation and is expected to have no significant micro-relief, moderate soil fertility, a minimum effective rooting of 0.5 m, better than poor internal soil drainage and suitable pH and salinity characteristics.

As a conservative estimate, it is expected that the rehabilitated land will experience a reduction in relative soil fertility from moderately high to moderate. Relative soil fertility in the Interim Protocol is associated with an ASC nomenclature. Information on which ASC order will be constructed will be available after a high intensity survey of soil resources has been undertaken (refer **Section 5**). Notwithstanding this and given the known quality of the soil resources associated with the Bald Hill Soil Landscape Unit, a constructed profile to no less than moderate fertility would be expected.

Further details on success criteria for key soil and landscape characteristics are contained in **Section 5**.

BSAL Reinstatement

It is proposed that the same quantity of BSAL to be permanently impacted upon is reinstated on less capable land within the Project Boundary. This approach has the following advantages over reinstatement on the disturbed area at closure:

- Soil can be placed directly onto the less capable land concurrent with soil stripping activities. This has the advantage of limiting adverse impacts to soil resources that can occur during handling, stockpiling and then re-handling during the life of the Project.

- BSAL in the north-western Overburden Emplacement Area and eastern Open Cut Mining Area is fragmented and consolidation of BSAL to a concentrated area will increase the practicality of using this high capability land for agricultural enterprises.

- Monitoring and reporting on the success of the BSAL re-instatement, in consultation with relevant government agencies, can occur during the life of Project with techniques improved and adjusted over time to ensure success.

The reinstated BSAL will initially be required to meet all the BSAL soil and landscape criteria (see **Section 5**) followed by consideration of LSC Class 3 criteria. The developed landform will be suitable for cropping enterprises with some cultivation and is expected to have no significant micro-relief, moderately high soil fertility, a minimum effective rooting of 0.75 m, better than poor internal soil drainage and satisfactory pH and salinity characteristics to facilitate LSC Class 3 agricultural enterprises.

Further details on success criteria for key soil and landscape characteristics are contained in **Section 5**.

4.2.4 Overall Change in Soil Fertility Class

The amount of land in each post-mining relative soil fertility class is summarised in **Table 4.2** and the key findings are:

- The predicted permanent reduction in moderately high soil fertility will be offset by the reinstatement of BSAL with the same relative fertility ranking elsewhere within the Project Boundary. Suitable land selected for reinstatement works is expected to exhibit moderate relative soil fertility. Should a suitable tract of land for BSAL instatement works not be located within the Project Boundary, land surrounding the Project Boundary will be assessed for suitability.

- The predicted permanent increase in moderate soil fertility from the construction of the LSC Class 4 profile will be mitigated through the selection of similar fertility land for fertility improvement during BSAL reinstatement works.

- Given the mitigation and offset commitments made by KEPCO, there is no predicted change in the quantity of relative soil fertility classes within the Project Boundary. The change will be in spatial distribution of the classes.

Table 4.2 – Pre- and Post-Mining Soil Fertility Class

Relative Soil Fertility	Pre-mining		Post-mining		Per cent change
Ranking	ha	%	ha	%	%
Low	2,933.6	28.4	2,933.6	28.4	Nil
Moderately low	1,689.3	16.4	1,689.3	16.4	Nil
Moderate	16.9	0.2	16.9	0.2	Nil
Moderately high	4,139.1	40.0	4,139.1	40.0	Nil
High	1,538.1	15.0	1,538.1	15.0	Nil
Total	**10,317.0**	**100.0**	**10,317.0**	**100.0**	

4.3 Post-mining Land and Soil Capability Class

Approximately three quarters (73.6%) of the BSAL to be impacted upon by the Project is Class 3 land with the remainder being Class 5 land.

4.3.1 Temporary Impacts

Land temporarily impacted upon, both directly and indirectly, will be returned to pre-mining condition. Therefore there is no change in LSC classes for temporary impacts.

4.3.2 Permanent Impacts

Of the 194.4 ha of land that will be permanently impacted upon, 95.6 ha is LSC Class 3 land and 98.8 ha is LSC Class 5 land. Rehabilitation works, as discussed in **Section 4.2**, will return the impacted land to LSC Class 4 and will be suitable for moderate impact land uses. Target post-mining land use is similar is pre-mining land use, which is grazing with some cultivation. Further details on success criteria for LSC Class 4 and appropriate soil handling protocols are contained in **Section 5**.

4.3.3 Overall Change in Land and Soil Capability Class

The amount of land in each LSC Class is summarised in **Table 4.3** and the key findings are:

- The predicted permanent reduction in LSC Class 3 and LSC Class 5 lands will be offset by the reinstatement of BSAL that has a target LSC of Class 3. Therefore the quantity of LSC Class 3 land within the Project Boundary will marginally increase by approximately 1% and the quantity of LSC Class 5 land will marginally decrease by 1%.

- The predicted permanent increase in LSC Class 4 land from the construction of the LSC Class 4 profile is numerically cancelled out as LSC Class 4 land will be targeted for improvement to LSC Class 3 during BSAL re-instatements works.

- Therefore, the spatial distribution of LSC classes will change; however, the quantity of each LSC class largely remains the same.

Table 4.3 – Pre- and Post-Mining Land Soil Capability Class

LSC	Pre-mining		Post-mining		Per cent change
Class	ha	%	ha	%	%
3	2,806.2	27.2	2,905.0	28.2	+1.0
4	1,273.5	12.3	1,273.5	12.3	Nil
5	1,293.8	12.6	1,195.0	11.6	-1.0
6	2,891.7	28.1	2,891.7	28.1	Nil
7	2,051.8	19.8	2,051.8	19.8	Nil
Total	**10,317.0**	**100.0**	**10,317.0**	**100.0**	

4.4 Post-mining Quantity of BSAL

The proponent has committed to avoiding (where practicable) and minimising the impacts on BSAL. The quantity of BSAL that will be directly and permanently impacted upon is proposed to be offset to mitigate Project impacts. There will be no reduction in the quantity of BSAL; however, as per the LSC classes, the spatial distribution of BSAL will differ from the pre-mining landscape.

Further details regarding the rehabilitation of this land and compensatory measures are provided in **Section 5**.

4.5 Evidence of Successful Reinstatement of Good Quality Agricultural Land

KEPCO proposes to reinstate 194.4 ha of BSAL on less capable land within or surrounding the Project Boundary. A number of recent examples of mine rehabilitation (as described below) demonstrate that this proposal is achievable.

The Alluvial Lands Project at the Rio Tinto owned Hunter Valley Operations (Nelson and Stewart, 2007) provided evidence that rehabilitation of mined land to the former Rural Land Capability Class I and II land is achievable and that this land can facilitate agricultural production. The operations required selective handling and reinstatement of 630,000 m³ of subsoil to a depth of 1 m, along with 252,000 m³ of topsoil to 0.4 m depth. The entire process followed particular rigour with tolerance for the final land surface set to be within 0.5 m of the pre-mining survey.

A lucerne hay productivity yield of *"at least equivalent to the average crop productivity yields for the Upper Hunter Region for three consecutive years"* was required. Regular inspections and meetings with officers from NSW DPI's Environmental Sustainability Branch and the NSW DPI's regional agronomist demonstrated Rio Tinto's compliance with yield, quality and monitoring requirements for the reinstatement to Class I and II land capabilities. As such the project achieved the conditioned target land capability class characteristics for agricultural production and was endorsed by the NSW Government at the time.

The Alluvial Lands Project is considered to be a good example of successful reinstatement of arable land after mining, particularly in comparison to that proposed for the Project (i.e. rehabilitating back to LSC Class 3 and 4 land).

The most recent example of successful soil profile reconstruction and rehabilitation of high value agricultural land has been demonstrated at Bengalla Mine in Muswellbrook, NSW. Bengalla Mine has recently gained approval for the restoration of Rural Land Capability Class III land. Bengalla has established an area of approximately 5.7 ha of an existing OEA to Class III Rural Land Capability where slopes are less than 3% and Black Vertosol soils have been applied as topsoil (BMC, 2013). This area was sown with pasture in late 2012 and will be monitored as part of the annual rehabilitation audit with results presented in an Annual Review. Given the early stages of the program, no further information has been made available regarding the long term sustainability of land capability characteristics and agricultural productivity.

In the Midwestern United States, similar suggestions were made that prime agricultural farmland should not be mined due to unproven reclamation techniques. To help allay these concerns, a reclamation research program was initiated at the Universities of Illinois and Kentucky to investigate the best reclamation strategies. Darmody et al. (2002) compiled research which has shown that surface mining can be a short term land use which can be followed by productive higher agricultural uses, if rehabilitation is undertaken correctly. Achieving a higher mine land productivity is possible if rehabilitation plans are designed to minimise compaction, if good quality soil materials are used, and if high management levels (herbicides, fertility, adapted crop varieties) and practices are followed.

Given the relatively gentle topography and landscape characteristics within the Project Boundary, the available topsoil and subsoil resource and recent evidence afforded by other parties, SLR is confident that land within the Project Boundary can be successfully returned to BSAL provided that a detailed BSAL Reinstatement Plan (**Section 5**) has been prepared prior to soil disturbance activities. Furthermore, as KEPCO propose to reinstate BSAL outside of the Project disturbance footprint on undisturbed land (versus mined land as per the examples provided), there is even a greater likelihood of rehabilitation success.

5 BSAL REINSTATMENT PLAN

The Project will temporarily and permanently impact 401.3 ha of BSAL within the Project footprint. KEPC has committed to:

- Rehabilitating the direct and temporary disturbance of BSAL to pre-mining BSAL condition;
- Rehabilitating the indirect and temporary disturbance of BSAL within the Underground Extraction Area to pre-mining BSAL condition;
- Construction and instatement of a LSC Class 4 landform on the 194.4 ha of permanently impacted land; and
- Reinstatement of an equivalent amount of impacted BSAL (194.4 ha) within (or surrounding) the Project Boundary to offset the loss of BSAL. The BSAL's target LSC is Class 3.

Rehabilitation will be undertaken in accordance with a detailed BSAL Reinstatement Plan prepared for the Project upon grant of Development Consent and prior to commencement of construction works. The following information provides a basis for the development of the BSAL Reinstatement Plan.

5.1 Scope

Prior to commencement of any Project construction activities, KEPCO will prepare a BSAL Reinstatement Plan. The proposed scope of the plan is:

i. Stakeholder consultation process to develop the plan;
ii. Provision of success criteria;
iii. General management requirements such as training;
iv. Stockpile management including:
    - stripping and storage of topsoils and subsoils as identified by Soils Assessment and Site Verification (SLR, 2013) as
    - Stripping and storage of subsoils where practical at depths not identified by SLR (2013);
    - Management of soils in stockpile;
    - Recovery of soils from stockpile for use on reinstated lands;
v. Procedures for stripping, stockpiling, recovery and reinstatement;
vi. Records and reporting management; and
vii. Monitoring of the effectiveness of reinstatement methods on BSAL

5.2 Stakeholder Consultation

KEPCO will seek advice from representatives of the DTIRIS, DP&I and OEH regarding input into the development of the BSAL Reinstatement Plan.

5.3 Success Criteria

Rehabilitation planning criteria presented in this section have been taken from the *Strategic Framework for Mine Closure* (ANZMEC, 2000) to ensure the most appropriate and efficient rehabilitation techniques are applied. KEPCO will seek advice from representatives of DTIRIS, DP&I and OEH regarding any additional actions that may need to be adopted.

Key performance outcomes that are built into the preliminary rehabilitation success criteria include:

- clearing and/or vegetation disturbance and rehabilitation progress consistent with the MOP;

- successful establishment of vegetation on the final landform consistent with the MOP;
- progressive achievement of landform and land use objectives;
- achievement of the committed objectives with respect to flora and fauna, soil resources, LSC Class, erosion and sediment control and air quality;
- verification of achievements through monitoring;
- a legally binding arrangement to secure the long-term security of the BSAL offset areas; and
- performance reporting in the Annual Environmental Management Report (AEMR).

The success criteria (often referred to as 'closure criteria') are performance objectives or standards against which rehabilitation success (i.e. achieving a sustainable system for the proposed post-mine land use) is measured. Satisfaction and maintenance of the success criteria (as indicated by monitoring results) will demonstrate that the rehabilitated landscape is ready to be relinquished from the mine's financial assurance and handed back to stakeholders in a productive and sustainable condition. The preliminary success criteria for the rehabilitation areas are identified in **Tables 6.1** and **6.2**.

Criteria that define rehabilitation success at mine closure will be provided for each rehabilitation element. Based on the generic indicators provided, each criterion will be further developed to be specific, measurable, achievable, realistic and outcome based, and to reflect the principle of sustainable development. This will be based on results of further research and ongoing monitoring of the progressive rehabilitation areas. The success criteria will be reviewed every three to five years with stakeholder participation to ensure the nominated success criteria remain realistic and achievable.

5.3.1 Indirect and Temporary Impacts

Land indirectly impacted temporarily by the Underground Extraction Area will experience localised short-term changes in soil and landscape characteristics and will require surface remediation works.

Representative reference sites specific to the soil unit impacted upon will be used to measure the success of surface remediation works. The development of the success criteria will be driven by these reference sites with the post-mining soil and landscape characteristics similar to pre-mining condition.

5.3.2 Direct and Temporary Impacts

Land directly impacted temporarily upon by the Mine Infrastructure and road network will experience short-term changes in soil and landscape characteristics and will require rehabilitation post decommissioning of the Project elements.

Representative reference sites specific to each soil unit impacted upon will be used to measure the success of the rehabilitation works. The development of the success criteria will be driven by these reference sites with the post-mining soil and landscape characteristics similar to pre-mining condition.

5.3.3 Direct and Permanent Impacts

Land directly and permanently impacted temporarily upon by the Open Cut Mining Area and OEAs will experience long-term changes in soil and landscape characteristics. The disturbance footprint will be rehabilitated to LSC Class 4 land landform with a similar quantity of BSAL offset within or surrounding the Project Boundary, which has a target LSC of Class 3.

5.3.3.1 Biophysical Strategic Agricultural Land – Land and Soil Capability Class 3

Preliminary success criteria for the re-instatement of BSAL on less capable land will be based on the 12 BSAL criteria of the Interim Protocol as well as consideration of the LSC hazard criteria in *The land and soil capability assessment scheme: second approximation – A general rural land evaluation system for NSW* (OEH, 2012; hereafter referred to as the LSC Guideline).

The BSAL criteria and LSC Class 3 hazard criteria are provided in **Table 5.1**. The refinement of the combination of the BSAL criteria with relevant LSC Class 3 criteria will be developed in conjunction with the BSAL Reinstatement Plan whereby reference sites will be selected and analysed for relevant site specific parameters for each success criteria. Other criteria will be developed as appropriate.

The information provided in tabular format below will form the basis from which the criteria thresholds will be developed. Measurement of rehabilitation effectiveness for post mining LSC Class 3 land will also include yield targets that are based on equivalent LSC Class 3 land from within and surrounding the Project Boundary.

Table 5.1 – Biophysical Strategic Agricultural Land and Land and Soil Capability Class 3 Success Criteria

Criteria	Relevance to Interim Protocol & LSC Guideline	BSAL	LSC Class 3 criteria
Slope	BSAL Criteria 1 LSC Hazard 1	Slope less than 10%	Slope < 10% **or** < 3% if slope is > 500 m in length
Rock outcrop	BSAL Criteria 2 LSC Hazard 7	Rock outcrop less than 30%	Rock outcrop less than 30%
Surface Rockiness	BSAL Criteria 3	Less than 20% of the area has unattached rock fragments greater than 60 mm diameter	Not applicable
Gilgai	BSAL Criteria 4	Less than 50% of the area has gilgai depression that are deeper than 500 mm	Not applicable
Slope, relative soil fertility class and rock outcrop	BSAL Criteria 5,6,7 LSC Hazard 1	Moderate fertility **and** <5% slope **and** nil rock outcrop **OR**	Not applicable
		Moderately high or high fertility **and** <5% slope **and** <30% rock outcrop **OR**	
		Moderately high or high fertility **and** 5-10% slope **and** <30% rock outcrop	
Physical Barrier	BSAL Criteria 8 LSC Hazard 7	Effective rooting depth to a physical barrier (i.e. bedrock, gravel layer) is greater than or equal to 750 mm	Soil depth is >75 cm
Soil Drainage	BSAL Criteria 9 LSC Hazard 6	Soil drainage is better than poor	Imperfectly drained soil (waterlogging is 1-8 weeks duration)

Criteria	Relevance to Interim Protocol & LSC Guideline	BSAL	LSC Class 3 criteria
pH	BSAL Criteria 10 LSC Hazard 4	pH within range of 5.0 to 8.9 within upper 600mm of soil profile	Moderate or higher surface soil buffering capacity **and** pH >5.5 **or** low surface soil buffering capacity **and** pH 6.7-8.0
Soil Salinity	BSAL Criteria 11 LSC Hazard 5	ECe less than or equal to 4 dSm/m **or** if gypsum is present, chlorides less than 800 mg/kg within upper 600mm of soil profile	low salt store **OR** low discharge potential **and** moderate salt store
Chemical Barrier	BSAL Criteria 12	Effective rooting depth to a chemical barrier is greater than or equal to 750 mm Chemical barrier includes: • pH <5.0 **or** >8.9; • ECe > 4 dSm/m **or** if gypsum is present, chlorides > 800 mg/kg • ESP >15% • Ca:Mg ratio <0.1	Not applicable
Wind Erosion	LSC Hazard 2	N/A	Selected site to be a site that has low exposure to wind
Soil Structure Decline	LSC Hazard 3	N/A	Surface soil texture a sandy loam **OR** fine sandy loam with <60% silt and very fine sand **and** <5% ESP (hazard 3) **OR** normal loam/clay loam **OR** friable/ferric or weakly self-mulching clay**.**
Mass Movement	LSC Hazard 8	N/A	No mass movement
Vegetation	N/A	Land is useable as a functioning agricultural system as per the Class3 LSC parameters with yield similar or exceeding known yield of local Class 3 agricultural enterprises.	
Soil fauna	N/A	Representation of a range of soil species such as earthworms, springtails and fungi relative to the control site	

5.3.3.2 Land and Soil Capability Class 4

Preliminary success criteria for the development of LSC Class 4 land will be based on the LSC Guideline. The LSC Class 4 hazard criteria are provided in **Table 5.2**. The refinement of these criteria will be developed in conjunction with the BSAL Reinstatement Plan whereby reference sites will be selected and analysed for relevant site specific parameters for each success criteria. Measurement of rehabilitation effectiveness for post mining LSC Class 4 land will also include grazing targets that are based on equivalent LSC Class 4 land from within and surrounding the Project Boundary. Other criteria will be developed as appropriate.

Table 5.2 – Land and Soil Capability Class 4 Success Criteria

Criteria	Relevance to LSC Guideline	LSC Class 4
Water Erosion	LSC Hazard 1	Slope < 20%
Wind Erosion	LSC Hazard 2	Surface texture with no more than moderate erodibility where in a highly exposure position.
Soil Structure Decline	LSC Hazard 3	Surface soil texture with <8% ESP
Soil Acidification	LSC Hazard 4	Moderate or higher surface soil buffering capacity **and** pH >4.7 **or** low surface soil buffering capacity **and** pH 5.5-8.0
Salinity	LSC Hazard 5	moderate salt store
Waterlogging	LSC Hazard 6	Imperfectly drained soil (waterlogging is 8-12 weeks duration)
Soil Depth (rock outcrop)	LSC Hazard 7	<30% rock outcrop **and** soil depth >50cm **or** 30-50% rock outcrop **and** soil depth >100cm
Mass Movement	LSC Hazard 8	No mass movement
Vegetation	N/A	Land is useable as a functioning agricultural system as per the Class4 LSC parameters with yield similar or exceeding known yield of local Class 4 agricultural enterprises.
Soil fauna	N/A	Representation of a range of soil species such as earthworms, springtails and fungi relative to the control site

5.4 Management

5.4.1 General

Soil stripping, stockpiling, inventory systems and survey reconciliations used during the stripping and stockpiling process will be under the control of a Project Environmental Manager. Field monitoring will be controlled by appropriately trained personnel.

A regular review of activities, currently proposed to be weekly will be undertaken by an experienced soils consultant. The consultant and the review intervals may be altered to suit the progress of activities.

Management of soils whilst in stockpile, their recovery, placement for reinstatement, effectiveness trials and monitoring of rehabilitation effectiveness will be managed by the Project Environmental Manager who in-turn will be advised by soil consultants where necessary.

5.4.2 Training

All management and supervisory personnel involved in stripping and stockpiling of soil will undertake, as a minimum, a one day training program in recognition of the Project area's BSAL and the procedures put in place for its management. This will be the same or similar to the program undertaken by supervisors prior to the commencement of construction activities on the site. Training manuals and aids will be supplied during these courses and will be used for reference during the stripping operation. Experienced soil consultants will be engaged to carry out such training.

5.4.3 Inductions and Toolbox Talks

All persons involved in the stripping, stockpiling, recovery and reinstatement of BSAL will attend an induction session, prior to commencing work. This session will deal with soil issues and management and will generally include:

- Value of BSAL soils;
- Stockpile control and signage;
- Rules when working on stockpiles;
- Basic soils and land use information; and
- Rules when stripping soils.

Information regarding the soils management operation will be covered and reinforce at regular toolbox meetings.

5.4.4 Role of Experienced Soils Consultant

The soil consultant will be actively involved in the implementation of the BSAL Reinstatement Plan.

Specific tasks will include, but not limited to, the following:

- Carrying out regular inspections and attend meetings as required during the stripping process;
- Organising review of activities against the BSAL Reinstatement Plan;
- Providing advice regarding testing and testing procedures that need to be implemented;
- Providing testing equipment and procedures as necessary;
- Assessment of the suitability of laboratories to carry out testing services;
- Provide advice on earthmoving equipment to be used;
- Provide advice on earthmoving procedures to be used;
- Provide advice on soil stripping and stockpiling conditions;
- Review and advise on inventory and reconciliation records; and
- Supervision, monitoring and assessment of field trails and analogue sites.

5.4.5 Soils Plan

The Soils Assessment and Site Verification (SLR, 2013) was prepared at a scale of 1:25,000 for areas of high impact disturbance. During the preparation of the BSAL Reinstatement Plan, BSAL to be impacted upon will be re-surveyed at a larger scale of 1:4,000 to provide a greater level of accuracy.

These plans will also form part of the Mining Operations Plan ((Industry & Investment (I&I), 2013)) and will include:

- Soil mapping units with legend;
- Topsoil thickness;
- Subsoil thickness; and
- Pre-mining LSC classification.

Such plans will be used as a guide for topsoil and subsoil stripping depths and boundaries and for removal of unsuitable layers. These plans are based on limited information and on site decisions will be made as removal progresses by trained supervisors and as advised by the soil consultant.

Soil unit and LSC classification boundaries as assessed by SLR (2013) will be used initially to indicate the class and type of topsoil being stripped. This in turn will govern its stockpile location. Location of these boundaries will be pegged in the field prior to topsoil stripping commencing and in the case of the land to be permanently impacted upon. Boundaries will be fine-tuned by the excavation of extra soil inspection pits. Any major change to such boundaries will be recorded.

5.4.6 Inventory Reconciliation

Actual depths and position of topsoil and subsoil removed will be picked up by surveys (for active faces only) and recorded. These records will be updated on a regular basis. Such records will be used to reconcile actual soils stripped with soil quantities estimated from the original plans by SLR (2013).

Reconciliation shall be updated on a regular basis. Any subsoils stripped below 2.5 m will also be surveyed at regular intervals and included in records. Reported quantities shall be calculated based on these surveys. Estimates are to be based on scraper and or truck counts and corrected based on survey.

5.5 Stockpiles

5.5.1 Stockpile Location and Configurations

All soils removed from BSAL will be stockpiled in the area indicated on the plans annexed to the BSAL. The stockpile areas will be on land shaped to final rehabilitation levels and lie above the 1:100 flood level.

Topsoil will be stored separately to subsoil. For the temporary and directly impacted land where each individual soil unit will be rehabilitated, topsoil for each soil unit will be stored separately. Topsoil from LSC Class 3 and Class 4 lands will be stored in separate stockpiles. Subsoil down to 2.5 m below the surface will be stored separately to subsoil recovered below 2.5 m below the surface. A plan will be included in the BSAL Reinstatement Plan showing the arrangement of the stockpiles prior to stripping commencing.

Maximum stockpile heights are to be as follows:

All topsoils 2.0 m (max)

Subsoils < 2.5m to 3.0 m (max)

Subsoils > 2.5m to 5.0 m

Soils removed < 2.5m depth will only be used on BSAL for rehabilitation purposes.

Stockpiles will not be disturbed until required for rehabilitation, for weed and erosion control or for seeding and fertilising purpose.

5.5.2 Control of stockpile placement

During stripping and stockpiling operations active stockpiles or active sections of stockpiles will be clearly signposted as opened or closed.

The supervisor in charge of stripping and stockpiling operations will notify machine operators of the stockpile locations for that day and will regularly check to ensure that material is taken to the correct

stockpile location. Operators will immediately be notified of any changed to activities regarding stripping and dumping by the supervisor in charge of operations.

Regular checks and audits will be carried out in the regard by the Projects Environmental Manager.

Temporary signs will be erected indicating the stockpile number, its soil type and soil class. These signs will be at least 500 mm x 600 mm in size with lettering that is clearly able to be seen from 20 m away by an approaching operator. Signs with arrows will also be used to indicate the correct position of stockpiles.

5.5.3 Signage

On completion of a stockpile or section of stockpile, it will be shown as being closed off by signage or the use of pegs and barriers.

Completed stockpiles will be clearly posted with reflective signs of at least 500 mm x 600 mm size with reflective white lettering on a green reflective background. Such signs will be securely erected at both ends of completed stockpiles.

Signs will contain the following information:

- Soil type (topsoil/subsoil/soil type)
- Soil class (3, 4, etc.)
- Date stripped
- Volume
- Stockpile number

Information on the signs will be correlated to inventories and plans kept during the soils stripping operation.

5.5.4 Erosion Control and Drainage

The stockpile area will have contour drains built around its perimeter to divert water away from it. This water will be drained into existing mine sedimentation dams.

Soil will not be stockpiled on any surface with a grade in excess of 5%. Measures will not be taken on soil stockpiles to prevent scouring and erosion due to rainfall runoff. This may require the battering down of stockpile edges. Stockpiles will be arranged in the stockpile area to run near parallel to natural contours as far as practical. This will minimise scouring from rain events. Free draining gaps will be left between stockpiles to prevent pooling of water.

A combination of straw bales and silt fences will be placed in draining paths as determined on site to capture silt from runoff. Runoff from within the stockpile area will be directed into drainage sumps or sedimentation dams. Stockpiles will be seeded as quickly as possible after placement to minimise scouring from rainfall.

5.5.5 Dust Control

Dust control during stripping and stockpiling operations by earthmoving plant will be undertaken using mobile water carts. Water cart capacity will be such as to regularly water active roads and active face areas.

Dust will be controlled on completed stockpiles by the establishment of pasture cover.

5.5.6 Seeding

Completed topsoil and subsoil stockpiles will be sown and pasture established as prevailing weather conditions permit.

The seed mixture will include fast-growing, short-lived species and perennial grasses and legumes. Example pasture mixes for cool and warm seasons are presented in **Table 5.3**. The pasture mix will be sown simultaneously with an appropriate fertiliser; for example, 250 kg/ha di-ammonium phosphate. Following establishment of these areas, it is anticipated that rotational cropping of pasture and suitable crops will be undertaken.

Table 5.3 – Example Pasture Species Seed Mix

Pasture Species	Rate (kg/ha)
Autumn Sowing	
Oats	10
Cocksfoot	3
Perennial Ryegrass	6
Phalaris	3
Subterranean Clover	4
Red Clover	2
Spring Sowing	
Japanese Millet	10
Phalaris	5
Paspalum	5
White Clover	2
Lucerne	3

All legumes (clovers and lucerne) will be inoculated with appropriate rhizobia and lime pelleted.

5.5.7 Weed Control

Prior to stripping and placement of soils, inspections will be carried out to identify weed control measures.

5.5.8 Stockpile Inspections

Regular inspections of the stockpile area will be made particularly after significant rainfall events. The following features will be checked:

- Integrity of sediment control;
- Effectiveness of drainage;
- Integrity of erosion control measures;
- Grass growth; and
- Weed infestation.

Remedial measures will be undertaken as necessary. Revegetation and weed control will be carried out as assessed at the time in consultation with the soils consultant. Internal stockpile conditions will be assessed by moisture movement and limited inspection pits.

5.6 Procedures

5.6.1 Assessment of Equipment

Equipment for stripping, stockpiling and reinstatement of topsoils and subsoils will be selected to minimise compaction and to avoid breakdown of the soil structure.

Different practices may be implemented for the stripping of the fragile sandier soils and the stiffer and more robust loamy soils. Final equipment selection will be based on going research and conditions experienced during stripping.

Equipment and procedures that are successfully used during the stripping process will also be used in the recovery of stockpiles for reinstatement purpose. If necessary equipment and procedures used, based on experienced gained during stripping will be amended to minimise compaction and soil structure damage during recovery of stockpiles for reinstatement purposes.

Equipment will be selected with the aim of minimising ground pressures where soil structure and moisture conditions indicate this may be a problem.

5.6.2 Procedures for Stripping, Stockpiling, Recovery and Reinstatement

5.6.2.1 Access Road for Stripping

The stripping program will be designed to minimise the number of times machines travel over soils material. To accomplish this, the following will be implemented:

- For haulage, access road will be first constructed into defined stripping areas from which topsoil will be removed in advance;
- Heavy vehicles will only travel on these approved access roads to and from defined soils stripping areas;
- Sequencing of stripping operations will be set out to prevent machines running over soils materials;
- Stripping operations will be set out and controlled on a lot basis;
- Light vehicles will access areas only as approved by the Project's Environmental Manager; and
- Thick (> 0.1m) unsuitable layers between topsoil and subsoil will be considered as adequate for travelling on during stripping operations.

5.6.2.2 Removal of In-situ Subsoils

During construction activities, subsoils will be removed by scraper in certain cases as recommended by SLR (2013). If field testing indicates potential compaction problems then alternative measures will be taken as recommended by the soils consultant.

5.6.2.3 Stockpile

Stockpiles will be built to maximum heights as noted in **Section 5.5** to minimise machine movements and to minimise compaction.

Stockpiles will be monitored by the soils consultant during the stripping process to enable revision of stripping and stockpiling procedures, and to assess if remedial methods need to be carried out on stockpiles in cases where critical dry densities are exceeded or desired permeability's are not obtained.

Stockpile areas with vegetation will be cleared or sprayed prior to stockpiling and will be graded to minimise contamination of soils by overburden material during recovery operations. A surface stabilising species and a deep rooted perennial such as lucerne, will be planted immediately upon stockpile completion to promote moisture and air exchange at depth.

5.6.2.4 Reinstatement

Indirect and Temporary Impacts

Land indirectly impacted temporarily by the Underground Extraction Area will experience localised short-term changes in soil and landscape characteristics and will require surface remediation works.

Suitable soil will be sourced from land covered by Project components that will be permanently impacted upon. This soil will be used as appropriate for surface remediation works.

Direct and Temporary Impacts

Land directly impacted temporarily upon by the Mine Infrastructure and road network will experience short-term changes in soil and landscape characteristics and will require rehabilitation post decommissioning of the Project elements.

Subsoil will be ripped to alleviate compaction. The topsoil for each specific soil unit impacted upon will be replaced to the same depth as pre-mining condition.

Direct and Permanent Impacts

Land directly and permanently impacted temporarily upon by the Open Cut Mining Area and OEAs will experience long-term changes in soil and landscape characteristics. The disturbance footprint will be rehabilitated to LSC Class 4 land landform with a similar quantity of BSAL offset within or surrounding the Project Boundary, which has a target LSC of Class 3.

The construction and instatement of a LSC Class 4 landform will have a minimum of 0.5 m subsoil overlain by 0.3 m of topsoil. Further, the shaped overburden will be ripped to provide an additional 0.3 m of weathering substrate that will act a as BC horizon. Such a soil profile will be confirmed by a research trial prior to commencement of reinstatement of BSAL. Gravels or other similar porous medium will not be used as the material underlying the topsoil

The construction and instatement of a LSC Class 3 and BSAL landform will have a minimum of 1 m subsoil overlain by 0.5 m of topsoil. Such a soil profile will be confirmed by a research trial prior to commencement of reinstatement of BSAL. Gravels or other similar porous medium will not be used as the material underlying the topsoil.

5.6.3 Establishment

The process of re-establishing soil profile will include the following steps:

- Final shaping of overburden is scheduled to allow revegetation during autumn, the optimum time for sowing. The surface of the overburden will be left rough to maximise infiltration of rain and to minimise surface erosions;
- Soil will be placed by truck and spread by dozers to the required thickness or directly placed by scrapers where conditions allow. To establish the subsoil profile, soils will be placed, shaped and left roughened prior to topsoil spreading. Travel lanes will be set out on the areas

being rehabilitated to LSC Class 3 and BSAL standards to reduce the potential for soil compaction during placing;

- Prior to sowing, soils will be cultivated along the contour using a tyned plough drawn by a bulldozer. On the LSC Class 3 and BSAL areas a specially adapted ripper will be used to provide deep cultivation and to alleviate any compaction of the soil profile that may have occurred during placement;
- Surface cultivation will be undertaken using a tyned plough such as an "Agro Plough" for seed bed preparation; and
- Pastures or lucerne crops will be sown and fertilisers will be applied.

Soil movements onto shaped areas will be sequenced in such a manner as to prevent or minimise travel over areas where either soils or subsoils are in place. This will involve setting out of specific soils access roads to shaped areas on overburden. Areas where such roads exist will be ripped prior to placement of subsoil and if necessary deep ripped upon completion of soils profile.

Where possible replacement sequence of soils profiles will encourage the use of loamy sand and sandy clay loam covers over the silty clays and light clays.

Existing topsoils that are weed contaminated and not adequately treated prior to stripping will be discretely stockpiled for used on LSC Class 4 lands depending upon availability of alternate sources of topsoil.

5.6.4 Stockpiling and Stripping Guidelines

Stripping operations for mining will not commence until the cut off wall is complete and overlying levee is built to the design limit.

Stripping operations will not be undertaken during excessive dry periods to prevent pulverisation of the natural soil aggregates. Similarly, stripping during wet periods will not be undertaken to prevent damage through compaction. Stripping of soils will be undertaken during daylight hours.

Stripping will occur well ahead of mining to avoid interference and to ensure complete recovery of soils. It will involve up to four faces – topsoil, the unsuitable layer, subsoils to 2.5 m depth and subsoils below 2.5 m depth. The fourth face will depend on the in-field identification of the > 2.5 m subsoils.

Stripping should occur at a moisture content between the air day and plastic limit such that deformation is minimised without pulverisation occurring. The theoretically desirable moisture range for stripping for each texture group on BSAL is:

- Loamy sands and clayey sands 9 -11%
- Sandy clay loams, clay loams, sandy clays 12 -14%
- Silty clays, light clays 20 -22%

It is probable that stripping outside the desired range will be necessary, in which case the stripping procedure or amelioration will be reassessed. Placement at wetter then above may necessitate deep rigging once the profile has been dried to below the plastic limit. Stripping should not occur at wetter than the plastic limit except where the normal moisture regime is above this level. Modifications to the stripping procedure may be required should this occur.

If severe wheel compaction is likely, the dumping will best be undertaken by following set tracks and subsequent ripping those tracks rather than compacting the whole dump surface.

Topsoils and subsoil stockpiles will be established with a coarse seedbed to enhance moisture retention.

Stockpiles will immediately be sown by seeder (where practical) with a permanent cover crop such as Lucerne, and if seasoned conditions warrant, a temporary cover crop such as oats with an under-sowing of a permanent species.

To ensure that finished stockpiles are not built beyond the recommended heights the following method shall be used:

- Prior to stockpiling commencing, the prepared receiving areas will be accurately surveyed and plans prepared;
- Survey stations will be set up to allow levels to be taken on the stockpile areas; and
- Pegs will be offset around stockpile areas indicating remaining fill required (and cut if necessary).

5.7 Testing

5.7.1 In-situ Test Pits

Prior to commencement of stripping topsoil and subsoils, small test pits will be excavated using a backhoe or small excavator to accurately determine sol profiles and soil type boundaries. These pits will:

- Be supervised by a suitably trained person;
- Positioned to give advance indication of stripping depths for changes in profile;
- Be accurately logged by a suitably trained person;
- Be excavated to a depth of 2.5 m below the surface; and
- Materials won from these trenches will be discretely stockpiled as topsoil, unsuitable and subsoils.

Test pits will also be used to determine in-situ densities and moisture contents according to standards and methods as specified by the soils consultant.

5.7.2 Test Pits in Stockpiles

Test pits will be excavated through topsoil and subsoil stockpiles during the stripping operation to ensure that critical densities are not being exceeded, that soil structure is not being destroyed and to indicate the necessity for deep ripping. Monitoring will also be undertaken on soil benches during the construction of the stockpile.

Extra test pits will be excavated during the life of the soil stockpiles to determine the “health” of the soils within these stockpiles.

5.7.3 Test Pits in Reinstated Land and Soil Capability Class 3 and 4

Test pits will be excavated as part of the assessment procedure as recommended by the soils consultant in reinstated LSC Class 3 and 4 lands. Dry densities and infiltration will also be monitored. Accepted procedures, as recommended by the soils consultant, will be utilised for all testing.

5.8 Records and Report

5.8.1 Reconciliation

Reconciliation will be carried out as indicated in **Section 5.4.6** during the stripping and placement process. A typical reconciliation record is attached in **Appendix 1**. Reconciliation surveys shall be completed regularly.

5.8.2 Reports

A monthly report will be prepared and will include:

- Cumulative stripped quantities;
- Updated reconciliation records;
- Indicated status of stockpiles and soil face positions;
- Seeding and reseeding details; and
- Weed control measures.

5.8.3 Inventory

An inventory recording system shall be kept for each soil type and soil class on a stockpile basis. This shall be updated on a regular basis and shall be used as a means of tracking soils movements from stripped areas to stockpile locations and for reconciliation purposes. The inventory system will enable cross referencing with soil face plans and soil stockpiles positions.

Typical inventory records are as attached as **Appendix 2.**

5.8.4 Stockpile Height Monitoring

Measures to control and monitor stockpile heights are described in **Section 5.5**.

Plans based on field surveys will be completed on a monthly basis detailing stockpile heights and stockpile RLs.

5.8.5 Reviews

The soil consultant will inspect the site initially on a weekly basis and then as required and agreed. These inspections will be recorded in writing.

5.8.6 Seeding and Weed Control

Records will be kept and updated on a quarterly basis showing the status of stockpile seeding. This record will also detail seeding and fertilised mixes and rates applied. On-going assessment of vegetation cover present will be undertaken. Weed control measures and applications will also be indicated.

5.9 Rehabilitation Effectiveness

5.9.1 Trial Plot

A 50 m x 100 m trial plot simulating LSC Class 3 land will be constructed within the Project Boundary.

The plot will be used to assess the acceptability of the minimum 1.5 m deep soil profile for use in the LSC Class 3 land to carry out trials to assess yields and to establish the effect of handling techniques and deep ripping.

Crop production rates will be used to assess the effectiveness of reinstatement of LSC Class 3 land.

A measure of rehabilitation effectiveness will be that post mining LSC Class 3 land should achieve similar yields to that from equivalent land in the same region. Proposed success criteria have been developed based on soil and land capability land characteristics compared to analogue or reference sites. The analogue sites will be selected prior to the commencement of the initial rehabilitation campaign. Anologue sites will be sourced in collaboration with a local landholder reference group containing farmers and graziers from surrounding properties.

5.9.2 Updating of the Plan

The BSAL Reinstatement Plan will not be static and will be continually updated and reviewed on the basis of research and best field practice at the time and a continuous improvement philosophy.

6 CONCLUSION

The Project is a SSD that is required to go through the Policy's Gateway process and must address Clause 17H(4a) of the Mining SEPP. This Preliminary BSAL Rehabilitation Strategy has been prepared to support the Gateway Application for the Project and addresses Clause 17H(4a), specifically items (i), (ii), (iii) and (vi) and. A detailed Rehabilitation Strategy for the broader Project will be prepared as component of the EIS once proceeding to the DA stage.

The key findings of the strategy are summarised below:

- The Project footprint is 2,666.6 ha and there are approximately 401.3 ha of verified BSAL mapped in the Project disturbance footprint. Of this
    - 46.2% (185.6 ha) of the verified BSAL within the Project disturbance footprint will be indirectly and temporarily impacted by the underground extraction area and will be returned to the pre-mining state;
    - 5.3% (21.3 ha) of the verified BSAL within the Project disturbance footprint will be directly; however, temporarily impacted by the development of internal road networks and will be returned to the pre-mining state; and
    - 48.4% (194.4 ha) of the verified BSAL within the Project disturbance footprint will be directly and permanently impacted by open cut mining areas and OEAs.
- A letter was tabled to the DP&I in November this 2013 regarding the inclusion of the LSC classification to the Interim Protocol and an inconsistency with the first approximation of relative fertility rankings relative to existing soils literature. Should the recommendations of the letter be taken on board there may be a reduction in mapped BSAL within the Project Boundary of 564 ha of BSAL, which is associated with LSC Class 4 or Class 5 lands. And/or a reduction of 410 ha of BSAL within the Project Boundary that would have moderate inherent fertility and be associated with a slope incline or greater than 5%.
- The Project has been designed such that potentially direct and permanent activities will avoid BSAL that is hydrologically linked and soil unit impacts are largely associated with the Bald Hill and Growee soil units.
- The land proposed to be directly and permanently impacted upon is LSC Class 3 (23.8%) and Class 5 (24.6%). LSC Class 3 is associated with the Bald Hill and Bylong soil units whereas Class 5 is associated with the Growee Soil Unit G05. The footprint currently includes approximately 1 ha of Bylong soil units B01 and B06; however; this land will be avoided where practicable to limit impacts. All soil is considered to have moderately high relative fertility with the exception of 1 ha of the Bylong soil units.
- Temporary impacts will be effectively handled through surface remediation works and rehabilitation works with the impacted land returned to pre-mining condition that is capable of sustaining current land uses.
- Direct and permanent impacts on BSAL will be mitigated through the offset of BSAL on less capable land. There will be no reduction in the quantity of BSAL.

- Direct and permanent impacts that increase the quantity of LSC Class 4 land will be mitigated through the selection of Class 4 land for BSAL reinstatement works, which will elevate the land's LSC to Class 3.

- Overall, there will a spatial change in the distribution of soil fertility classes but no overall change in quantity of each relative soil fertility class within the Project Boundary.

- Overall, there will a spatial change in the distribution of LSC classes with a marginal increase in LSC Class 3 and a marginal decrease in LSC Class 5 within the Project Boundary.

- Upon grant of Project Approval and prior to commencement of construction activities, KEPCO will prepare a BSAL Reinstatement Plan in consultation with relevant government authorities. The proposed scope of the plan includes stakeholder consultation, success criteria, stockpile management, procedures for stripping, stockpiling, recovery and reinstatement, records and reporting management and monitoring of the effectiveness of reinstatement methods on BSAL.

- Project impacts on BSAL are not considered to be significant as most impacts will be avoided, mitigated or offset in accordance with the detailed BSAL Reinstatement Plan prepared prior to disturbance.

7 REFERENCES

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Appendix 1

RECONCILIATION DURING STRIPPING AND STOCKPILING

SOIL TYPE: TOPSOIL

SOIL CLASS: LSC CLASS 3

Date		Estimated Volumes m^3		Surveyed	Difference	
Week Ending (Face Pickup)	**Reporting Month Date**	**By Scraper or Truck (1)**	**From SLR Soil Thickness Plans (2)**	**Volumes (m^3) (3)**	**[3-1] m^3**	**[3-2] m^3**

TOPSOIL AND SUBSOIL INVENTORY

SOIL TYPE: TOPSOIL

SOIL CLASS: LSC CLASS 3

STOCKPILE No.: No. 1

STOCKPILE CO-ORDINATES:

Date of Removal	Source Location		Method of Removal	Load Description	Load Volume (m^3)
	Description	Approximate Location			

TOPSOIL AND SUBSOIL INVENTORY SUMMARY

Stockpile No.	Height	Volume m^3	Date of Seeding	Date of Removal	Reuse Location
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					
11.					
12.					
13.					
14.					
15.					
16.					
17.					
18.					
19.					
20.					
21.					
22.					