C ### | HANCOCK GALILEE PTY LTD

Kevin's Corner Project | Supplementary Environmental Impact Statement

T4.09 Rehabilitation Plan (ToC)





HANCOCK GALILEE PTY LTD

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KEVIN'S CORNER PROJECT SEIS

Rehabilitation Management Plan

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Table of Contents

1.	INTRO	ODUCTION	8
1.1.	Proj	ect Overview	8
1.2.	Purp	OSE AND SCOPE	10
1.3.	Plan	Structure	10
2.	REHA	BILITATION OVERVIEW	
2.1.	Rена	BRI ITATION HIERARCHY	
2.2.	REHA	BI ITATION OBJECTIVES	
	2.2.1.	ADDITIONAL DECOMMISSIONING WORKS PRIOR TO REHABILITATION	
	2.2.2.	ACHIEVING REHABILITATION OBJECTIVES	
3.	REHA	BILITATION MANAGEMENT STRATEGY	14
3.1.	Dom	AINS	
3.2.	Post	MINE LAND USE PLAN	
4.	GENE	RAL REHABILITATION METHODS	
4.1.	SOIL	Management	19
4.2.	Eros	SION AND SEDIMENT CONTROL	
4.3.	FLOR	A SPECIES SELECTION FOR REHABILITATION	20
4.4.	Pest	AND WEED MANAGEMENT	23
5.	DOMA	AIN 1 – INFRASTRUCTURE, ROADS, AND TRACKS	24
5.1.	Final	L LAND USE OBJECTIVES	
5.2.	Reha	BILITATION ACTIONS	24
	5.2.1.	Post Mine Land Use Plan	24
	5.2.2.	LANDFORM DESIGN	24
	5.2.3.	WATER QUALITY MANAGEMENT	25
	5.2.4.	TOPSOIL MANAGEMENT	25
<	5.2.5.	REVEGETATION AND FAUNA HABITAT REPLACEMENT	
5.3.	Сомя	PLETION CRITERIA	25
6.		AIN 2 – PITS, VOIDS, AND OVERBURDEN	28
C A			
6.1.	FINAL	L LAND USE OBJECTIVES	
6.2.	KEHA	BILITATION ACTIONS	
	6.2.1.	POST MINE LAND USE PLAN	28
	6.2.3		
	6.2.4.	Overburden Emplacement	
	6.2.5.	TOPSOIL MANAGEMENT	
	6.2.6.	Revegetation and Fauna Habitat	30
	6.2.7.	Void Management	30



	6.3.	Сом	PLETION CRITERIA	31
7.		DOM	AIN 3 – TAILINGS STORAGE FACILITY	35
	7.1.	Fina	L LAND USE OBJECTIVES	35
	7.2.	Reha	ABILITATION ACTIONS	35
	7	.2.1.	Post Mine Land Use Plan	35
	7	.2.2.	TAILINGS STORAGE FACILITY DECOMMISSIONING	35
	7	.2.3.	LANDFORM DESIGN	35
	7	.2.4.	Revegetation	36
	7.3.	Сом	PLETION CRITERIA	36
8.		DOM/	AIN 4 – DAMS AND SURFACE WATER FEATURES	38
:	8.1.	Fina	LAND USE OBJECTIVES	38
:	8.2.	Reha	ABILITATION ACTIONS	38
	8	.2.1.	Post Mine Land Use Plan	38
	8	.2.2.	DECOMMISSIONING OF DAMS	38
	8	.2.3.	LANDFORM STABILITY	38
	8	.2.4.	WATER QUALITY MANAGEMENT	39
	8	.2.5.	REVEGETATION AND FAUNA HABITAT	39
:	8.3.	Сом	PLETION CRITERIA	39
9.		DOM/	AIN 5 – SUBSIDENCE AFFECTED AREAS	41
9	9.1.	Fina	L LAND USE OBJECTIVES	41
9	9.2.	Reha	ABILITATION ACTIONS	41
	9	.2.1.	Post Mine Land Use Plan	41
	9	.2.2.	Post Subsidence Mitigation Works	41
	9	.2.3.	REVEGETATION	42
	9.3.	Сом	PLETION CRITERIA	42
10		DOM/	AIN 6 – OTHER LANDS	46
	10.1.	Fina	L LAND USE OBJECTIVES	46
	10.2.	REH	ABILITATION ACTIONS	46
A	1	0.2.1.	Post Mine Land Use Plan	46
	1	0.2.2.	DECOMMISSIONING OF REMAINING INFRASTRUCTURE	46
	1	0.2.3.	LANDFORM DESIGN	46
	1	0.2.4.	TOPSOIL MANAGEMENT	47
	1	0.2.5.	REVEGETATION AND FAUNA HABITAT	47
	10.3.	COM	IPLETION CRITERIA	47
11	•	REHA	BILITATION MONITORING PROGRAM	49
	11.1.	Asse	ESSING COMPLETION CRITERIA	51
12		REFE	RENCES	53



Tables

Table 3-1	Final Land Use and Rehabilitation Approval Schedule	15
Table 4-1	Species to be Used for Rehabilitation throughout the Life of the Project \ldots .	20
Table 5-1	Landform Design Criteria	24
Table 5-2	Rehabilitation Completion Criteria for Domain 1	25
Table 6-1	Landform Design Criteria	28
Table 6-2	Progressive Rehabilitation	30
Table 6-3	Rehabilitation Completion Criteria for Domain 2	31
Table 7-1	Landform Design Criteria	36
Table 7-2	Rehabilitation Completion Criteria for Domain 3	36
Table 8-1	Rehabilitation Completion Criteria for Domain 4	40
Table 9-1	Rehabilitation Completion Criteria for Domain 5	42
Table 10-1	Landform Design Criteria	47
Table 10-2	Rehabilitation Completion Criteria for Domain 6	47
Table 11-1	Reference Sites	49
Table 11-2	Likely Regional Ecosystems requiring reference site establishment	51

Figures

Figure 1-1	Regional Location of the Kevin's Corner Project	9
Figure 3-1	Overall Site Layout Domain Plan	
Figure 3-2	Conceptual Rehabilitation and Final Land Use	



ABBREVIATIONS

Abbreviations used in this document are defined as follows.

Abbreviation	Definition		
DEHP	Department of Environment and Heritage Protection		
EIS	Environmental Impact Statement		
ESCP	rosion and Sediment Control Plan		
ESP	Exchange Sodium Percentage		
GQAL	Good Quality Agricultural Land		
HGPL	Hancock Galilee Pty Ltd		
MLA	Mining lease application		
Мtра	Million tonnes per annum		
PMLUP	Post Mine Land Use Plan		
SEIS	Supplementary Environmental Impact Statement		
ТМР	Topsoil Management Plan		
TSF	Tailings storage facility		
VMS	Void Management Strategy		



1. INTRODUCTION

1.1. PROJECT OVERVIEW

Hancock Galilee Pty Ltd (HGPL) aims to develop an integrated open-cut and underground longwall coal mine with nominal production of up to 30 million tonnes per annum (Mtpa) of product coal over a 30 year period within the Galilee Basin, Queensland. The mining lease is located 65 km north of the town of Alpha, 110 km south-west of the town of Clermont and approximately 340 km south-west of Mackay in Central Queensland (Figure 1-1).

Project development is planned to commence in early 2014 with first production in early 2016, with construction to continue beyond the initial 24 month period for up to nine years. It is anticipated that the Project will employ up to 2500 personnel during peak construction and a permanent workforce of approximately 1500 personnel to operate the mine, with periodic additions up to 2000 people.

The Project is adjacent to Hancock Coal Pty Ltd's (HCPL) Alpha Coal Project. The mining lease application (MLA 70425) covers an area of 37,499 ha.

The proposed mine consists of three underground longwall operations, supplemented initially, with two open-cut pits.

The associated operations involved with the open-cut mine include:

- Mining by conventional drill and blast and haul back and terrace mining methods
- Placement of overburden and inter-burden materials from the open-cut area to a combination of out-of-pit and in-pit overburden emplacements
- On-site crushing and temporary stockpiling of the mined coal within a defined coal processing area
- Acceptance and placement of back-loaded reject material from the Project for placement in the mined out areas of the mine
- Progressive shaping and rehabilitation of the mine area and other areas of disturbance.

Key relevant infrastructure to be developed as part of the Project includes.

- Coal Handling and Preparation Plant (CHPP)
- Three Underground Mine Areas
- Two Open-Cut Mine Areas
- Supporting Infrastructure (including on-site accommodation village for 100% of the workforce (contract and permanent), on-site airstrip, and on-site light industrial area).

The Project has a scheduled mine life of approximately 30 plus years.







1.2. PURPOSE AND SCOPE

The purpose of this Rehabilitation Management Plan is to provide an overview of progressive rehabilitation and revegetation to be implemented following the completion of mining activities to minimise and mitigate impacts caused by the Project. It provides a framework for site rehabilitation works in association with other management plans and monitoring programs for the management of environmental issues associated with the Project.

This Rehabilitation Management Plan is an active document and will continue to be developed as the Project planning progresses. The Rehabilitation Management Plan will be reviewed and updated at least every five years or as required to remain consistent with the Plan of Operations. The rehabilitation requirements are integrated with the Plan of Operations by the inclusion how much rehabilitation is predicted during the term of the plan (e.g. 1 - 5 years).

This Plan covers rehabilitation of disturbance areas associated with activities within the MLA. Whilst the management of subsidence and the minimisation of subsidence impacts are covered under the Interim Subsidence Management Plan, Appendix N of the Supplementary Environmental Impact Statement (SEIS), the rehabilitation of areas impacted by subsidence is covered in this plan.

1.3. PLAN STRUCTURE

The Rehabilitation Management Plan incorporates rehabilitation objectives, overall management strategy and general rehabilitation methods for the Project structured around six domains within the MLA. The following details have been developed for each domain:

- Design criteria
- Success factors and completion criteria
- Reference sites to be used to develop rehabilitation success criteria
- A description of the monitoring of reference sites inclusive of statistical design
- Rehabilitation methods applied to each domain
- Landform design criteria including end of mine design
- Detail on how landform design will be consistent with the surrounding topography
- Provision of schematic representation of the final landform inclusive of:
 - Drainage design and features
 - > Slope designs
 - > Cover design
 - > Erosion controls proposed on reformed land.
- Explanation of planned native vegetation rehabilitation areas and corridors
- A description of rehabilitation monitoring and maintenance requirements to be applied to all areas of disturbance
- A contingency plan for rehabilitation maintenance or redesign.



A framework for rehabilitation monitoring relevant to each domain is presented at the end of this Rehabilitation Management Plan.





2. **REHABILITATION OVERVIEW**

2.1. REHABILITATION HIERARCHY

HGPL intend to use the rehabilitation hierarchy from the Department of Environment and Heritage Protection (DEHP) Rehabilitation Requirements for Mining Projects (DEHP 2012) to guide rehabilitation choices where possible. The rehabilitation hierarchy, in order of decreasing capacity to prevent or minimise environmental harm, is:

- 1. Avoid disturbance that will require rehabilitation to prevent or minimise future environmental harm
- 2. Reinstate the original "natural" ecosystem
- 3. Develop an alternative outcome with a higher economic value than the previous land use
- 4. Reinstate previous land use (e.g. grazing or crops)
- 5. Develop lower value land use (if this is acceptable to relevant stakeholders)
- 6. Leave the site in an unusable condition or with a potential to generate future pollution or adversely affect environmental values (unacceptable).

2.2. REHABILITATION OBJECTIVES

HGPL intends to return the MLA to a stable landform capable of supporting similar land uses to predisturbance in a manner which is consistent with the rehabilitation hierarchy in DEHP's Guideline; Rehabilitation requirements for mining projects. Detailed performance criteria or rehabilitation methodologies are to be developed prior to rehabilitation commencing. As per current industry practice, success criteria and rehabilitation methods will be regularly assessed and updated based on a "continuous loop of improvement" with respect to future rehabilitation strategies and relinquishment. During operations rehabilitation works will be designed specifically to optimise the potential for rapid ecosystem re-establishment.

The nominated post-mine land use is a mix of native bushland and low density cattle grazing land (Section 3). For areas disturbed by the Project the following objectives will be used in accordance with the DEHP Guideline; Rehabilitation requirements for mining projects (DEHP 2012):

- The mine site will be safe to humans and fauna
- Mining and rehabilitation will aim to create a landform that is stable and with similar land use capabilities and/or suitability that existed prior to the disturbance, unless other beneficial end uses are pre-determined and agreed
- Mine wastes and disturbed land will be rehabilitated so that they are non-polluting and selfsustaining or to a condition where the maintenance requirements are consistent with an agree post-mining land use
- Surface and ground waters leaving the Project area will not be degraded compared to their condition prior to the commencement of mining operations. Current and future water quality will be maintained at levels that are acceptable for users downstream of the site and meet environmental needs



- Potential acid mine drainage will be determined and management measure implemented (e.g. encapsulation of sulphides or treatment systems), if required
- Vegetation cover will be established to reduce rates of erosion and sediment loss to that in surrounding, comparable undisturbed landscapes
- Soil suitability for use in rehabilitation will be assessed and soils will be enhanced as required
- Following final rehabilitation, there will be limited need for ongoing maintenance of rehabilitated areas.

2.2.1. Additional Decommissioning Works Prior to Rehabilitation

At the cessation of operations, decommissioning activities are required in the following areas prior to rehabilitation works and revegetation:

- Infrastructure areas (including hardstands, parking areas, and airstrips)
- Roads and tracks including diversions
- Stock route diversions
- Dams and creek diversions
- The control and management of mine waste (i.e. overburden, coarse and fine reject (tailings))
- Shafts, portals/adits, and boreholes
- Underground mining and subsidence areas.

A decommissioning plan will be developed for these areas.

2.2.2. Achieving Rehabilitation Objectives

These rehabilitation objectives will be achieved through:

- Control and management of mine waste
- Void management
- Management of subsidence affected areas
- Diversions (road/track, creek, and stock route)
- Sustainable rehabilitation methods for the disturbed areas
- Management of topsoil resources for use in rehabilitation of the site
- Progressive revegetation of areas across the mine site
- Re-fill and re-contour subsided areas to create a stable, adequately drained landscape that complies with rehabilitation and erosion control guidelines and post-mining land use objectives
- Integration with ongoing and future rehabilitation activities across the wider mining area
- Rehabilitation monitoring and maintenance management.



3. REHABILITATION MANAGEMENT STRATEGY

3.1. DOMAINS

Within the context of this plan, rehabilitation actions only apply to the six Domains detailed below and illustrated in Figure 3.1:

- Domain 1 Infrastructure, Roads and Tracks
- Domain 2 Pits, Voids and Overburden Emplacements
- Domain 3 Tailings Storage Facility
- Domain 4 Dams and Surface Water Features
- Domain 5 Subsidence Affected Areas
- Domain 6 Other Lands.

A Conceptual Rehabilitation and Final Land Use Plan for each domain are shown in Figure 3-2.

Sections 5, 6, 7, 8, 9, and 10 provide a high-level assessment of rehabilitation strategies and requirements for each of the Domains. Additional detail which can be implemented at an operational level will be developed to finalise rehabilitation methods and strategies within these Domains.

All areas significantly disturbed by mining activities will be rehabilitated in accordance with Table 3-1.



Table 3-1 Final Land Use and Rehabilitation Approval Schedule						
			Domains	Domains		
	Pits and M	line Waste	Tailings Storage Facility	Infrastructure	Remainder of Mining Lease Area	
	Pits	Mine Waste				
Approximate surface area (ha)	897	2,418	420	2,566	30,802	
Pre-mine land use	Combination of low intensity	y cattle grazing and bushland				
Post-mine land use	Voids to reach a stable water level over time for storage and stock watering.	Combination of low intensity cattle grazing and bushland.	Low intensity cattle grazing.	Low intensity cattle grazing.	Combination of low intensity cattle grazing and bushland.	
Post-mine land capability classification	Voids – Class V1	Land Suitability (Low Intens All other areas – Class III1	ity Grazing). or IV1.			
Projective cover range (%)	Not applicable	>70% vegetative cover is present (or 50% if rocks, logs, or other features of cover are present).	>70% vegetative cover is present (or 50% if rocks, logs, or other features of cover are present).	>70% vegetative cover is present (or 50% if rocks, logs, or other features of cover are present).	Consistent with existing vegetation as these areas are going to have minimal disturbance.	
				5		

Table 3-1 Final Land Use and Rehabilitation Approval Schedule



3.2. POST MINE LAND USE PLAN

A Post Mine Land Use Plan (PMLUP) consistent with the Plan of Operations will be developed for each Domain describing how the rehabilitation objectives for each Domain will be achieved. The PMLUPs will be included in the relevant Domain sections of this Rehabilitation Management Plan and include, where relevant:

- Schematic representation of final land form inclusive of drainage features
- Drainage design
- Erosion controls proposed on reformed land
- Geotechnical, geochemical and hydrological studies
- Chemical, physical and biological properties of soil and water
- Proposed revegetation methods inclusive of plant species selection, re-profiling, respreading soil, soil ameliorants/amendments, surface preparation and method of propagation
- A rehabilitation monitoring program (Section 11).











4. GENERAL REHABILITATION METHODS

The general rehabilitation methods and principles detailed in this section are common across all Domains. Specific rehabilitation methods for each Domain are presented in Sections 5, 6, 7, 8, 9, and 10.

4.1. SOIL MANAGEMENT

The handling of soil during the construction and operation of the mine will include activities such as vegetation clearing, topsoil stripping, subsoil removal, stockpiling, re-profiling, ripping and scarification, and soil amelioration.

Appropriate soil handling during construction and rehabilitation is critical to the successful rehabilitation of disturbed areas, particularly for soils with significant subsoil constraints such as sodicity and salinity.

During construction a range of general actions will be implemented to minimise impacts to land, with the main objective being to return disturbed areas as near as practical to pre-existing environmental conditions by:

- Removing topsoil and stockpiling it separately to the subsoil layer
- Maintaining topsoil quantity and quality through the use of sediment fencing, windrowing the topsoil and respreading as soon as practicable after backfilling of the trench
- Returning the land as far as practicable to the pre-disturbance land use and capability as early as possible
- Returning the land to a stable landform (i.e. no subsidence, land slips, or major erosion), with no greater management inputs than those required prior to land disturbance.

A Topsoil Management Plan (TMP; SEIS, Volume 2, Appendix T4.13) will be developed to maximise the recovery and reuse of topsoil. This TMP will include:

- All relevant aspects for topsoil retrieval such as stripping, stockpiling, erosion prevention and re-spreading procedures, stockpile locations, and inventory
- Topsoil stripping quantities formulated from pre-mining soil survey information
- Stripping and stockpile management.

Specific requirements for different post-mining landform elements will be specified in the TMP and in the Erosion and Sediment Control Plan (ESCP).

4.2. EROSION AND SEDIMENT CONTROL

A site-based ESCP (SEIS, Volume 2, Appendix T4.04) will be prepared for all disturbance activities. ESCPs will be prepared with reference to the International Erosion Control Association Best Practice Erosion and Sediment Control Guidelines 2008.

All ESCP measures will be fully implemented to provide effective erosion control prior to land disturbance activities. All measures will be installed and kept in place and maintained in a fully functional state until the area has been effectively rehabilitated.



4.3. FLORA SPECIES SELECTION FOR REHABILITATION

Flora species selection for areas to be rehabilitated will focus on those native species that will successfully establish on the available growth medium, will bind the soil, and will result in a variety of structure and habitat resources. Native species will be established through direct seeding or planting of tube stock/nursery-raised stock from local propagules. Seed will be collected locally where possible to ensure it is adapted to local environmental conditions. The Florabank Guidelines 6, Native Seed Collection will be used for seed collection activities.

Revegetation will be achieved using species from the local plant communities that were identified during the flora assessment undertaken in 2010 (see EIS Volume 1, Section 9). A summary of species likely to be used for revegetation of the disturbance areas within the MLA is presented in Table 4.1.



Species to be Used for Rehabilitation throughout the Life of the Project

Table 4-1



Scientific Name	Common Name	
Digitaria brownii	cotton panic grass	
Dodonaea lanceolata var. lanceolata	Hopbush	
Enchylaena tomentosa	ruby saltbush	
Eragrostis sp.	lovegrass	
Eremophila latrobei	crimson turkey bush	
Eremophila mitchellii	false sandalwood	
Erythrina vespertilio	bat's wing coral tree	
Eucalyptus brownii	Reid river box	
Eucalyptus camaldulensis	river red gum	
Eucalyptus cambageana	Dawson gum	
Eucalyptus coolabah	coolabah	
Eucalyptus melanophloia	silver-leaved ironbark	
Eucalyptus populnea	poplar box	
Eucalyptus tessellaris	Moreton Bay ash	
Eucalyptus thozetiana	Thozet's box	
Melaleuca tamariscina	weeping bottlebrush	
Heteropogon contortus	Black Speargrass	
Paspalidium caespitosum	brigalow grass	
Setaria surgens	annual pigeon grass	
Themeda triandra	kangaroo grass	
Grasslands		
Astrebla elymoides	hoop mitchell grass	
Astrebla pectinata	barley mitchell grass	
Astrebla squarrosa	bull mitchell grass	
Dichanthium sericeum subsp sericeum	bluegrass	
Panicum decompositum	native millet	
Sporobolus caroli	fairy grass	
Themeda triandra	kangaroo grass	
Riparian Zones		
Aristida inaequiglumis	feathertop three-awn	
Aristida latifolia	feather top wiregrass	
Atalaya hemiglauca	whitewood	
Brachychiton populneus	kurrajong	



Scientific Name	Common Name
Chloris divaricata	slender chloris
Corymbia dallachiana	Dallachy's gum
Enchylaena tomentosa	ruby saltbush
Eragrostis elongata	clustered lovegrass
Eragrostis lacunaria	purple lovegrass
Eragrostis parviflora	weeping lovegrass
Eucalyptus camaldulensis	river red gum
Eucalyptus cambageana	Dawson gum
Eucalyptus coolabah	Coolabah
Eucalyptus melanophloia	silver-leaved ironbark
Eucalyptus tessellaris	Moreton Bay ash
Heteropogon contortus	black speargrass
Lysiphyllum carronii	red bauhinia
Paspalidium caespitosum	brigalow grass
Sporobolus caroli	fairy grass
Themeda triandra	kangaroo grass
Steep Slopes / High Erosion	JA
Brachyachne convergens	native couch/spider grass
Chloris pectinata	comb chloris
Iseilema vaginiflorum	red Flinders grass

A combination of native pasture species and non-invasive cover crop (e.g. millet, oats or barley) may be used on the disturbance areas to ensure the quick establishment of a continuous groundcover, thereby reducing the risk of erosion. Legumes may also be selected to assist in the supply of bioavailable nitrogen to the soil. If the use of native grasses and/or legumes is deemed necessary for erosion control in the bushland areas, native pasture seed and fertiliser will be applied at a lower rate than for pasture outcomes to reduce competition with tree seed and/or seedlings.

Native pasture species (warm season perennial, cool season perennial, yearlong green perennial and annual) will be sown on pasture areas requiring rehabilitation. If steep slopes are present and it is not practicable to re-shape the area and/or there is a high risk of erosion, native stoloniferous grass species (e.g. *Brachyachne convergens* (native couch/spider grass), *Chloris pectinata* (comb chloris), and *Iseilema vaginiflorum* (red Flinders grass)) will be sown as their growth provides more extensive coverage in a shorter time.

If native species are unsuccessful, discussions will be held with DEHP regarding implementation of conditions for the use of introduced species, including buffer zones, as outlined in Volume 1, Section 26 of the EIS and in Appendix T1, Section T.3.8.6 of the SEIS.



Aerial sowing, or direct seeding with a seeder attached to a tractor and ground broadcasting will be conducted for both tree and pasture seed as the preferred sowing methods and stock will be excluded whilst the vegetation is establishing.

All revegetated areas will be monitored for the initial establishment of groundcover and in the longer term against completion criteria to ensure completion criteria are met. The irrigation of revegetated areas during the establishment stage (typically 12 weeks/3 months) will be used, where practicable, for long term revegetation success. Additional vegetation will be seeded or planted where regeneration of dominant species does not occur within one year.

Revegetation trials and other site based investigations will be undertaken to understand and determine the most appropriate species and conditions required for successful rehabilitation. Trials may include the assessment of species, topsoil depth, the use of structured soils, soil amelioration, and use of organic mulch. Revegetation techniques will be continually developed and refined over the life of mine through an ongoing process of monitoring at the site and recognition of other industry experiences.

4.4. PEST AND WEED MANAGEMENT

Weeds will be managed across the site through a series of control measures, including:

- Washing down of 'at risk' equipment in an approved wash down area before entry to site
- Scalping weeds off or herbicide treatment of weeds on topsoil stockpiles prior to respreading
- Regular inspections of rehabilitation to identify potential weed infestations
- Identifying and treating existing weed populations on-site for the duration of the mine-life
- Restricting soil and machinery movements from infested areas to areas free from weed infestations
- Wash down of at risk equipment before movement from infested areas to weed free areas within the mine site
- Using agricultural herbicides in the areas to be stripped and on stripped topsoils.

A detailed Pest and Weed Management Plan (SEIS, Volume 2, Appendix T4.02) is contained in the SEIS.



5. DOMAIN 1 – INFRASTRUCTURE, ROADS, AND TRACKS

Rehabilitation will be consistent with the rehabilitation objectives in Section 2.1 and the final land use objectives for Domain 1.

5.1. FINAL LAND USE OBJECTIVES

The post-mine land use proposed for Domain 1 is low density cattle grazing land. Post-disturbance grazing land will be rehabilitated to land suitability Class 3, which has moderate limitations, and Good Quality Agricultural Land (GQAL) Class C2 and C3 Pasture Lands (to allow land to remain as sustainable low density cattle grazing).

5.2. REHABILITATION ACTIONS

Rehabilitation actions required within Domain 1 include landform stability, water quality, topsoil management, and revegetation and fauna habitat replacement. Completion criteria will address these rehabilitation actions and the rehabilitation objectives outlined in Section 2.

At the cessation of operations, decommissioning activities are required in this domain prior to final rehabilitation works and revegetation.

5.2.1. Post Mine Land Use Plan

A PMLUP (Section 3.2) will be included in this section for the rehabilitation of disturbance areas consistent with the Plan of Operations to meet the final land use objectives. The PMLUP will be supported by other rehabilitation actions for this domain.

5.2.2. Landform Design

The objective is to create a stable post-disturbance landform with that is self-sustaining, or a landform where maintenance requirements are consistent with grazing land. All areas significantly disturbed by mining activities will be rehabilitated in accordance with Table 5.1.

Table 5-1 Landform Design Criteria

I	Domain	Target Slope Range (Degrees)	Approximate Surface Area (ha)
Infrastructure	Including CHPP. ROM stockpiles, workshops, landfill, raw water dam, administration areas, etc.	No less than 75% of the rehabilitated area has slopes of less than 5° and up to 25% of the rehabilitated area has slopes greater than 5°.	2,566



5.2.3. Water Quality Management

A detailed Erosion and Sediment Control Plan (ESCP; SEIS, Volume 2, Appendix T4.04) will be developed prior to the commencement of construction works. The ESCP can be used to manage water quality, and monitoring downstream will be used to assess and minimise the Project impacts on downstream water quality. A Water Management System will also be implemented to manage flows into, on, and from the site.

5.2.4. Topsoil Management

To achieve the desired post-mine land use of low density cattle grazing land, topsoil will require management to allow revegetation. A TMP (SEIS, Volume 2, Appendix T4.13) will be developed to maximise the recovery, management and reuse of topsoil. Specific requirements for different post-mining landform elements will be specified in the TMP and in the ESCP.

5.2.5. Revegetation and Fauna Habitat Replacement

To re-establish low density cattle grazing land, native species will be sown, where possible. Native pasture species (warm season perennial, cool season perennial, yearlong green perennial and annual) will be sown on pasture areas requiring rehabilitation. If steep slopes are present and it is not practicable to re-shape the area and/or there is a high risk if erosion, native stoloniferous grass species (e.g. *Brachyachne convergens* (native couch/spider grass), *Chloris pectinata* (comb chloris) and *Iseilema vaginiflorum* (red Flinders grass)) will be sown as their growth provides more extensive coverage in a shorter time. If native species are unsuccessful, discussions will be held with DEHP regarding implementation of conditions for the use of introduced species, including buffer zones, as outlined in Volume 1, Section 26 of the EIS and in the Appendix T1, Section T.3.8.6 of the SEIS.

Cleared vegetation will be used in the revegetation process in two ways. This includes use as organic mulch and, where possible, re-use of logs and tree stumps to provide shelter for fauna within the rehabilitated areas.

5.3. COMPLETION CRITERIA

Preliminary completion criteria for Domain 1 are outlined in Table 5.2. These criteria relate to the long term rehabilitation objectives for the mine identified in Section 2.2 and to the rehabilitation actions identified in Section 5.2.

Rehabilitation Element	Indicator	Criteria
Landform stability	Slope gradient	Area has a gradient of <2°.
Landform stability	Erosion control	Erosion mitigation measures have been applied.
Landform stability	Surface water and drainage	Use of contour banks and diversion drains to direct water into stable areas or sediment control basins.
Water quality		Ensure receiving waters affected by surface water runoff have contaminant limits of electrical conductivity maximum of 2000 μ S/cm and pH range of 4.4 to 9.5, or as determined to be

Table 5-2	Dobabilitation	Completion	Critoria for	Domain 1
	Kenabintation	completion	CITCEIIa IUI	



Rehabilitation Element	Indicator	Criteria
		sustainable subject to future investigations and setting water quality objectives.
Water storages, creek diversions		Clean water storages and diversions to be stabilised and left as required.
Topsoil	Physical and chemical soil parameters	Soil salinity content is <0.6 Ds/m. Soil pH is between 5.5 and 8.5. Soil Exchange Sodium Percentage (ESP) is <15%. Nutrient accumulation and recycling processes are occurring as evidenced by the presence of a little layer, mycorrhizae, and/or other microsymbionts. Adequate macro and micro-nutrients are present.
Vegetation	Land use	Buildings, water storage, roads (except those used by the public), and other infrastructure have been removed unless stakeholders have entered into formal written agreements for their retention. Areas are readily accessible and conducive to safe cattle management activities. Predicted economics and/or benefits have been defined and agreed by the stakeholders.
Vegetation	Surface cover	Minimum 70% vegetation cover is present (or 50% if rocks, logs or other cover features are present). No bare surfaces >20 m ² in area or >10 m in length down slope.
Vegetation	Species composition	Palatable, nutritious pasture grass species are present.
Vegetation	Community structure	Desirable grass species comprise at least 60% of total grass cover. Tree density and height of >25 stems per 5 ha each being >2 m in height.
Vegetation	Resilience to disturbance	Established species survive and/or regenerate after disturbance. Weeds do not dominate native species after disturbance or after rain. Pests do not occur in substantial numbers or visibly affect the development of the native plant species.
Vegetation	Sustainability	Nitrogen fixing grass species present. More than 75% of shrubs and/or trees are healthy when ranked healthy, sick, or dead.
Fauna	Vertebrate species	Representation of a range of species characteristics (e.g. activity pattern, habitat usage, diet, dispersal character etc. (WBM 2003; Kimber <i>et al</i> 1999) from each faunal assemblage group (e.g. reptiles, birds, mammals) present in the grassland ecosystem type, based on pre-mine fauna lists and sighted within the 3 year period preceding mine lease relinquishment. The number of vertebrate species does not decrease by more than 40% over the two successive seasons prior to mine leave relinquishment.
Fauna	Invertebrate species	Presence of representatives of a broad range of functional indicator groups involved in different pastoral ecological processes (including termites for soil structure). Collembola for decomposition.



Rehabilitation Element	Indicator	Criteria
		Hemiptera for herbivory and predatory groups such as arachnids, centipedes, earwigs, cockroaches and ants as indicators of a range of other processes (Bisevac and Majer 1998).
Fauna	Habitat structure	Typical food, shelter, and water sources required by the majority of vertebrate and invertebrate inhabitants of pastoral ecosystem type are present, including: a variety of food plants and signs of natural generation of shelter sources including leaf litter.
Safety		Risk assessment has been undertaken in accordance with relevant guidelines and Australian Standards and risks reduced to levels agreed with the stakeholders.
C C		Closure documentation includes the contaminated sites register which identifies contaminated sites and the treatment applied.



6. DOMAIN 2 – PITS, VOIDS, AND OVERBURDEN EMPLACEMENTS

These areas will undergo major earthworks and will not be returned to their original landform. Rehabilitation will be consistent with the rehabilitation objectives in Section 2.1 and the final land use objectives for Domain 2.

6.1. FINAL LAND USE OBJECTIVES

The post-mine land use proposed for Domain 2 is native vegetation and a final void. Section 4.3 contains a list of potential rehabilitation species; however vegetation community composition and species selection will be undertaken at a later date. Native vegetation planted to achieve a stable community will depend on the final landform design and the characteristics of the substrate media.

6.2. REHABILITATION ACTIONS

At the cessation of operations, decommissioning activities are required in this domain prior to rehabilitation works and revegetation.

Rehabilitation actions that will need to be addressed within Domain 2 include landform and drainage design, overburden emplacement, topsoil management, revegetation and replacement of fauna habitat, and void management. Completion criteria will address these rehabilitation actions and the rehabilitation objectives outlined in Section 2.

6.2.1. Post Mine Land Use Plan

A PMLUP (Section 3.2) will be included in this section for the rehabilitation of disturbance areas consistent with the Plan of Operations to meet the final land use objectives. The PMLUP will be supported by other rehabilitation actions for this domain.

6.2.2. Landform and Drainage Design

Further studies are required for the development of the final landform design with an appropriate drainage network. Detailed plans will be prepared to show the final landform. Landform design criteria will include visual impact/consistency, geotechnical stability, drainage and erosion, and sediment control.

All areas significantly disturbed by mining activities will be rehabilitated in accordance with Table 6.1.

Domains		Target Slope Range (Degrees)	Approximate Surface Area (ha)
1. Pits and	Void – Pit 1	Final void batter slopes will be designed and excavated to exhibit	897
Mine Waste	Void – Pit 2	permanent geotechnical stability. Prior to closure, further investigations will be undertaken to specify design criteria and appropriate action will be taken to ensure effective long term	

Table 6-1	Landform Docid	in Critoria
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Domains		Target Slope Range (Degrees)	Approximate Surface Area (ha)
		safety, stability and management of the void.	
Borrow Pit		No less than 75% of the rehabilitated area has slopes of less than 10°, and up to 25% of the rehabilitated area has slopes greater than 10°.	
	Overburden	No less than 75% of the rehabilitated area has slopes of less than 10°, and up to 25% of the rehabilitated area has slopes greater than 10°.	2,418

6.2.3. Water Quality Management

A detailed ESCP (SEIS, Volume 2, Appendix T4.04) will be developed prior to the commencement of construction works. The ESCP can be used to manage water quality, and monitoring downstream will be used to assess and minimise the Project impacts on downstream water quality. A Water Management System will also be implemented to manage flows into, on, and from the site.

6.2.4. Overburden Emplacement

The overburden emplacement areas will undergo reshaping where required to ensure they meet the final landform criteria prior to final revegetation works commencing. The areas will be rehabilitated to create the final landforms as prepared in the final plans.

The final landform will incorporate structural soil conservation works to ensure that water is directed into the site water management system. Such works may include the construction of contour banks, waterways, drains, graded banks, and check dams, as is current rehabilitation practice on the site.

6.2.5. Topsoil Management

A TMP (SEIS, Volume 2, Appendix T4.13) will be prepared prior to commencement of any disturbance activities and will be based on the results of a detailed soil survey. The TMP will include an inventory which identifies the topsoil requirements for the Kevin's Corner Coal Mine Project and availability of suitable topsoil.

The TMP will be developed to maximise the recovery and reuse of topsoil and will include:

- All relevant aspects for topsoil retrieval such as stripping, stockpiling and re-spreading procedures, stockpile locations, and inventory
- Topsoil stripping quantities formulated from pre-mining soil survey information
- Stripping and stockpile methodology.

Topsoil must be strategically stripped ahead of mining in accordance with the TMP. Topsoils are to be tracked to ensure they are used optimally. Topsoil and subsoils must be managed to ensure stability and minimise the release of contaminants. Measures include:

- Vegetating stockpiles
- Separation of topsoil from subsoil, including separating stockpile areas



- Minimising height and ongoing management (regular turning or revegetation) of stockpiles
- Reusing stockpiles as soon as possible.

6.2.6. Revegetation and Fauna Habitat

A detailed revegetation plan will developed and included in this Rehabilitation Management Plan following the characterisation of overburden material and the development of the topsoil management plan and final landform plans (**Section 6.2.1**). The aim of the revegetation is to re-establish native bushland, with the use of native species where possible. Plant selection for areas to be rehabilitated as bushland will use species that will successfully establish on available growth medium, bind the soil, and result in a variety of food and habitat resources for fauna as presented in Section 4.3. The species likely to be used have been provided for each of the predominant pre-mining land uses (woodlands, grasslands, and riparian zones).

Cleared vegetation will be used in the revegetation process in two ways. This includes use as organic mulch and, where possible, re-use of logs and tree stumps to provide shelter for fauna within the rehabilitated areas.

The progressive rehabilitation of areas disturbed through mining operations will be undertaken within 2 years of becoming available in order to create this desired low maintenance, geo-technically stable landform. A staged rehabilitation approach for the Project area is outlined in Table 6.2.

Year from Commencement of Operations	Total Area of Rehabilitation Completed (ha)
Year 6	319.5
Year 11	464.2
Year 16	147.3
Year 21	198.9
End of mine life	714.0

 Table 6-2
 Progressive Rehabilitation

6.2.7. Void Management

The final voids will remain at the end of mining to ensure the zone of influence, both groundwater level changes and hydrochemistry will be managed and maintained after the mining ceases. The voids will remain as permanent features incapable of supporting grazing activity, resulting in a land suitability Class 5 with an agricultural land class of D.

The residual void will be designed and managed to avoid environmental harm to land, surface waters, or any recognised ground water aquifer, other than the environmental harm constituted by the existence of the residual void itself.

Prior to closure, further investigations will be undertaken to specify landform design criteria and appropriate action will be taken to ensure effective long term safety, stability, and management of the void.



Upon closure of the mine, a Void Management Strategy (VMS) will be implemented targeting several key environmental issues for the long term management of the void. The primary objectives of the VMS are to:

- Propose mitigation measures to minimise potential impacts associated with the final void
- Propose measures for the management and monitoring the potential impacts of the void over time
- Present options for the final land use of the void following cessation of mining.

The residual void will be designed and managed to minimise environmental issues in the future.

6.3. COMPLETION CRITERIA

Preliminary completion criteria for Domain 2 are outlined in Table 6.4. These criteria relate to the long term rehabilitation objectives for the mine identified in Section 2.2 and to the rehabilitation actions identified in Section 6.2.

Rehabilitation Element	Indicator	Criteria
Overburden Empla	cement	
Landform stability	Slope gradient	No less than 75% of the area has slopes $<10^{\circ}$ and up to 25% of the area has slopes $>10^{\circ}$. Where reject layers are present and exposed, the landform is capped.
Landform stability	Erosion control	Erosion control structures are installed commensurate with the slope of the landform.
Landform stability	Surface water drainage	Use of contour banks and diversion drains to direct water into table areas or sediment control basins.
Water quality		Ensure receiving waters affected by surface water runoff have contaminant limits of electrical conductivity maximum of 2000 μ S/cm and pH range of 4.4 to 9.5, or as determined to be sustainable subject to future investigations and setting water quality objectives.
Water Storages, Creek Diversions		Clean water storages and diversions to be stabilised and left as required.
Topsoil	Salinity (electrical conductivity)	Soil salinity content is <0.6 Ds/m.
Topsoil	рН	Soil pH is between 5.5 and 8.5.
Topsoil	Sodium content	Soil Exchange Sodium Percentage (ESP) is <15%.
Topsoil	Nutrient cycling	Nutrient accumulation and recycling processes are occurring as evidenced by the presence of a little layer, mycorrhizae, and/or other microsymbionts. Adequate macro and micro-nutrients are present.
Vegetation	Land use	Area accomplishes and remains as a healthy working bushland ecosystem.

Table 6-3	Rehabilitation	Completion	Criteria for Domain	12



Rehabilitation	Indicator	Criteria
Vegetation	Surface cover	Minimum 70% vegetation cover is present (or 50% if rocks, logs, or other cover features are present). No bare surfaces >20 m ² in area or >10 m in length down slope.
Vegetation	Species composition	Comprise a mixture of native trees, shrubs, and grasses representative of regionally occurring woodland to open forest where possible.
Vegetation	Community structure	Groundcover, understorey and overstorey structure similar to that of appropriate reference site(s).
Vegetation	Resilience to disturbance	Established species survive and/or regenerate after disturbance. Weeds do not dominate native species after disturbance or after rain. Pests do not occur in substantial numbers or visibly affect the development of the native plant species.
Vegetation	Sustainability	Species are capable of setting viable seed, flowering, or otherwise reproducing. Evidence of second generation of tree/shrub species. Vegetation develops and maintains a litter layer evidenced by a consistent mass and depth of litter over subsequent seasons. More than 75% of shrubs and/or trees are healthy when ranked healthy, sick, or dead.
Fauna	Vertebrate species	Representation of a range of species characteristics (e.g. activity pattern, habitat usage, diet, dispersal character etc. (WBM 2003; Kimber <i>et al</i> 1999) from each faunal assemblage group (e.g. reptiles, birds, mammals) present in the grassland ecosystem type, based on pre-mine fauna lists and sighted within the 3 year period preceding mine lease relinquishment. Sighting of species of conservation significance or indicators of the presence of species conservation significance (e.g. tracks) likely to be present in the established ecosystem type within the three-year period preceding mien closure (assuming non-mine related disturbance has not eliminated local populations thereby removing the colonising source). The number of vertebrate species does not decrease by more than 40% over the two successive seasons prior to mine lease relinquishment.
Fauna	Invertebrate species	Presence of representatives of a broad range of functional indicator groups involved in different pastoral ecological processes (including termites for soil structure). Collembola for decomposition. Hemiptera for herbivory and predatory groups such as arachnids, centipedes, earwigs, cockroaches and ants as indicators of a range of other processes (Bisevac and Majer 1998).
Fauna	Habitat structure	Typical food, shelter, and water sources required by the majority of vertebrate and invertebrate inhabitants of pastoral ecosystem type are present, including: a variety of food plants and signs of natural generation of shelter sources including leaf litter.
Safety		Risk assessment has been undertaken in accordance with relevant guidelines and Australian Standards and risks reduced to levels agreed with the stakeholders.



Rehabilitation Element	Indicator	Criteria
Final Voids (includi	ng ramps)	
Landform stability	Slope gradient	Final void batter slopes will be designed and excavated to exhibit permanent geotechnical stability. Prior to closure, further investigations will be undertaken to specify design criteria and appropriate action will be taken to ensure effective long term safety, stability and management of the void.
Landform stability	Erosion control	Erosion mitigation measures have been applied to ensure slope stability.
Landform stability	Surface water drainage	Use of contour banks and diversion drains to direct water into stable areas or sediment control basins.
Water quality	5/	Electrical conductivity of any void water may exceed 2000 μ S/cm if an ecological assessment shows the long-term ecological stability and ground water quality is not adversely affected.
Water Storages, Creek Diversions		Clean water storages and diversions to be stabilised and left as required.
Topsoil		Soil salinity content is <0.6 Ds/m. Soil pH is between 5.5 and 8.5. Soil Exchange Sodium Percentage (ESP) is <15%. Nutrient accumulation and recycling processes are occurring as evidenced by the presence of a little layer, mycorrhizae, and/or other microsymbionts. Adequate macro and micro-nutrients are present.
Vegetation	Land use	Where ramps and in-pit spoil design allow, area accomplishes and remains as a healthy working bushland ecosystem (although naturalised grasses may be used).
Vegetation	Surface cover	Minimum 70% vegetation cover is present (or 50% if rocks, logs, or other cover features are present). No bare surfaces >20 m ² in area or >10 m in length down slope.
Vegetation	Species composition	Comprise a mixture grasses, shrubs, and trees (where possible) suitable for establishment on steeper slopes.
Vegetation	Community structure	Groundcover and understorey structure to that of appropriate reference site(s)*.
Vegetation	Resilience to disturbance	Established species survive and/or regenerate after disturbance. Weeds do not dominate native species after disturbance or after rain. Pests do not occur in substantial numbers or visibly affect the development of the native plant species.
Vegetation	Sustainability	More than 75% of individual grasses and shrubs are healthy when ranked healthy, sick, or dead.
Safety		Risk assessment has been completed and risk mitigation measures have been implemented. Where risk mitigation measures include bunds, safety fences, and



Rehabilitation Element	Indicator	Criteria
		warning signs, these have been erected generally in accordance with relevant guidelines and Australian Standards.





7. DOMAIN 3 – TAILINGS STORAGE FACILITY

These areas will not be returned to their original condition. Rehabilitation will be consistent with the rehabilitation objectives in Section 2.1 and the final land use objectives for Domain 3.

7.1. FINAL LAND USE OBJECTIVES

The tailings dam will be used for the disposal of tailings. Given the sensitive nature of the capping and rehabilitation endeavours, and the consequences of impacting on the integrity and stability of the capping layer, the post-mining land use will be limited to vegetative cover for erosion protection. No grazing is recommended for this area and therefore will have a land suitability Class 5 for cropping and grazing with ALC of D.

7.2. REHABILITATION ACTIONS

Rehabilitation actions that will need to be addressed within Domain 3 include tailings dam decommissioning, landform stability, topsoil management, and revegetation and fauna habitat. Completion criteria will address these rehabilitation actions and the rehabilitation objectives outlined in Section 2.

7.2.1. Post Mine Land Use Plan

A PMLUP (Section 3.2) will be included in this section for the rehabilitation of disturbance areas consistent with the Plan of Operations to meet the final land use objectives. The PMLUP will be supported by other rehabilitation actions for this domain.

7.2.2. Tailings Storage Facility Decommissioning

Prior to rehabilitation the structural integrity of the tailings storage facility (TSF) and the potential presence of hazardous material in the TSF will be determined and then decommissioned accordingly to limit the potential for their release. Decommissioning will include capping.

Capping trials will be undertaken with the aim of optimising rehabilitation design (capping thickness, type of materials and drainage measures). Vegetation species and growing methods will also be investigated.

Given the arid climate of the region, the tailings surface in the TSF is expected to dry out relatively quickly and form a dense compact solid material which will facilitate a cover placement and rehabilitation at the end of the mine life. A cover system will be utilised for TSF closure and topsoil will be placed onto the re-profiled final landform slopes.

7.2.3. Landform Design

The objective is to create a stable post-disturbance landform that is self-sustaining or a landform where maintenance requirements are consistent with vegetative cover to minimise erosion and protection of the capping. Landform stability will protect the integrity and stability of the sensitive capping layer. All areas significantly disturbed by mining activities will be rehabilitated in accordance with Table 7.1.



Domain		Target Slope Range (Degrees)	Approximate Surface Area (ha)
Tailings	Tailings Dam	No less than 75% of the rehabilitated area has slopes	
Storage		of less than 5°, and up to 25% of the rehabilitated	
Facility		area has slopes greater than 5°.	

Table 7-1 Landform Design Criteria

7.2.4. Revegetation

A detailed revegetation plan will be developed prior to rehabilitation and amended through the use of capping trials. The aim of the revegetation is to provide a vegetative cover for erosion protection of the capped TSF in a manner which will not compromise the integrity of the TSF. Native species will be used where possible (Section 4.3), with species selection driven by a selection for species that will successfully establish on available growth medium and bind the soil without comprising the integrity of the TSF.

7.3. COMPLETION CRITERIA

Preliminary completion criteria for Domain 3 are outlined in Table 7.2. These criteria relate to the long term rehabilitation objectives for the mine identified in Section 2.2 and to the rehabilitation actions identified in Section 5.2.

Rehabilitation Element	Indicator	Criteria
Landform stability	Erosion control	Tailings are capped to a depth to be defined in field trials, which includes a maximum topsoil depth of 200 mm on the cap. Erosion mitigation measures have been applied. Average soil loss per annum per domain unit is >40 tonnes/ha/yr (sheet erosion).
Landform stability	Surface water and drainage	Drainage control measures are installed. No water is observed leaching from the facility.
Water quality		Ensure receiving waters affected by surface water runoff have contaminant limits of electrical conductivity maximum of 2000 μ S/cm and pH range of 4.4 to 9.5, or as determined to be sustainable subject to future investigations and setting water quality objectives. Area accomplishes and remains as native vegetation.
Topsoil	Physical and chemical soil parameters	Soil salinity content is <0.6 Ds/m. Soil pH is between 5.5 and 8.5. Soil Exchange Sodium Percentage (ESP) is <15%. Nutrient accumulation and recycling processes are occurring as evidenced by the presence of a little layer, mycorrhizae, and/or other microsymbionts.

Table 7-2 Rehabilitation Completion Criteria for Domain 3



Rehabilitation Element	Indicator	Criteria
		Adequate macro and micro-nutrients are present.
Vegetation	Land use	Area accomplishes and remains as sustainable grazing.
Vegetation	Surface cover	Minimum 70% vegetation cover is present (or 50% if rocks, logs, or other cover features are present). No bare surfaces >20 m ² in area or >10 m in length down slope.
Vegetation	Species composition	Grasses, shrubs and trees representative of regionally occurring vegetation communities where possible.
Vegetation	Resilience to disturbance	Established species survive and/or regenerate after disturbance. Weeds do not dominate native species after disturbance or after rain. Pests do not occur in substantial numbers or visibly affect the development of the native plant species.
Vegetation	Sustainability	Species are capable of setting viable seed, flowering, or otherwise reproducing.
Fauna	Vertebrate species	Representation of a range of species characteristics from each faunal assemblage group (e.g. reptiles, birds, mammals) present in the ecosystem type based on pre-mine fauna lists and sighted within the 3 year period preceding mine lease relinquishment. The number of vertebrate species does not decrease over a number
		of successive seasons prior to mine leave relinquishment.
Fauna	Invertebrate species	Presence of representatives of a broad range of functional indicator groups involved in different pastoral ecological processes.
Safety		Risk assessment has been undertaken in accordance with relevant guidelines and Australian Standards and risks reduced to levels agreed with the stakeholders. Closure documentation includes the contaminated sites register which identifies contaminated sites and the treatment applied.



8. DOMAIN 4 - DAMS AND SURFACE WATER FEATURES

Rehabilitation will be consistent with the rehabilitation objectives in Section 2.1 and the final land use objectives for Domain 4.

8.1. FINAL LAND USE OBJECTIVES

Consultation with landholders will determine if clean water dams, will be stabilised and remain on site for stock watering purposes. Water in 'dirty' water dams will be removed, the dam re-profiled and revegetated and drainage channels will be re-established. Dams will likely remain as depressions in the landscape with ponding capacity, and may have possible uses associated with the post mining land use of grazing. The post-mining land use suitability for dams is expected to be Class D.

A PMLUP will be included in this plan for the rehabilitation of disturbance areas consistent with the Plan of Operations.

8.2. REHABILITATION ACTIONS

Rehabilitation actions that will need to be addressed within Domain 4 include decommissioning of dams, landform stability, water quality management, and revegetation and fauna habitat. Completion criteria will address these rehabilitation actions and the rehabilitation objectives outlined in Section 2.

8.2.1. Post Mine Land Use Plan

A PMLUP (Section 3.2) will be included in this section for the rehabilitation of disturbance areas consistent with the Plan of Operations to meet the final land use objectives. The PMLUP will be supported by other rehabilitation actions for this domain.

8.2.2. Decommissioning of Dams

Any excess water retained within the dam at completion of operations will be removed prior to reshaping works. A Mine Water Management Plan (SEIS, Volume 2, Appendix T4.12) will be prepared to prevent release of contaminants to any waters. The plan will consider potential irrigation water sources and water quality objectives required for rehabilitation works. An ESCP will also assist to ensure water leaving the disturbed area is adequately treated.

8.2.3. Landform Stability

The objective is to create stable post-disturbance landforms that are self-sustaining or landforms where maintenance requirements are consistent with final land use objectives.

Creek diversions must allow for replication of substrate conditions similar to the existing stream substrates of significance for geomorphic processes, water quality, vegetation, and aquatic habitat features as required. Subsidence will be monitored so that the stability of diversions is not reduced.

Once dams have been decommissioned the slope angles, lengths, and shapes should be compatible with proposed land use and not prone to an unacceptable rate of erosion. This should be integrated



with a drainage pattern that is capable of conveying runoff from the newly created catchments whilst minimising the risk of erosion and sedimentation. Final slope gradient should not exceed 17%.

8.2.4. Water Quality Management

A detailed ESCP (SEIS, Volume 2, Appendix T4.04) will be developed prior to the commencement of construction works. The ESCP can be used to manage water quality. Monitoring downstream will be used to assess and minimise the Project impacts on downstream water quality. A Water Management System will also be implemented to manage flows into, on and from the site.

Dirty water storages will be cleaned out and left in a non-polluted condition.

8.2.5. Revegetation and Fauna Habitat

A revegetation plan of disturbed diversion areas will be included in this plan in line with the diversion channel construction staging. The rehabilitated vegetation must be stable and self-sustaining.

Establishment of vegetation on disturbed areas of diversions will be undertaken as soon as practicable before commissioning. Diversions will be re-vegetated using baseline information from the reaches which are being diverted. Clearing of riparian vegetation for the proposed creek diversion will be conducted in a staged manner to allow fauna to migrate to adjacent habitat areas. Stock will be excluded for a distance of at least 30 m from the top of the bank.

Dams will be re-vegetated to re-establish low density cattle grazing land. Where possible, native species will be sown. Native pasture species (warm season perennial, cool season perennial, yearlong green perennial and annual) will be sown on pasture areas requiring rehabilitation. If steep slopes are present and it is not practicable to re-shape the area and/or there is a high risk if erosion, native stoloniferous grass species (e.g. *Brachyachne convergens* (native couch/spider grass), *Chloris pectinata* (comb chloris), and *Iseilema vaginiflorum* (red Flinders grass)) will be sown as their growth provides more extensive coverage in a shorter time. If native species are unsuccessful, discussions will be held with DEHP regarding implementation of conditions for the use of introduced species, including buffer zones, as outlined in Volume 1, Section 26 of the EIS and in Appendix T1, Section T.3.8.6 of the SEIS.

Cleared vegetation will be used in the revegetation process in two ways. This includes use as organic mulch and re-use where possible of logs and tree stumps to provide shelter for fauna within the rehabilitated areas.

8.3. COMPLETION CRITERIA

Preliminary completion criteria for Domain 4 are outlined in Table 8.1. These criteria relate to the long term rehabilitation objectives for the mine identified in Section 2.2 and to the rehabilitation actions identified in Section 5.2.



Rehabilitation Element	Indicator	Criteria
Landform stability	Surface water and drainage	Use of contour banks and diversion drains to direct water into stable areas or sediment control basins.
Water quality		Ensure receiving waters affected by surface water runoff have contaminant limits of electrical conductivity maximum of 2000 μ S/cm and pH range of 4.4 to 9.5, or as determined to be sustainable subject to future investigations and setting water quality objectives.
Water storages, creek diversions	$\mathbf{\cap}$	Clean water storages and diversions to be stabilised and left as required.
(3%	Dirty water storages to be cleaned out and rehabilitated to a stable non-polluting condition.
required. Dirty water storages to be cleaned out and rehabilitated to a st non-polluting condition.		

Table 8-1 Rehabilitation Completion Criteria for Domain 4



9. DOMAIN 5 – SUBSIDENCE AFFECTED AREAS

Rehabilitation and monitoring activities within Domain 5 will be guided by the Interim Subsidence Management Plan, Appendix N of the SEIS. This section provides a summary of these requirements. Domain 5 areas will not be subject to any major earthworks, but will be prone to surface subsidence effects resulting from underground mining operations.

9.1. FINAL LAND USE OBJECTIVES

Most subsidence will not alter land suitability and the area can continue to be used for low intensity grazing. Conservation works will be implemented to ensure a free draining landscape is maintained. Mitigation measures including native vegetation planting will be dependent on monitoring results. Revegetation will be designed to replace vegetation affected by subsidence and will be undertaken to assist in soil stabilisation and restoration of native vegetation communities and fauna habitats.

9.2. REHABILITATION ACTIONS

Rehabilitation actions that will need to be addressed within Domain 5 include re-profiling of slumping, channel and bed works, remediation of cracked areas, revegetation and replacement of fauna habitat. Completion criteria will address these rehabilitation actions and the rehabilitation objectives outlined in Section 2. The findings of the subsidence monitoring program will determine the rehabilitation actions required in combination with the completion criteria. Where monitoring of mitigation measures, including revegetation, after five years is showing that the extent of environmental impacts are not adequately mitigated, these areas of residual impact will be offset. This five year staging of monitoring and offsets will occur for the continuation of underground mining. This approach is consistent with the offset hierarchy in both Commonwealth and State offset policies, where offsets are viewed as the third strategy after avoid and mitigate to reduce potential impacts to biodiversity values.

9.2.1. Post Mine Land Use Plan

A PMLUP (Section 3.2) will be included in this section for the rehabilitation of disturbance areas consistent with the Plan of Operations to meet the final land use objectives. The PMLUP will be supported by other rehabilitation actions for this domain.

9.2.2. Post Subsidence Mitigation Works

In the event that post-subsidence surveys indicate that additional works are required, the following measures will be considered:

- Replace sand across the channel bed, including higher sand deposits suitable for re-creation of in channel benches
- In areas where less active bank erosion develops, large woody debris will be placed in-stream to encourage the deposition of sediment and revegetation over time
- Targeted revegetation will be undertaken in areas where surface water patterns have been affected
- Ripping and seeding of cracks. This will be supplemented with grouting where required



• Re-grading and backfilling with mine spoil to minimise erosion and sedimentation.

Any additional mechanisms, as identified by the post-subsidence monitoring, will also be considered.

Surface rehabilitation will include a cover of topsoil in a weathered rock matrix to create a stable substrate for revegetation of channel banks. Weathered rock provides temporary erosion protection by covering erodible soils and minimising topsoil loss. Amelioration of cracks and transport of rock and soil will be undertaken with small machinery to avoid further impacts to remnant vegetation where possible.

Erosion controls will be put in place to prevent topsoil leaving the site. Local drainage works will be designed to prevent the uncontrolled flow of runoff from the subsided floodplain area over the channel banks. Small diversion bunds directing floodplain runoff to properly engineered rock chute structures will be installed to minimise bank erosion. In areas of high flow timber groynes/pile field retards will be installed at the base of the channel banks (extending into the channel) to mitigate erosion undercutting the channel banks. In areas where less active bank erosion develops, large woody debris will be placed in-stream to encourage the deposition of sediment and revegetation over time.

9.2.3. Revegetation

A program of revegetation using native species found in the effected Regional Ecosystems (REs) will be undertaken in areas experiencing the level of impacts outlined in Section 11.1.3 of Appendix N of the SEIS. Areas affected by ponding should be rehabilitated with species from the closest riparian communities within same relevant broad vegetation group.

If some trees have to be cleared to allow amelioration these should be counted as among the dead trees. Cleared trees should be immediately replaced 3:1 with the same species (unless that species is showing susceptibility to subsidence impacts then another common species for the impacted RE can be used). All dead tree material should be left on site and used in rehabilitation as habitat. Stock will be excluded to a width of at least 30 m from the top of bank and subsided floodplain areas in order to minimise further impacts on vegetation cover and land condition.

9.3. COMPLETION CRITERIA

Preliminary completion criteria for Domain 5 are outlined in Table 9.1. These criteria relate to the long-term rehabilitation objectives for the mine identified in Section 2.2 and to the rehabilitation actions identified in Section 5.2.

Rehabilitation Element	Indicator	Criteria
Landform stability	Erosion control	Erosion mitigation measures have been applied.
Landform stability	Subsidence impacts	Perform regular inspections over subsidence areas to identify any surface cracks and/or sinkholes.
		Undertake minimal clearing, if required, of areas around cracks and/or sinkholes to allow for ripping and seeding.
		Ripping and seeding of areas where required. Following initial ripping and seeding, if trees are to be planted, they will not be planted until enough rain has fallen.

Table 9-1	Rehabilitation	Completion	Criteria	for Domain 5
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Rehabilitation	Indicator	Criteria
Liement		Seed and/or plant appropriate species of vegetation to achieve a post-subsidence land use the same as that pre-subsidence (i.e. low intensity cattle grazing).
		Regrade subsidence areas and where necessary backfill with mine spoil to control surface water flow and minimise erosion and sedimentation.
		Undertake drainage works, such as graded banks and diversion drains, to partially drain larger subsidence voids and direct water into stable areas or sediment control areas.
(S	If ripping is not feasible due to the width of the cracks, topsoil will be stripped and stockpiled. Clay material will be imported to fill and seal cracks and the topsoil will be respread once the cracks have sealed. The area will then be reseeded with appropriate plant species.
Landform stability	Surface water and drainage	Use of contour banks and diversion drains to direct water into stable areas or sediment control basins.
Water quality		Ensure receiving waters affected by surface water runoff have contaminant limits of electrical conductivity maximum of 2000 µS/cm and pH range of 4.4 to 9.5, or as determined to be sustainable subject to future investigations and setting water quality objectives.
Water storages, creek diversions		Clean water storages and diversions to be stabilised and left as required
Water storages, creek diversions		Provide a cover of topsoil in a weathered rock matrix to create a stable substrate for revegetation of channel banks. Weathered rock provides temporary erosion protection by covering erodible soils and minimising topsoil loss.
		Replace sand across the channel bed, including higher sand deposits suitable for re-creation of in-channel benches.
		Install timber groynes/pile field retards at the base of the channel banks (extending into the channel) to mitigate erosion undercutting the channel banks and to facilitate creation of in- channel benches. The structures will be built between each of the subsidised panels affecting the river before subsidence occurs.
		In areas where less active bank erosion develops, large woody debris will be placed in-stream to encourage the deposition of sediment and revegetation over time.
		Local drainage works will be designed to prevent the uncontrolled flow of runoff from the subsidised floodplain area over the channel banks. Small diversion bunds directing floodplain runoff to properly engineered rock chute structures will be installed to minimise bank erosion.
		Topsoil will be placed on banks and banks will be revegetated.



Rehabilitation	Indicator	Criteria
Liement		top of the banks and subsidised floodplain areas in order to minimise further impacts on vegetation cover and land condition. A targeted revegetation will be undertaken in areas where surface water patterns have been affected.
Topsoil	Physical and chemical soil parameters	Soil salinity content is <0.6 Ds/m. Soil pH is between 5.5 and 8.5. Soil Exchange Sodium Percentage (ESP) is <15%. Nutrient accumulation and recycling processes are occurring as evidenced by the presence of a little layer, mycorrhizae, and/or other microsymbionts. Adequate macro and micro-nutrients are present.
Vegetation	Land use	Roads (except those used by the public) and other infrastructure have been removed unless stakeholders have entered into formal written agreements for their retention. Areas are readily accessible and conducive to safe cattle management activities. Stock will be excluded to a width of at least 30 m from the top of bank and subsided floodplain areas in order to minimise further impacts on vegetation cover and land condition.
Vegetation	Surface cover	Minimum 70% vegetation cover is present (or 50% if rocks, logs, or other cover features are present). No bare surfaces >20 m ² in area or >10 m in length down slope.
Vegetation	Species composition	Palatable, nutritious pasture grass species are present.
Vegetation	Community structure	Desirable grass species comprise at least 60% of total grass cover. Tree density and height of >25 stems per 5 ha each being >2 m in height.
Vegetation	Resilience to disturbance	Established species survive and/or regenerate after disturbance. Weeds do not dominate native species after disturbance or after rain. Pests do not occur in substantial numbers or visibly affect the development of the native plant species.
Vegetation	Sustainability	Nitrogen fixing grass species present. More than 75% of shrubs and/or trees are healthy when ranked healthy, sick, or dead.
Fauna	Vertebrate species	Representation of a range of species characteristics (e.g. activity pattern, habitat usage, diet, dispersal character etc. (WBM 2003; Kimber <i>et al</i> 1999) from each faunal assemblage group (e.g. reptiles, birds, mammals) present in the grassland ecosystem type, based on pre-mine fauna lists and sighted within the 3 year period preceding mine lease relinquishment. The number of vertebrate species does not decrease by more than 40% over the two successive seasons prior to mine leave relinquishment.
Fauna	Invertebrate species	Presence of representatives of a broad range of functional indicator groups involved in different pastoral ecological processes



Rehabilitation Element	Indicator	Criteria
		(including termites for soil structure). Collembola for decomposition. Hemiptera for herbivory and predatory groups such as arachnids, centipedes, earwigs, cockroaches and ants as indicators of a range of other processes (Bisevac and Majer 1998).
Fauna	Habitat structure	Typical food, shelter and water sources required by the majority of vertebrate and invertebrate inhabitants of pastoral ecosystem type are present, including: a variety of food plants and signs of natural generation of shelter sources including leaf litter.
Safety	0	Risk assessment has been undertaken in accordance with relevant guidelines and Australian Standards and risks reduced to levels agreed with the stakeholders.



10. DOMAIN 6 – OTHER LANDS

This Domain consists of the areas within the Mining Lease that are indirectly affected by mining works. Rehabilitation will be consistent with the rehabilitation objectives in Section 2.1 and the final land use objectives for Domain 6.

10.1. FINAL LAND USE OBJECTIVES

These areas will not be subject to any major earthworks and the final land use objective is a combination of low intensity cattle grazing and bushland. The post-mining land suitability continues to be dominated by Class C1 land. A PMLUP will be included in this plan for the rehabilitation of areas not required for operational use following disturbance in conjunction with the Plan of Operations.

10.2. REHABILITATION ACTIONS

Rehabilitation actions that will need to be addressed within Domain 6 include decommissioning of remaining infrastructure, landform stability, topsoil management, and revegetation of fauna habitat. Completion criteria will address these rehabilitation actions and the rehabilitation objectives outlined in Section 2.

10.2.1. Post Mine Land Use Plan

A PMLUP (Section 3.2) will be included in this section for the rehabilitation of disturbance areas consistent with the Plan of Operations to meet the final land use objectives. The PMLUP will be supported by other rehabilitation actions for this domain.

10.2.2. Decommissioning of Remaining Infrastructure

Any remaining infrastructure such as access tracks will be removed (with the exception of one access track to remain for inspection and monitoring purposes). All exploration boreholes within the lease will be grouted, capped, and sealed. Bores into underground workings will also be appropriately capped and sealed. Creek crossings will be removed and natural conditions restored.

10.2.3. Landform Design

The objective is to create stable post-disturbance landforms that are self-sustaining, or landforms where maintenance requirements are consistent with final land use objectives. Once any remaining infrastructure has been decommissioned minor re-shaping and grading will take place to ensure surface level consistency with the surrounding areas. Any areas significantly disturbed by mining activities will be rehabilitated in accordance with Table 10.1.



	Domain	Target Slope Range (Degrees)	Approximate Surface Area (ha)
Other areas	Roads and tracks	As required	
	Exploration and groundwater monitoring bores	As required	

Table 10-1 Landform Design Criteria

10.2.4. Topsoil Management

To achieve the desired post-mine land use of low intensity cattle grazing and bushland, topsoil will require management to allow natural regeneration and revegetation. A TMP (SEIS, Volume 2, Appendix T4.13) will be developed to maximise the recovery and re-use of topsoil.

10.2.5. Revegetation and Fauna Habitat

The revegetation of any disturbed areas will be consistent with surrounding vegetation as these areas are going to have minimal disturbance. Section 4.3 contains a list of potential rehabilitation species, which will be dependent on the vegetation community being rehabilitated.

Cleared vegetation will be used in the revegetation process in two ways. This includes use as organic mulch and re-use where possible of logs and tree stumps to provide shelter for fauna within the rehabilitated areas.

10.3. COMPLETION CRITERIA

Preliminary completion criteria for Domain 6 are outlined in Table 10.2. These criteria relate to the long term rehabilitation objectives for the mine identified in Section 2.2 and to the rehabilitation actions identified in Section 5.2.

Rehabilitation Element	Indicator	Criteria
Vegetation	Land use	Roads (except those used by the public) and other infrastructure have been removed unless stakeholders have entered into formal written agreements for their retention. Areas are readily accessible and conducive to safe cattle management activities. Predicted economics and/or benefits have been defined and agreed by the stakeholders.
		Minor dozer reshaping work will be undertaken to ensure surface level consistency with the surrounding areas.
		Any creek crossings (i.e. culverts, etc.) will be removed and the pre-existing drainage line re-instated where applicable. If required the area will be deep ripped to loosen compacted material.
		A light vehicle access road is to be maintained to enable inspections of the site following closure of the mine.
		Fertiliser and pasture/tree seed will be applied to assist establish

Table 10-2 Rehabilitation Completion Criteria for Domain 6



Rehabilitation Element	Indicator	Criteria
		pasture post-mine land use.
Water Quality	Physical and chemical parameters	A ground and surface water monitoring program will remain in place to closely monitor any changes to water chemistry within the site boundary.
Safety	State and federal OH & S requirements	Risk assessment has been completed and risk mitigation measures have been implemented. Where risk mitigation measures include safety fences and warning signs, these have been erected generally in accordance with relevant guidelines and Australian Standards.
Sarety State and federal OH & S requirements		



11. REHABILITATION MONITORING PROGRAM

A Rehabilitation Monitoring Program for each domain will be developed and implemented by a person possessing appropriate qualifications and experience in the field of rehabilitation management.

An Impact Management Schedule will be maintained to assess actual impacts to vegetation and this will be used to guide rehabilitation where native ecosystems are being rehabilitated.

Monitoring will be undertaken annually (once rehabilitation has commenced), and include sufficient spatial and temporal replication to enable statistically valid conclusions as established under the rehabilitation program. Rehabilitation monitoring will finish once it has been demonstrated that relevant rehabilitation completion criteria have been met.

The Program will measure success factors and completion criteria for each domain as outlined in the relevant section and will involve:

- The use of reference (or "analogue") sites where available (e.g. Table 11.1), or baseline monitoring results as applicable as benchmarks against which the relevant completion criteria will be measured
- Monitoring the key indicators over time so as to track their trajectory towards the benchmarks defined by the reference sites or baseline data.

Reference Site	Domain Reference	Latitude (Decimal Degree GDA94)	Longitude (Decimal Degree, ,GDA94)	Description
1	5	146.3627	-23.0208	10.3.27a
2	5	146.4148	-22.9769	10.3.27a
3	5	146.4979	-22.9249	10.3.27a
4	5	146.5066	-22.9395	10.5.12
5	5	146.4172	-22.953	10.5.12
6	5	146.4346	-22.9187	10.5.12
7	5	146.3982	-22.9514	10.3.13a
8	5	146.4826	-22.8723	10.3.13a
9	5	146.4902	-22.9006	10.3.13a
10	5	146.3644	-23.0334	10.3.14
11	5	146.5063	-23.1039	10.3.14
12	5	146.3875	-22.9901	10.3.14
13	5	146.3996	-22.9826	10.3.28a
14	5	146.3497	-23.0288	10.3.28a
15	5	146.4846	-22.9376	10.3.28a
16	5	146.3341	-23.0382	10.3.3a
17	5	146.3504	-23.0052	10.3.3a

Table 11-1 Proposed Reference Sites



Reference Site	Domain Reference	Latitude (Decimal Degree, GDA94)	Longitude (Decimal Degree, GDA94)	Description
18	5	146.295	-23.027	10.3.3a
19	5	146.5266	-23.0922	10.7.7
20	5	146.562	-23.103	10.7.7
21	5	146.5198	-23.0728	10.7.7
22	5	146.3657	-22.9483	10.7.3b
23	5	146.5217	-23.1053	10.7.3b
24	5	146.5543	-23.0907	10.7.3b
25	5	146.4082	-22.9899	10.5.5a
26	5	146.5833	-23.1055	10.5.5a
27	5	146.5951	-23.0198	10.5.5a

To allow for benchmarking and monitoring rehabilitation of remnant regional ecosystems analogue / reference sites will be established prior to the commencement of vegetation clearing for each regional ecosystem to be disturbed. Details and locations of these sites will be developed in this Rehabilitation Monitoring Program. Success criteria will be developed for the rehabilitation of remnant regional ecosystems and other pre-disturbance land use types and approved for mine rehabilitation prior to mining activities commencing. The *BioCondition, a Condition Assessment Framework for Terrestrial Biodiversity in Queensland, Assessment Manual* (Eyre et al 2011) and accompanying document, *Methodology for the Establishment and Survey of Reference Sites for BioCondition* (Eyre et al 2006) will be used as the guiding documents.

Key parameters to be measured and monitored in the analogue sites and rehabilitation areas for determining rehabilitation success will include:

- 1. Flora species richness and diversity
- 2. A description of the structural strata present
- 3. Dominant species within each strata
- 4. Associated stem count densities
- 5. Per cent foliage cover.

Photo monitoring points will also be established at each analogue site and representative rehabilitation area for each regional ecosystem type (SEIS Volume 2, Appendix T1, Section M.3.8.7; SEIS Volume 2, Appendix C, Section C.26). A photo monitoring procedure will be prepared to ensure consistency for the installation and monitoring of permanent photo points. Regard will be made to; DERM's 'Land Manager's Monitoring Guide: Photo Point Monitoring Guide' and the Government of South Australia-Monitoring Photo points (South Australian Arid Lands Natural Resources Management Board). The procedure will include guidance on photo numbers and locations and site descriptions for each type of photo monitoring site. The establishment of the permanent photo monitoring sites will involve taking baseline photos and a description which adequately characterises the site.

Three reference sites will to be used to develop rehabilitation success criteria for relevant revegetation activities, where appropriate. These reference sites could coincide with subsidence monitoring sites required by Appendix N of the SEIS to gauge vegetation conditions subsidence impacts are predicted



and which will include photo monitoring and observations of other criteria such as foliar discolouration, increased pathogenic attack, tree death, climatic factors, etc. The monitoring of reference sites will use an appropriate statistical design to enable statistically valid conclusions as established.

The program will contain details of:

- The minimum sampling intensity must be specified for the monitoring of progressive rehabilitation
- Justification of the suitability of the minimum sampling intensity
- How monitoring provides sufficient replication to enable statistical analysis of results at an acceptable power.

Subsidence affected areas will be monitored and following assessment, and restoration works and mitigation measures may be undertaken if required to address any mine-related adverse effects on the geomorphic environment. The REs likely to require monitoring and the establishment of analogue sites are presented in Table 11-2.

Regular field inspections will be undertaken of all rehabilitated areas, particularly waterways, banks, sediment control dams and diversions. The monitoring program will assess signs of failure, sedimentation, erosion and any other areas that may require repair. The inspection will also include the presence of noxious weeds with a weed spraying program to be implemented as required. The frequency of the field inspections could be reduced once it can be demonstrated that the vegetation is established and the final landform is stable.

Regional Ecosystem	Description
10.3.27a	Eucalyptus populnea open-woodland on alluvial plains
10.5.12	Eucalyptus populnea open-woodland on sandplains
10.3.13a	Melaleuca fluviatilis and/or Eucalyptus camaldulensis woodland along watercourses
10.3.14	<i>Eucalyptus camaldulensis</i> and/or <i>E. coolabah</i> open-woodland along channels and on floodplains
10.3.28a	Eucalyptus coolabah +/- Casuarina cristata open-woodland on alluvial plains
10.3.3a	Riverine wetland or fringing riverine wetland. Melaleuca bracteata woodland. On alluvial plains
10.7.7	Melaleuca spp. and/or Acacia leptostachya shrubland on ferricrete (eastern)
10.7.3b	Acacia shirleyi woodland or A. catenulata low woodland at margins of plateaus
10.5.5a	Eucalyptus melanophloia open-woodland on sandplains

 Table 11-2
 Likely Regional Ecosystems requiring reference site establishment

11.1. Assessing Completion Criteria

The completion criteria are performance objectives or standards against which rehabilitation success in achieving a sustainable system for the proposed post-mine land use is demonstrated. The criteria will be reviewed every 3 to 5 years with stakeholder participation to ensure the criteria remain realistic and achievable.



Adoption of mine completion criteria based on creek and landform design, erosion control, drainage, soil processes, flora, fauna, and ecosystem function as set out in the Domain Sections of this plan.

Completion criteria will reference the rehabilitation objectives (Section 2) and rehabilitation actions. Completion criteria will require DEHP satisfaction that HGPL has met rehabilitation undertakings provided in the Rehabilitation Plan and rehabilitation has achieved a standard whereby rehabilitation bonds can be released.





12. **REFERENCES**

The following references are quoted in the rehabilitation plan or relevant guidelines.

Australian Tree Seed Centre and Mortlock, W. (1999). Florabank Guidelines 6, Native Seed Collection.

Department of Main Roads (2004) Road Landscape Manual. Department of Main Roads, Brisbane.

Department of Minerals and Energy (1995). *Technical Guidelines for Environmental Management of Exploration and Mining in Queensland.*

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Engineers Australia (1996). Soil Erosion and Sediment Control, Engineering Guidelines for Queensland Construction Sites. The Institution of Engineers, Australia (Queensland Division), Brisbane.

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Lovett, S. & Price, P. (eds). 2002. Riparian Land Management Technical Guidelines Volume 1: Principles of Sound Management and Volume 2: On-ground Management Tools and Techniques. Land & Water Australia, Canberra. http://www.rivers.gov.au/publicat/guidelines.htm

Lovett, S. & Price, P. (eds) (2007) *Principles for riparian lands management*. Land & Water Australia, Canberra.

Model Code of Practice, *Florabank Guideline 6: Native Seed Collection Methods*, [Online] Accessed 2012. Available at http://www.florabank.org.au/ 5 Feb 2012'

Minerals Council of Australia (1998). Mine Rehabilitation Handbook.

Queensland Mining Council (2001). Guidelines for Mine Closure Planning in Queensland.

Rutherfurd I. D., Jerie K. & Marsh N. (2000). *A Rehabilitation Manual for Australian Streams*. Cooperative Research Centre for Catchment Hydrology and Land & Water Resources Research & Development Corporation. Canberra. Vols. 1 & 2.

DEHP Rehabilitation guidelines (2012) available on their website:

- Rehabilitation of Areas Containing Shafts, Boreholes or Adits
- Open Pit Rehabilitation
- Rehabilitation of Spontaneous Combustion Areas
- Rehabilitation of Land Subsidence Areas
- Geotechnical Slope Stability
- Erosion Control



- Growth Media Management
- Revegetation Methods
- Assessment of Revegetation
- Housekeeping on Rehabilitated Areas
- Mine site Decommissioning
- Estimation of Mine Rehabilitation Costs.

