

Central Queensland Coal Project

Chapter 11 – Rehabilitation and Decommissioning

Environmental Impact Statement

Central Queensland Coal Project
**Chapter 11 – Rehabilitation and
Decommissioning**

24 October 2017

CDM Smith Australia Pty Ltd
ABN 88 152 082 936
Level 4, 51 Alfred Street
Fortitude Valley
QLD 4006
Tel: +61 7 3828 6900
Fax: +61 7 3828 6999



Table of Contents

11	Rehabilitation and Decommissioning.....	11-3
11.1	Project Overview.....	11-3
11.2	Relevant Legislation, Policies and Guidelines.....	11-4
11.2.1	Relevant Legislation.....	11-4
11.2.2	Policies.....	11-5
11.2.3	Guidelines.....	11-5
11.3	Key Ecosystem Processes and Functions.....	11-6
11.5	Current Land Use and Post Mining Land Use.....	11-14
11.6	Rehabilitation Framework.....	11-14
11.7	Rehabilitation Objectives and Performance Criteria.....	11-14
11.7.1	Short and Long-term Rehabilitation Goals.....	11-15
11.8	Mine Domains.....	11-16
11.9	Proposed Rehabilitation Strategy.....	11-19
11.9.1	Progressive Rehabilitation Program.....	11-19
11.9.2	Landforming.....	11-26
11.9.3	Erosion and Sediment Control.....	11-26
11.9.4	Soil Management.....	11-27
11.9.5	Revegetation.....	11-28
11.9.6	Undisturbed Land.....	11-30
11.9.7	Mine Infrastructure Area.....	11-30
11.9.8	Water Infrastructure.....	11-31
11.9.9	Open Pits.....	11-32
11.9.10	Waste Rock Dumps.....	11-32
11.9.11	Pest and Weed Management.....	11-33
11.9.12	Contaminated Land.....	11-34
11.10	Qualitative Risk Assessment.....	11-35
11.11	Post-mining Indicators and Completion Criteria.....	11-37
11.12	Rehabilitation Monitoring and Measurement.....	11-48
11.13	Relinquishment.....	11-49
11.14	Conclusion.....	11-49
11.15	Commitments.....	11-50
11.16	ToR Cross-reference Table.....	11-51

List of Figures

Figure 11-1	Catchments.....	11-9
Figure 11-2	Local watercourse, drainage features, wetlands and dams.....	11-10
Figure 11-3	Ecosystem services.....	11-13
Figure 11-4	Rehabilitation domains.....	11-17
Figure 11-5	Progressive rehabilitation (year 4).....	11-20
Figure 11-6	Progressive rehabilitation (year 8).....	11-21
Figure 11-7	Progressive rehabilitation (year 12).....	11-22
Figure 11-8	Progressive rehabilitation (year 16).....	11-23
Figure 11-9	Progressive rehabilitation (final landform at year 20).....	11-24
Figure 11-10	Flooding at year 20 final landform.....	11-25
Figure 11-11	Process of determining rehabilitation progress and success.....	11-36

List of Tables

Table 11-1 Key landscape processes.....	11-7
Table 11-2 Rehabilitation domains and surface area	11-16
Table 11-3 Strategies to achieve rehabilitation goals based on individual domains	11-18
Table 11-4 Tree and shrub species	11-28
Table 11-5 Decommissioning and rehabilitation objectives and completion criteria by domain.....	11-38
Table 11-6 Commitments – rehabilitation and decommissioning	11-50
Table 11-7 ToR Cross reference	11-51

11 Rehabilitation and Decommissioning

This chapter describes the options, strategic approaches and methods for progressive and final rehabilitation from disturbances to the environment caused by the Central Queensland Coal Project (herein referred to as the Project). Without effective rehabilitation, mining has the potential to permanently reduce the capacity of land and ecosystems to provide economic and ecological services, and be unsafe for future use.

This chapter specifically identifies the following key aspects relating to the rehabilitation of the Project:

- The control and management of mine waste;
- Proposed rehabilitation methods;
- The management of topsoil resources for use in rehabilitation of the site;
- Description of the planned progressive rehabilitation and revegetation of areas across the mine site;
- The integration with ongoing and future rehabilitation activities across the wider mining area; and
- Rehabilitation monitoring and maintenance requirements which may apply.

This chapter sets out acceptable and realistic criteria for rehabilitation and closure that would allow the Project to meet the principles of Ecologically Sustainable Development without any unacceptable liability to the State.

11.1 Project Overview

The Project is located 130 km northwest of Rockhampton in the Styx Coal Basin in Central Queensland. The Project will be located within Mining Lease (ML) 80187 and ML 700022, which are adjacent to Mineral Development Licence (MDL) 468 and Exploration Permit for Coal (EPC) 1029, both of which are held by the Proponent.

The Project will involve mining a maximum combined tonnage of up to 10 million tonnes per annum (Mtpa) of semi-soft coking coal (SSCC) and high grade thermal coal (HGTC). Development of the Project is expected to commence in 2018 and extend for approximately 20 years until the current reserve is depleted.

The Project consists of three open cut operations that will be mined using a truck and shovel methodology. The run-of-mine (ROM) coal will ramp up to approximately 2 Mtpa during Stage 1 (Year 1-4), where coal will be crushed, screened and washed to SSCC grade with an estimate 80% yield. Stage 2 of the Project (Year 4-20) will include further processing of up to an additional 4 Mtpa ROM coal within another coal handling and preparation plant (CHPP) to SSCC and up to 4 Mtpa of HGTC with an estimated 95% yield. At full production two CHPPs, one servicing Open Cut 1 and the other servicing Open Cut 2 and 4, will be in operation.

A new train loadout facility (TLF) will be developed to connect into the existing Queensland Rail North Coast Rail Line. This connection will allow the product coal to be transported to the established coal loading infrastructure at the Dalrymple Bay Coal Terminal (DBCT).

The Project is located within the Livingstone Shire Council (LSC) Local Government Area (LGA). The Project is generally located on the “Mamelon” property, described as real property Lot 11 on MC23, Lot 10 on MC493 and Lot 9 on MC496. The TLF is located on the “Strathmuir” property, described as real property Lot 9 on MC230. A small section of the haul road to the TLF is located on the “Brussels” property described as real property Lot 85 on SP164785.

11.2 Relevant Legislation, Policies and Guidelines

11.2.1 Relevant Legislation

11.2.1.1 Environmental Protection Act 1994

The *Environmental Protection Act 1994* (EP Act) describes the requirements of applications for a site specific environmental authority including how the land which is the subject of the application will be rehabilitated after each relevant activity ceases. This information is used to aid the Department of Environment and Heritage Protection (EHP) in preparing the draft environmental authority (EA) for a resource project. Rehabilitation requirements are implemented through financial assurance requirements, Plan of Operations and a Rehabilitation Management Plan.

11.2.1.2 Financial Assurance

Queensland’s EHP will, by condition of the EA, require financial assurances to be lodged before carrying out any activities on the mining leases (s292 of EP Act). Financial assurance provides the government with a financial security to cover any costs or expenses incurred to prevent or minimise environmental harm or rehabilitate or restore the environment, should the EA holder fail to meet their environmental obligations in the EA.

For resource activities, financial assurance is calculated based on the year in which rehabilitation costs are likely to be the highest. The EHP Guideline Financial Assurance under the Environmental Protection Act 1994 provides guidance on the circumstances when financial assurance is required, the form of financial assurance, calculation method, application requirements and other matters such as lodging, changing, discharging or claiming financial assurance.

11.2.1.3 Plan of Operations

The Plan of Operations will detail how the Project will implement progressive rehabilitation throughout the operations. The Plan of Operations will include the following (S288 of EP Act):

- Description of all resources activities that will take place on the site during the time frame covered by the plan;
- Proposed program of actions to comply with EA conditions;
- Rehabilitation program for land disturbed or land that will be disturbed during the period of the plan;
- Proposed amount of financial assurance based on the guidelines for calculating financial assurance; and
- Compliance statement describing how a proponent has complied with the EA conditions.

As part of the Project’s EA, the Plan of Operations will be submitted to EHP at least 20 business days prior to commencing activities (s287 of the EP Act). The Plan will also be reviewed by an independent, suitably qualified auditor. The Plan of Operations must be renewed on a five-year basis

but typically it is renewed more frequently. EHP may suspend or cancel the EA in the event of inadequacy or non-compliance of operations in meeting the approved Plan of Operations. It is also an offence under s290 to fail to comply with a Plan of Operations.

11.2.1.4 Rehabilitation Management Plan

A rehabilitation program for land disturbed during activities associated with the Plan of Operations is a requirement of the EA. A Rehabilitation Management Plan will be developed, guided by the EHP Guideline – Rehabilitation requirements for mining resource activities.

11.2.1.5 Final Rehabilitation Report and EA Surrender

Upon completion of the Project, Central Queensland Coal will be required to submit an EA surrender application. As part of the surrender application, Central Queensland Coal will be required to prepare and submit a progressive or final rehabilitation report to EHP for assessment. EHP must consider the relevant completion criteria (s318ZI or s268) when deciding whether to certify progressive rehabilitation or whether to approve a surrender application. EHP must be satisfied with the rehabilitation before it can certify progressive rehabilitation for part of a mining project or accept the surrender of an environmental authority for the whole of a project.

The discharge of financial assurance is sought after activities have ceased and subject to successful rehabilitation at the time of surrendering the EA. However, EHP may, after approving the surrender of an EA, require that the financial assurance remains in force until it is satisfied that no claim is likely to be made in the future (s292 of the EP Act).

11.2.2 Policies

The Australian and New Zealand Minerals and Energy Council (ANZMEC) and the Minerals Council of Australia (MCA) jointly published the Strategic Framework for Mine Closure (ANZMEC and MCA 2000). The framework recognised that the mining industry is responsible for rehabilitation of mine disturbance in an environmentally and socially acceptable way.

The National Strategy for Ecologically Sustainable Development (COA 1992) (NSESD) promotes economic growth that safeguards the welfare of future generations, provides equity within and between generations, protects biological diversity and maintains essential ecological processes and life support systems.

These policies underpin the Queensland rehabilitation requirements.

11.2.3 Guidelines

The Commonwealth Government's Leading Practice Sustainable Development Program (LPSP) for the mining industry issued a handbook series in 2006 which has been revised in 2016. These provide leading practice approaches, attitudes and technologies which have been considered in the proposed rehabilitation of this Project.

Guideline EM1122, Rehabilitation Requirements for Mining Resource Activities (EHP 2014) has been developed by EHP and has been used to develop acceptable rehabilitation outcomes and strategies for this Project. The guideline also explains how the administering authority will assess whether progressive or final rehabilitation for either new or established mining projects is satisfactory.

11.3 Key Ecosystem Processes and Functions

Under the new LPSDP's Mining Rehabilitation Handbook, the goal of rehabilitation is to reinstate ecosystem functioning and land productivity to re-establish ecosystem structure and function (Australian Government 2016). To acquire a self-sustaining post-mining land use, species compositions like surrounding ecosystems, and an understanding of the processes and influences within those ecosystems, is vital in designing and implementing a rehabilitation management plan. Ecosystems can be examined on a sliding scale from global, regional, local and micro systems and they contain complex interactions of abiotic (geology, soils, water, atmosphere and land form) and biotic components (plants, animals and decomposers) (Chapin, Matson and Vitousek 2011). These interactions determine the ecosystem structure, function and biodiversity and their understanding is fundamental to mine site rehabilitation.

11.3.1 Climate

The climate of a region, particularly rainfall and temperate, influence the species composition of a plant community and the distribution of biomass. Temperature, moisture, carbon dioxide and oxygen availability influence the rates of chemical reactions and biological activity in ecosystem processes (Chapin, Matson & Vitousek 2011). When engineering and restoring ecosystems, it is also important to consider weather extremes (e.g. more frequent cyclones, intense rainfall and longer drought periods) from global warming impacts. Many terrestrial species have shifted their geographic ranges, seasonal activities and migration patterns (IPCC 2014), thus consideration should be given to species that are resilient to climate change.

The Project area has a climate which is characterised by a distinct wet season in the months of December, January and February, with monthly rainfall averages of greater than 100 mm and a distinct dry season between the months April through October with less than 50 mm mean monthly rainfall between these months. Evaporation rates are highest during the summer months, and lowest mid-year. In any given month, the average evaporation is greater than the average rainfall. Natural or induced climate related hazards such as severe storms, cyclones, floods, bushfires and droughts occur and pose risks which require management and climate change predictions show an anticipated increase of these events.

11.3.1.1 Key Rehabilitation Considerations

- Engineering for stability and intense rainfall events in site stormwater controls;
- Seeding and vegetation cover to be in place prior to the wet season to reduce erosion risk and increase success of vegetation establishment; and
- Selection of species will include those that are most resilient to climate change.

11.3.2 Landscape and Landform

To effectively rehabilitate land, it is important to understand the catchment landscape, particularly the landscape processes of weathering and material movement as well as land use and the upstream and downstream ecosystem services. Weathering is fundamental to landscape evolution and topographic development and the development of soil, regoliths and weathering profiles (Turkington, Philips and Campbell 2005). Landscape processes cause spatial variation of soil moisture, fertility and rooting depth which drives the distribution of plant species and communities. Key landscape processes which must be considered in mining restoration are outlined in Table 11-1.

Table 11-1 Key landscape processes

Process	Description	Relevance
Water and sediment movement process	The fluvial landscapes and the sediment will be transported from the mountains into the valleys then deltas.	<ul style="list-style-type: none"> ▪ Altering this process and movement of sediment within the landscape can significantly change the downstream landscape; and ▪ Identify potential downstream impact areas if contamination released offsite.
Landscape evolution process	The topographically controlled redistribution of materials through gravitational force moving water and sediment downhill, landslides, soil creep.	<ul style="list-style-type: none"> ▪ Controls over soil losses; ▪ Topography and slope influence erosion and deposition (Chapin, Matson and Vitousek 2011); ▪ Physical pathway by which materials move between ecosystems; and ▪ Understand how the rehabilitated site will behave over time.
Physical weathering process	The fracturing and breaking of rocks into smaller fragments caused by heat, freezing of water and expansion, salt crystal growth, wetting and drying, exfoliation.	<ul style="list-style-type: none"> ▪ Understanding the local weathering pressures and processes at the site; ▪ Dissolution of saline content in rock and material overtime; and ▪ Stability and integrity risks of reformed areas.
Chemical weathering	Process through reactions (dissolution, redox reactions, reaction with water, oxygen or carbonic dissolution).	<ul style="list-style-type: none"> ▪ Mining rehabilitation with waste rock management to avoid acid mine drainage; ▪ Soil salinity and toxicity; and ▪ Development of the soil profile and mineral composition.

These processes will be considered through the application of landform evolution modelling in revising the final landscape design. This will enable engineering of landform restoration to integrate into the surrounding landscape, protect long term stability, avoid detrimental impacts from weathering and obtain a functional landscape system.

Waste rock analysis presented in Chapter 8 – Waste Rock and Rejects indicated the risk of heavy metals leaching from waste rock is low and will have minimal impact on surface and groundwater. The waste rock was classified as non-acid forming (barren), with generally high acid neutralising capacity, and likely to remain pH neutral to alkaline following excavation. Therefore, dissolution of heavy metals in an acidic environment from physical and chemical weathering processes is unlikely to pose ongoing risks to rehabilitation success.

11.3.2.1 Key Rehabilitation Considerations

- The Project is in an area subject to infrequent intense rainfalls, heat and is also subject to high winds associated with cyclonic events. The landscape is highly fragmented from cattle grazing which increases the physical weathering of the soil surface;
- The region's seasonality makes it prone to wind erosion, particularly during the dry season. Therefore, ground cover should be established prior to the dry season; and
- Further minimisation of potential acid generation from waste rock because of physical and chemical weathering, through operational management by replacing areas of risk materials back in-pit and having long-term exposure of weathering to acid neutral materials within residual spoils.

11.3.3 Hydrology

Hydraulic regimes are driven by climatic precipitation and influence structural aspects of the ecosystem such as the floristic structure and plant species distribution through the soil moisture profile, infiltration for plant growth and biomass. They also influence the landscape structure through erosion rates, sediment movement and deposition and soil profile formation. The hydrology can also influence the functional aspects as water movement in the soil and exposed rocks can leach soluble heavy metals and contaminants and transport seeds and organisms into waterways and the downstream environment facilitating dispersal (Gurnell *et al.*, 2008) and genetic diversity (Larsen *et al.*, 2012).

11.3.3.1 Project

The Project is wholly contained within the Styx River Basin, comprising Styx River, Waverley and St Lawrence Creeks. The Styx Basin discharges to the Great Barrier Reef Marine Park (GBRMP) (refer Figure 11-1), which is listed as a World Heritage Area. The Project is bordered by two watercourses as defined under the Water Act, namely Tooloombah Creek and Deep Creek (Figure 11-2). These creeks meet at a confluence downstream of the Project area to form the Styx River. The coastal zone, commencing downstream of the North Coast Rail Line, is located approximately 10 km downstream of the ML area. The GBRMP is located approximately 40 km downstream of the ML area.

The Fitzroy Basin Association Natural Resource Management (NRM) body manages waters within the Styx Basin. Fitzroy Basin Association NRM body encompasses eight sub-catchments; Lower-Fitzroy, Isaac-Connors, Comet, Upper and Lower Dawson, Styx-Herbert, Water Park and Boyne-Calliope. Due to the NRM comprising an area over 152,000 km², the region has been split into 192 Neighbourhood Catchments. The Project is located within the F3 Neighbourhood Catchment which is described as having a high sediment delivery ratio to the Great Barrier Reef with a low number of landholders within the basin (Fitzroy Basin Association 2015). Sediment in the Fitzroy Region is the most significant risk to the Great Barrier Reef, with an estimated 1.5 million tonnes of extra sediment deposited each year and 83% of the sediment coming from grazing land. It is estimated that the Styx Basin contributes 97,892 t per year. The load contributions from the Styx Basin are based on limited monitoring results. Cattle grazing is the dominant land use of the area (80%) and the basin contains 14% wetland area. Many the wetlands are estuarine systems (8.8%) with approximately 187 lacustrine / palustrine wetlands (EHP 2017).

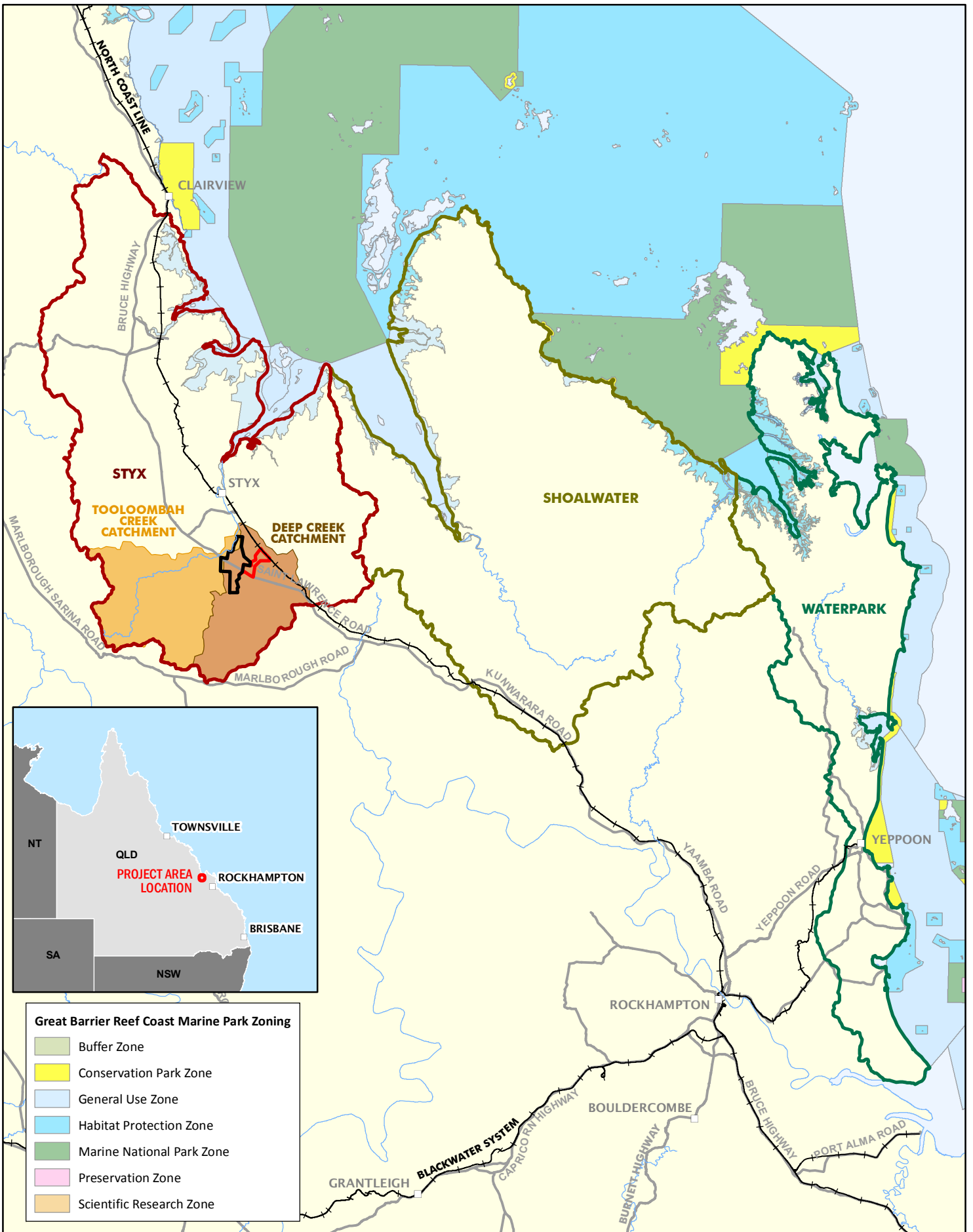


Figure 11-1
Catchments

Great Barrier Reef Coast Marine Park Zoning

- Buffer Zone
- Conservation Park Zone
- General Use Zone
- Habitat Protection Zone
- Marine National Park Zone
- Preservation Zone
- Scientific Research Zone

Scale @ A4 1:875,000
Date: 24/07/17
Drawn: Gayle B.

Legend

- Deep Creek Catchment
- Tooloombah Creek Catchment
- Shoalwater
- Styx
- Waterpark
- ML 80187
- ML 700022
- Major rail line
- Main road
- Watercourses

DATA SOURCE
QLD Spatial Catalogue (QSpatial), 2017



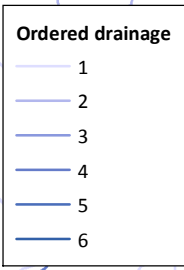
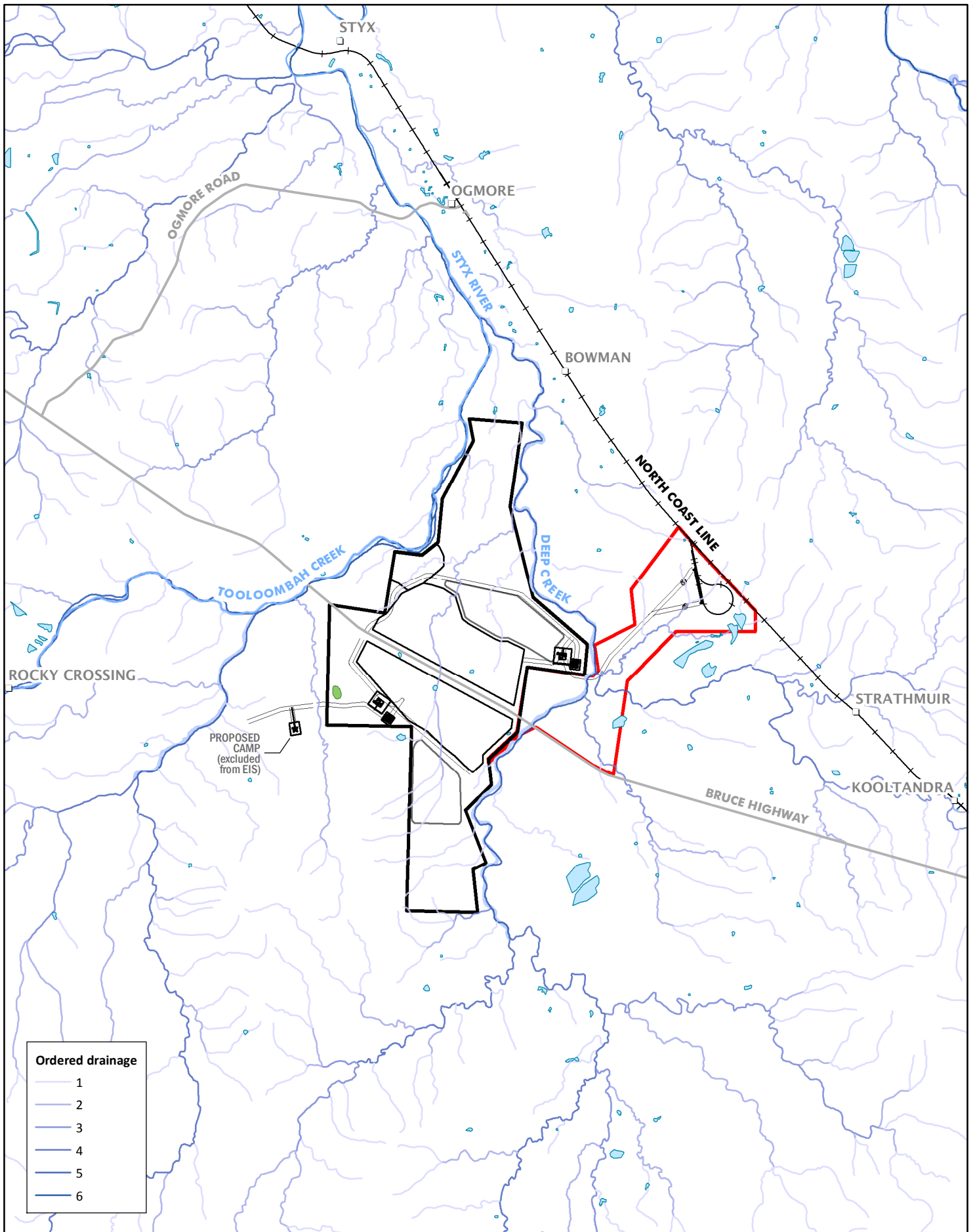
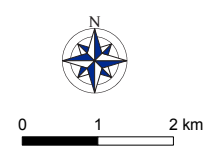


Figure 11-2

Local watercourse, drainage features, wetlands and dams



- Legend**
- ML 80187
 - ML 700022
 - Proposed mine infrastructure
 - Reservoir
 - Wetland Protection Area
 - Watercourse (defined by Water Act, 2000)
 - North Coast Rail Line
 - Main road

Scale @ A4 1:100,000
 Date: 24/07/17
 Drawn: Gayle B.

DATA SOURCE
 QLD Spatial Catalogue (QSpatial), 2017



11.3.3.2 Key rehabilitation considerations

- The drainage diversions will be permanently established to a stable, vegetated and self-sustaining channel by final mine closure. As such, they will be retained following mine closure to ensure continued protection of downstream water quality values;
- Due to risk of saline drainage and the location of waste rock dumps to Tooloombah and Deep Creeks, permanent dams will capture potential acid rock drainage (ARD) or saline drainage required to protect water quality values in the Styx River;
- Risks to rehabilitation success from ARD to be managed at the outset during planning and operations through further analysis and strategic placement; and
- The design life of these dams will need to consider the post mine use and extended life span.

11.3.4 Geology, Soils and Root Zone Function

Geological processes and structure influence the landscape features and formation, groundwater movement and the physical and chemical properties of the geological rates of weathering, sediment movement and soil properties. In addition to the parent material, soil properties are also determined by climate, organisms, topography and time. Soil age and weathering influences the mineral composition through the solubility and leaching of various elements (Chapin, Matson & Vitousek 2011). The Project's regional geology is located in an Early Cretaceous intra-cratonic sag basin. It probably developed by subsidence of the Strathmuir Synclinorium, an older feature containing Permian Bowen Basin strata (Geoscience Australia, 2008). The Styx Basin plunges to the north northwest, with an elongate shape bounded by the half graben fault to the east and onlapping the Permian Back Creek Group to the west (Arrow Energy, 2005; Waratah Coal, 2008), but the general dip of the Styx Coal Measures sequence is to the east.

Soil has physical, chemical and biological constituents that are essential components in the biogeochemical cycles of water, carbon, minerals and nutrients providing a foundation for vegetation communities. Physical properties such as soil bulk density, texture, structure and pore space influence soil water availability, root penetration, water storage and supply, porosity for transmission of liquids and gases and space for biota. The chemical constituents that influence species diversity and terrestrial primary productivity are nutrient availability, salinity and sodicity (Medinski *et al.*, 2010) and mineralogy. Nutrient availability is impacted by soil pH (Wright 1992), decomposition and microbial activity, mineral weathering and dissolution (Leopold 2012).

Biological soil fauna (moss, algae, lichen, worms and fungi) provide decomposition functions which breakdown organic matter increasing the available nutrients (Voroney and Heck 2015) and releases of carbon to the atmosphere (Chapin, Matson and Vitousek 2011). Decomposition can occur through leaching of materials which are absorbed or react with mineral phase of soil, fragmentation through digestion from soil biota or chemical alteration from soil microbes (bacteria and fungi) (Chapin, Matson and Vitousek 2011). Decomposition also improves soil aggregate formation (van Leeuwen *et al.* 2011), water penetration, resistance to erosion, and other ecosystem services, including water quality, limiting invasive species, and increasing disease prevention. Soil microorganisms produce plant growth stimulating substances and can immobilize heavy metals in the soil. Mining rehabilitation requires the understanding of these processes to engineer the soil profile through the stimulation of bio-weathering, promotion of nutrient cycling and addition of soil biota to support the vegetation community being restored.

The Project area contains several different soil types; Vertosols, Sodosols, Dermosols, Kandosols and Rudosols. The soil properties and land support capabilities are outlined in Chapter 5 – Land. Most soil types have few physical root limitations; however, the clay sodic B horizon of the Sodosol

will restrict root growth. Within the Central Queensland Coal mine area, soil salinity is generally low except for some salt build up found in the B horizons of the Sodosols. The Sodosols are also dispersive and prone to erosion and soil structural decline, if disturbed. For other soil types in the Central Queensland mine area, the non-sodic, minimal dispersive soils within the mine area is suited to pastoral land use. The baseline soil fertility and organic carbon levels within the Project area is low to moderate and most are suitable for pasture production and beef cattle grazing.

11.3.4.1 Key Rehabilitation Considerations

- Loss of topsoil fertility and viability from storage of topsoil over extended time periods;
- Soil pH should be used as an indicator as Kandosols have potential to create aluminium toxicity if conditions become acidic, however, assessment shows soils to be currently neutral to alkaline;
- Vertosols and Sodosols have tendencies to pose secondary salinity problems which need to be addressed within the rehabilitation; and
- Sodic soils have severe erosion potential on slopes in high intensity rainfall and as such, slopes require quick establishment of vegetative cover.

11.3.5 Terrestrial Ecology

Vegetation communities are composed of many co-existing species. Dominant vegetation species provide canopy structure influencing light infiltration and thus the substructure and species present within the community. Ecological restoration must consider the nutrient and water needs of the species, the synergistically or antagonistically co-existence of plant species and plant interactions with microbes, soil fauna and animals to restore ecosystem function.

Framework species, functional groups and keystone species play a significant role in restoring ecosystem function (Andel, Grootjans and Aronson 2012). Framework species can be introduced first as they have functional traits of fast growth and fruit / food production, high survival and high tolerance. These species can play a vital role in primary succession providing capacity to deal with the highly-disturbed environment with potentially organic poor (low nitrogen, low water holding capacity) soils (Chapin, Matson and Vitousek 2011). Plant root physiology and rooting depth must be considered, especially in areas of buried sodic or saline material or capped contaminates.

Ecosystem function relates to primary production, decomposition and nutrient cycling. Representation of species within these functional groups facilitates continued development and / or stability of the system (Andel, Grootjans and Aronson 2012). Nitrogen-fixing species provide nutrient cycling function by accessing nitrogen through symbiotic bacterium relations facilitating the establishment and growth of later successional species. This function is important in areas of low nitrogen and minimal soil development (Chapin, Matson and Vitousek 2011). Keystone species are plants or animals that play a unique and crucial role in the way an ecosystem functions (National Geographic Society 2016) and can be used as indicators of success. Biotic ecosystem structure is shaped by the food chain and the loss of keystone species may alter the ecosystem structure.

The Project area occurs within the Brigalow Belt bioregion. Dominant vegetation communities include open forests (dominated by Brigalow (*Acacia harpophylla*), Black Gidyea (*A. argyrodendron*), Gidgee (*A. cambagei*), Lancewood (*A. shirleyi*), Dawson River Blackbutt (*Eucalyptus cambageana*), River Red Gum (*E. camaldulensis*), Forest Red Gum (*E. tereticornis*)), woodlands (dominated by Silver-leaved Ironbark (*Eucalyptus melanophloia*), Narrow-leaved Ironbark (*E. crebra*), Poplar Box (*E. populnea*), Brown's Box (*E. brownie*), *E. persistens*, Mountain Coolibah (*E. orgadophila*), Coolibah (*E. coolabah*), River Red Gum and Forest Red Gum) and small patches of semi-evergreen vine thicket.

The majority of the Project area occurs in the Marlborough Plains subregion (BRB14) of the Brigalow Belt bioregion. The Marlborough Plains subregion is a characteristically undulating to hilly subregion with a complex geology. The subregion is dominated by alluvial plains and colluvial slopes, usually supporting woodlands characterised by Poplar Gum (*Eucalyptus platyphylla*), Ghost Gum (*Corymbia dallachiana*), Forest Red Gum and Tea-tree (*Melaleuca* spp.) with low rises supporting Narrow-Leaved Ironbark. Clearing over the past 150 years has resulted in a highly-fragmented landscape with vegetation generally confined to rockier hilly areas, linear strips of roadside vegetation, riparian vegetation and relatively small isolated remnants.

Vegetation within the mine area, haul road and TLF is generally representative of the Marlborough Plains subregion comprising:

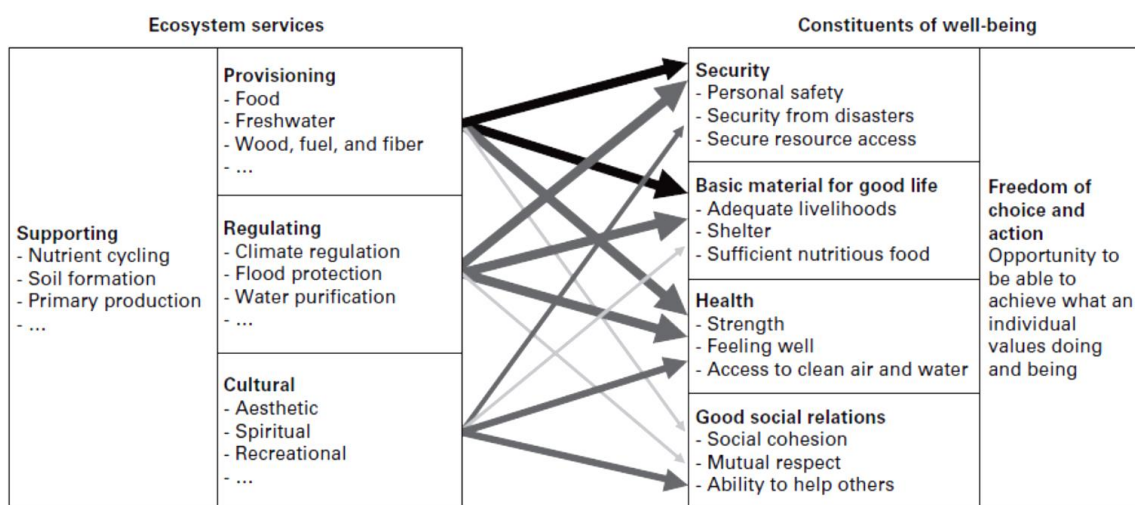
- Large areas of heavily disturbed habitats that have previously undergone significant clearing for cattle production; and
- Smaller pockets of fragmented closed canopy vegetation largely associated with creek systems and rocky areas.

11.3.5.1 Key Rehabilitation Considerations

- Restoration of the current vegetated areas would protect long-term values of Commonwealth and State significant vegetation;
- Protected or threatened species likely in the Project area include Great Glider, Squatter Pigeon, Ornamental Snake and Koala. Consideration in vegetation reestablishment includes potential food and habitat needs of these species; and
- Framework species of existing Regional Ecosystems onsite to be used in seed mix and flora food and habitat species for keystones species.

11.4 Ecosystem Services

Ecosystem services are ecosystem functions or groups of functions with utility for human society (Muller, Fohrer and Chicharo 2015). The Millennium Ecosystem Assessment (2005) defines four categories: supporting services, provisioning services, regulating services and cultural services, as shown in Figure 11-3.



Source: Bouma and Beukering 2015

Figure 11-3 Ecosystem services

The sustainability of ecosystem services is paramount as human well-being ultimately depends on the health of ecosystems (Bouma and Beukering 2015). Restoration of ecosystems should consider safeguarding these services for future generations. This requires high plant diversity and reduced human stressor impacts.

Several regulating ecosystem services are provided by this ecosystem including local climate, air quality, water flow regulation, water purification, nutrient regulation, erosion regulation and natural hazard protection.

11.5 Current Land Use and Post Mining Land Use

The current land use in the Project area is predominantly grazing with limited areas of native remnant vegetation. Investigations of land use following industry classification methods have been undertaken to define the current land use. This information has in turn allowed for the determination of the final land use, post-mining activities, to allow the development of potential rehabilitation strategies to minimise potential environmental impacts.

Central Queensland Coal intends to manage its operations and conduct decommissioning and rehabilitation activities to ensure that the land disturbed is returned to land suitable for cattle grazing or revegetated to meet conservation objectives where appropriate. It is intended that the extent of grazing and natural vegetation land uses at the completion of the Project replicate the extents of these land uses prior to mining.

11.6 Rehabilitation Framework

The Project is not expected to be decommissioned for approximately 20 years or following depletion of the target coal resource. Progressive rehabilitation is proposed to be carried out as operations progress rather than taking place as a large operation once mining is complete. Rehabilitation of the mine infrastructure area (MIA), haul road and TLF will take place once mining is completed and plant and structures have been decommissioned.

The Rehabilitation Framework will be developed and evolve over time to reflect changing regulatory requirements, community values, and lessons learned onsite or at other mines. A Rehabilitation Management Plan will be developed based on objectives and goals that seek to provide predetermined land uses for the different land units (domains) of the mine (see Section 11.8). Success criteria for each of these domains will be established which will need to be met to demonstrate rehabilitation. The rehabilitation works will be designed within the constraints of the site's conditions (e.g. the climate, topography and soil / rock types) as well as the mining plan and schedule.

11.7 Rehabilitation Objectives and Performance Criteria

The Technical Guidelines for the Environmental Management of Exploration and Mining in Queensland series (Department of Minerals and Energy (DME) 1995) and Guideline EM1122, Rehabilitation Requirements for Mining Resource Activities (EHP 2014) (the Guideline) state four general rehabilitation goals. These require rehabilitation of areas disturbed by mining to result in site conditions that are:

- Safe to humans and wildlife;
- Non-polluting;

- Stable; and
- Able to sustain an agreed post-mining land use.

Central Queensland Coal will seek to achieve the following overarching rehabilitation and decommissioning goals to address the general rehabilitation goals as nominated in the Guideline by:

- Providing landforms with the same or similar land use capabilities and / or suitability prior to the disturbance, unless other beneficial land uses are pre-determined and agreed with key stakeholders (post-mining land owners, managers and relevant regulators);
- Rehabilitation of disturbed land so that it presents a negligible safety or environmental risk in terms of stability;
- Providing land that is self-sustaining to agriculture or ecosystem processes where maintenance requirements are negligible and consistent with an agreed post-mining land use; and
- Maintaining the water quality and quantity acceptable for existing and future users within or surrounding the site.

These overarching goals will provide for a post-mining site that is physically safe to human and animals, geotechnically stable, non-polluting and capable of sustaining the agreed land uses. These goals are consistent with the principles of Ecologically Sustainable Development as required by the EP Act.

11.7.1 Short and Long-term Rehabilitation Goals

The above overarching rehabilitation goals can be defined into short-term and long-term goals as outlined in the following sections.

11.7.1.1 Short-term Goals

Short-term rehabilitation goals for the mine are to:

- Minimise clearing and vegetation disturbance consistent with operational requirements;
- Schedule operations including overburden and interburden emplacement and shaping, and revegetation to minimise visual exposure;
- Rehabilitate areas of disturbance no longer required for mining related operations;
- Apply soil (topsoil / subsoil) to the final landform based on material availability and post-mining land use;
- Stabilise all earthworks, drainage lines and disturbed areas to minimise erosion and sedimentation; and
- Control vermin, feral animals and noxious weeds.

11.7.1.2 Long-term Goals

The overall long-term goal is to rehabilitate the land to a low maintenance, stable and safe landform that blends with the surrounding topography and maximises the return of agricultural land suitability comparable to pre-mining levels. These long-term goals will be met by measures including:

- Post-mining land suitability for grazing with similar extents to that which occurred prior to mining including;
- Providing habitat for fauna and corridors for fauna movement within the final landform;
- Preservation of downstream water quality for ecological and existing beneficial uses;
- Establishment of a low maintenance, geotechnically stable landform commensurate with agricultural and nature conservation land uses;
- Blending the created landforms to appear as a natural extension of the surrounding environment; and
- Monitoring rehabilitation success in terms of physical and biological parameters.

A Mine Closure Plan will be prepared outlining the specific operational activities required to complete the rehabilitation and decommissioning of the Project. The Mine Closure Plan will include monitoring and management of:

- Wastewater collection systems and treatment systems;
- Groundwater quality and levels;
- Surface water quality and flows;
- Seepage rates;
- Erosion rates;
- Integrity and stability of slopes and ramps; and
- Health and resilience of vegetation cover.

11.8 Mine Domains

Rehabilitation goals and strategies are nominated for individual land management units or domains with discrete elements to be rehabilitated within each domain. The mine site has been divided into three major management domains and sub-domains. These are provided in Table 11-2 along with the maximum surface area for each domain and shown in Figure 11-4.

Table 11-2 Rehabilitation domains and surface area

Project Component	Approximate area (ha)
Mining and Infrastructure Areas	1,128
Open Cut 1	311
Open Cut 2	340
Open Cut 4	60
Waste Dump 1	133
Waste Dump 2	164
CHPP 1 and 2	21
MIA 1 and 2 including internal roads	19
Water Infrastructure (dams)	68
Conveyors	12
Haul Road (MIA to TLF)	9
TLF Area	23
TOTAL	1,160

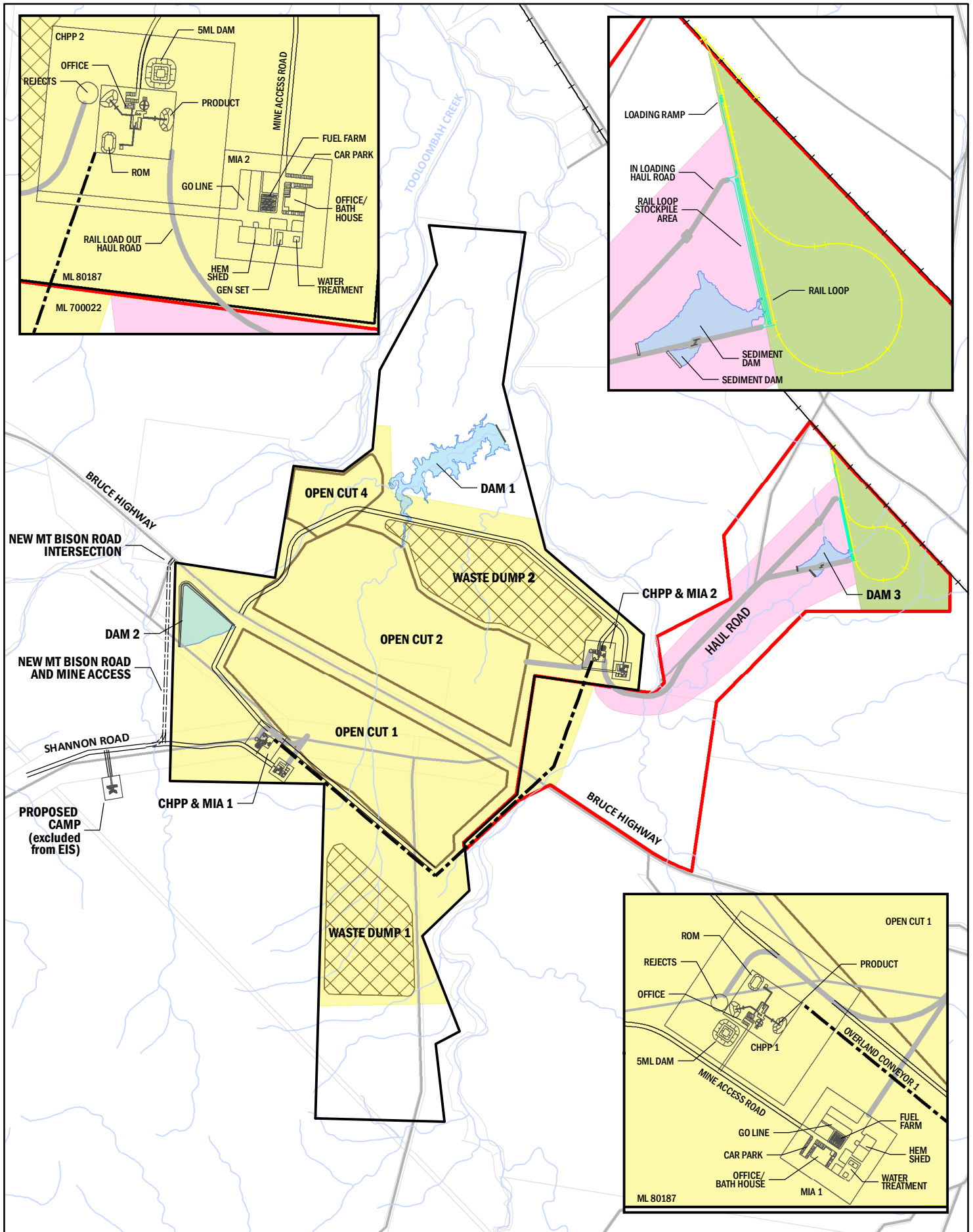


Figure 11-4
Rehabilitation domains

Strategies to achieve rehabilitation goals for specific Project domains are provided in Table 11-3.

Table 11-3 Strategies to achieve rehabilitation goals based on individual domains

Goal				
Domain	Safe	Non-polluting	Stable landform	Sustains agreed landuse
Mine				
Open cut pits	Backfill to original ground level (or higher to allow for settlement) to the extent possible.	Minimal to no residual water contained.	Settled, compacted and stabilised.	Maximise area returned to previous use and condition.
Ex-pit spoil waste dumps	Structurally safe to people and animals, hazardous material adequately treated or contained.	Runoff and seepage will be good quality water that is unlikely to affect known environmental values.	Place waste rock above natural surface with minimal slopes (for example less than 5°).	Return to previous use and condition.
Mine infrastructure	Minimise or avoid effects of hazardous materials used onsite by restricting use to contained facilities which are effectively managed with waste removed as required.	After removal of infrastructure - runoff and seepage will be good quality water that is unlikely to affect known environmental values. Remediate contamination so that runoff and seepage will not have unacceptable effects on known environmental values.	Remove infrastructure, re-shape disturbed areas to resemble surrounding landscape and establish adequate vegetation cover.	Return to previous use and condition.
Water Infrastructure	Remove hazardous materials	After removal of infrastructure - runoff and seepage will be good quality water that is unlikely to affect known environmental values	Allow continued use of permanent infrastructure that is stable or is managed under a maintenance program or removal depending on landholder.	Return to previous use and condition.
Haul Road				
Road, road furniture, drains, and cut and fill	Removal of all above ground infrastructure. No hazardous structures or chemicals used.	After removal of infrastructure - runoff and seepage will be good quality water that is unlikely to affect known environmental values.	Remove infrastructure, reshape disturbed areas to resemble surrounding landscape and establish adequate vegetation cover	Reinstate original ecosystem.
Train Loadout Facility				
Rail, stockpile, dams	Removal of all above ground infrastructure unless landholder or other project procures site for ongoing use and operation.	Remediate contamination so that runoff and seepage will not have unacceptable effects on known environmental values.	Allow continued use of permanent infrastructure that is stable or is managed under a maintenance program	Avoid areas of remnant vegetation by locating infrastructure on previously cleared areas.

11.9 Proposed Rehabilitation Strategy

The intended rehabilitation strategy and progressive rehabilitation program is described in the following sections.

11.9.1 Progressive Rehabilitation Program

Progressive rehabilitation will apply to the open cuts and waste rock dumps. The main features of the progressive rehabilitation process are:

- Constructing a stable land form for all disturbed areas;
- Topsoil spreading across available reshaped areas;
- Contour ripping immediately after topsoil placement to control erosion;
- Revegetation with an appropriate seed mix prior to the wet season; and
- Management of rainfall and runoff from the rehabilitated landform in sediment dams.

The proposed mine life is 20 years including the final four-year rehabilitation period. The indicative program for progressive rehabilitation is described below. Progressive rehabilitation will occur in accordance with the Plan of Operations. The Plan of Operations will identify areas to be rehabilitated and refer to the Rehabilitation Management Plan for specific rehabilitation details for each domain. The proposed rehabilitation program is summarised below.

Construction - Infrastructure construction to commence two years before the commencement of mining. All works areas to be cleared and grubbed with disposal of vegetation. Topsoil and subsoil to be stripped and separately stockpiled for future use. Primary sediment controls such as dams to be constructed in this phase.

Operational Years 1 to 16 - Ex-Pit Dumps (EPDs) to be utilised for coal rejects (filter press tailings – refer Chapter 8 – Waste Rock and Rejects for further disposal details). EPDs to be stabilised and contoured to minimise potential erosion. EPDs to be reshaped, stabilised, topsoiled and seeded. In-pit waste rock dumps to be shaped and used as cells for rejects. Reshaping and stabilisation of in-pit dumps. Progressive rehabilitation to include reshaping, topsoiling and seeding. Spoil piles will be progressively reshaped, stabilised, topsoiled and seeded.

Post-mining Completion Works Years 16 – 20 - All spoil piles and remaining voids will be rehabilitated. Mine infrastructure will be decommissioned and dismantled for removal from site with the individual locations rehabilitated accordingly. Dams and access roads will remain for future beneficial use or decommissioned. Rehabilitated areas will be monitored and if necessary reworked to achieve the required completion criteria.

The aim of progressive rehabilitation is to minimise the amount of land disturbed at any one time. The indicative program for progressive rehabilitation is shown in Figure 11-5 to Figure 11-9. The final landform and final landform cross-sections are shown in Figure 11-9. These show rehabilitation at various stages, including ex-pit waste rock dumps and in-pit dumping where rehabilitation has been completed in year 4, 8, 12 and 16 and the final landform. The final landform of the rehabilitated pits and waste dumps lie outside the post mining 1,000 year average recurrence interval (ARI) flooding (Figure 11-10). Progressive rehabilitation will also include the rehabilitation of any areas disturbed during construction that are not required for ongoing operations.

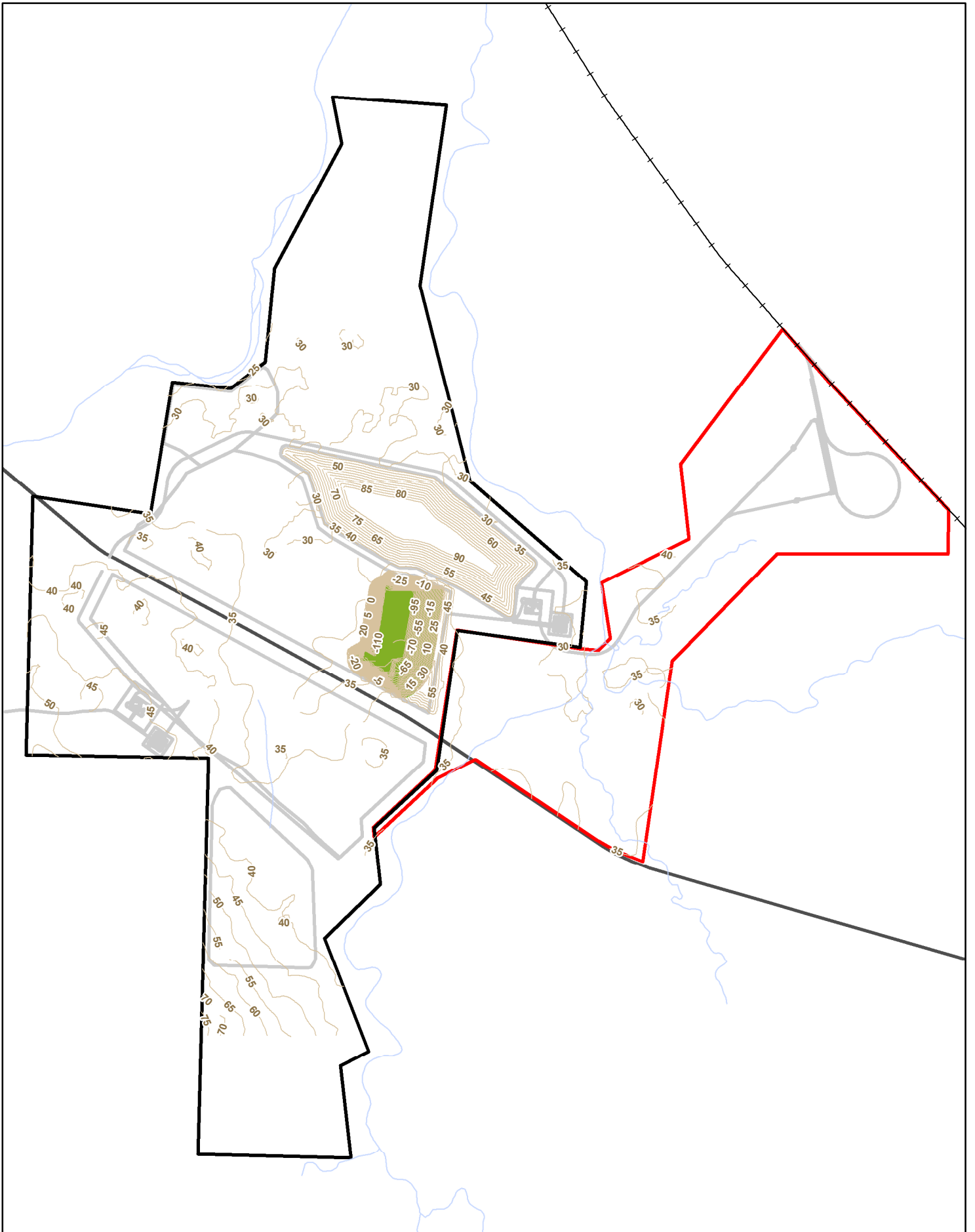


Figure 11-5

Progressive rehabilitation – Year 4



0 0.5 1 km

Legend

- Elevation contours (mAHD)
- Area of progressive rehabilitation
- ML 80187
- ML 700022
- Proposed mine infrastructure
- North Coast Rail Line
- Main road
- Watercourse

Scale @ A4 1:46,500
 Date: 25/07/17
 Drawn: Gayle B.

DATA SOURCE
 QLD Spatial Catalogue (QSpatial), 2017



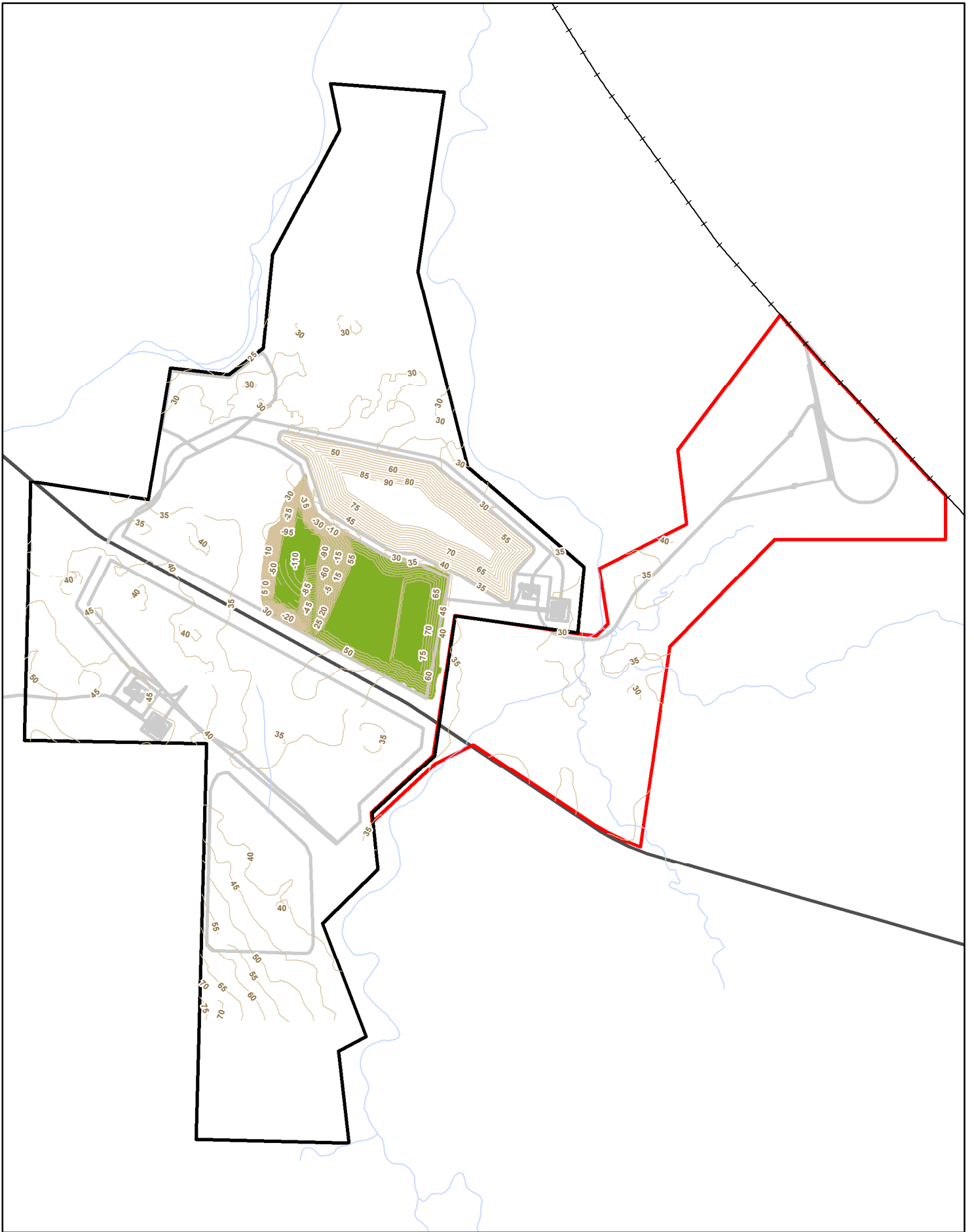


Figure 11-6

Progressive rehabilitation – Year 8



0 0.5 1 km

Legend

- Elevation contours (mAHD)
- Area of progressive rehabilitation
- ML 80187
- ML 700022
- Proposed mine infrastructure
- North Coast Rail Line
- Main road
- Watercourse

Scale @ A4 1:46,500
 Date: 25/07/17
 Drawn: Gayle B.

DATA SOURCE
 QLD Spatial Catalogue (QSpatial), 2017



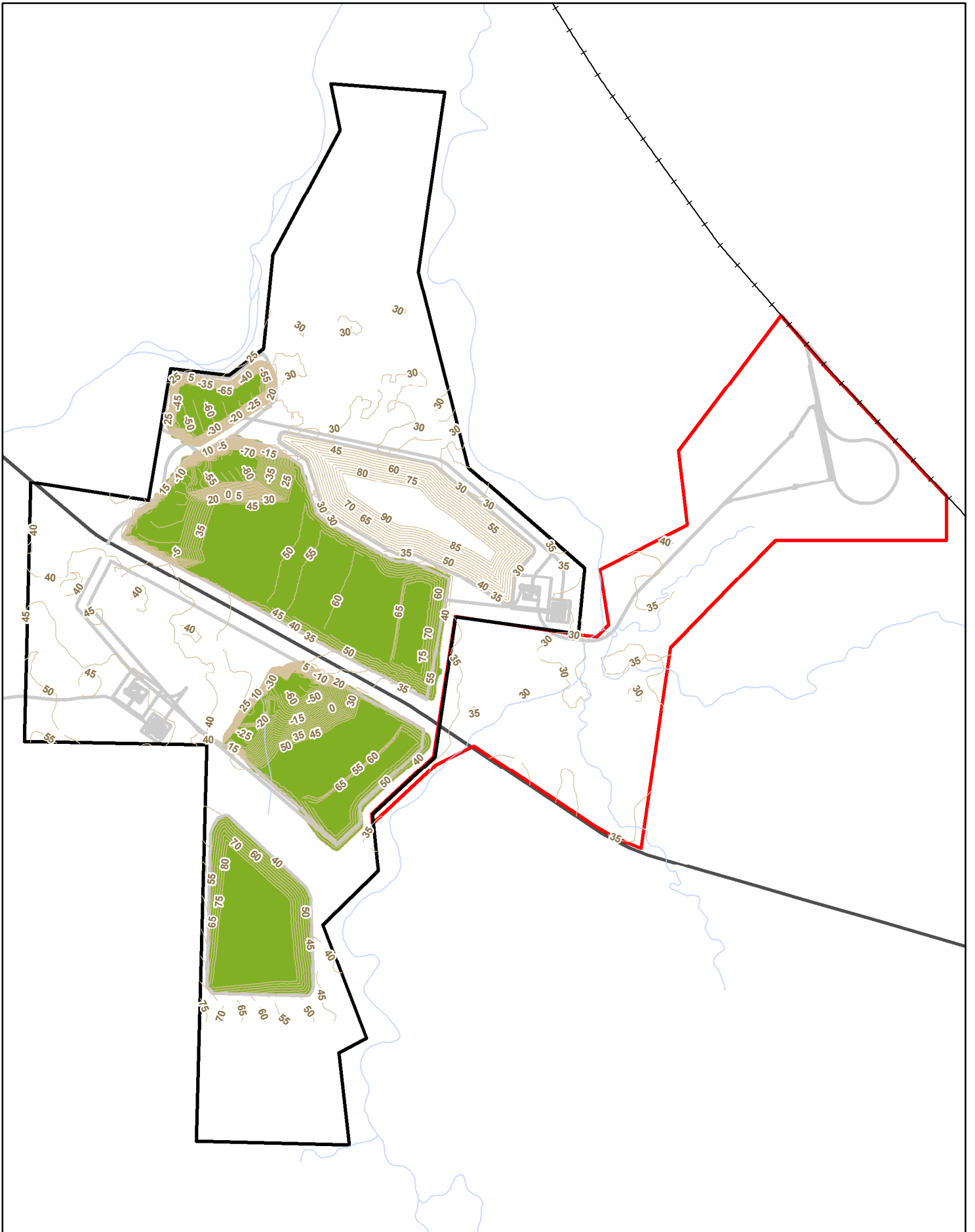


Figure 11-7
 Progressive rehabilitation – Year 12

Scale @ A4 1:46,500
 Date: 18/07/17
 Drawn: Gayle B.

Legend

- Elevation contours (mAHd)
- Area of progressive rehabilitation
- ML 80187
- ML 700022
- Proposed mine infrastructure
- North Coast Rail Line
- Main road
- Watercourse

DATA SOURCE
 QLD Spatial Catalogue (QSpatial), 2017



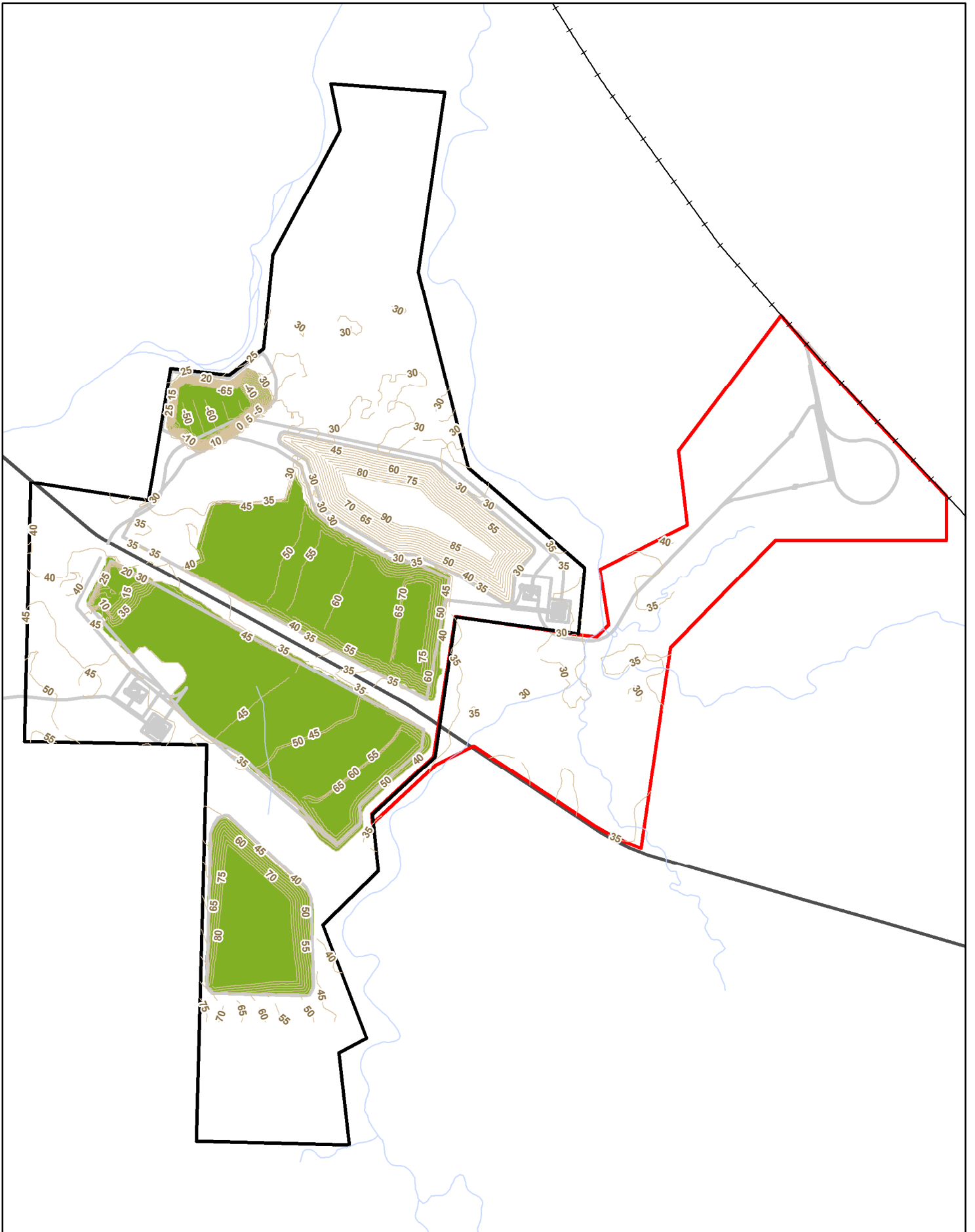
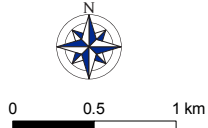


Figure 11-8
 Progressive rehabilitation – Year 16



Legend

- Elevation contours (mAHD)
- North Coast Rail Line
- Area of progressive rehabilitation
- Main road
- ML 80187
- ML 700022
- Proposed mine infrastructure
- Watercourse


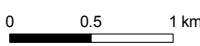









Scale @ A4 1:46,500
 Date: 18/07/17
 Drawn: Gayle B.

DATA SOURCE
 QLD Spatial Catalogue (QSpatial), 2017



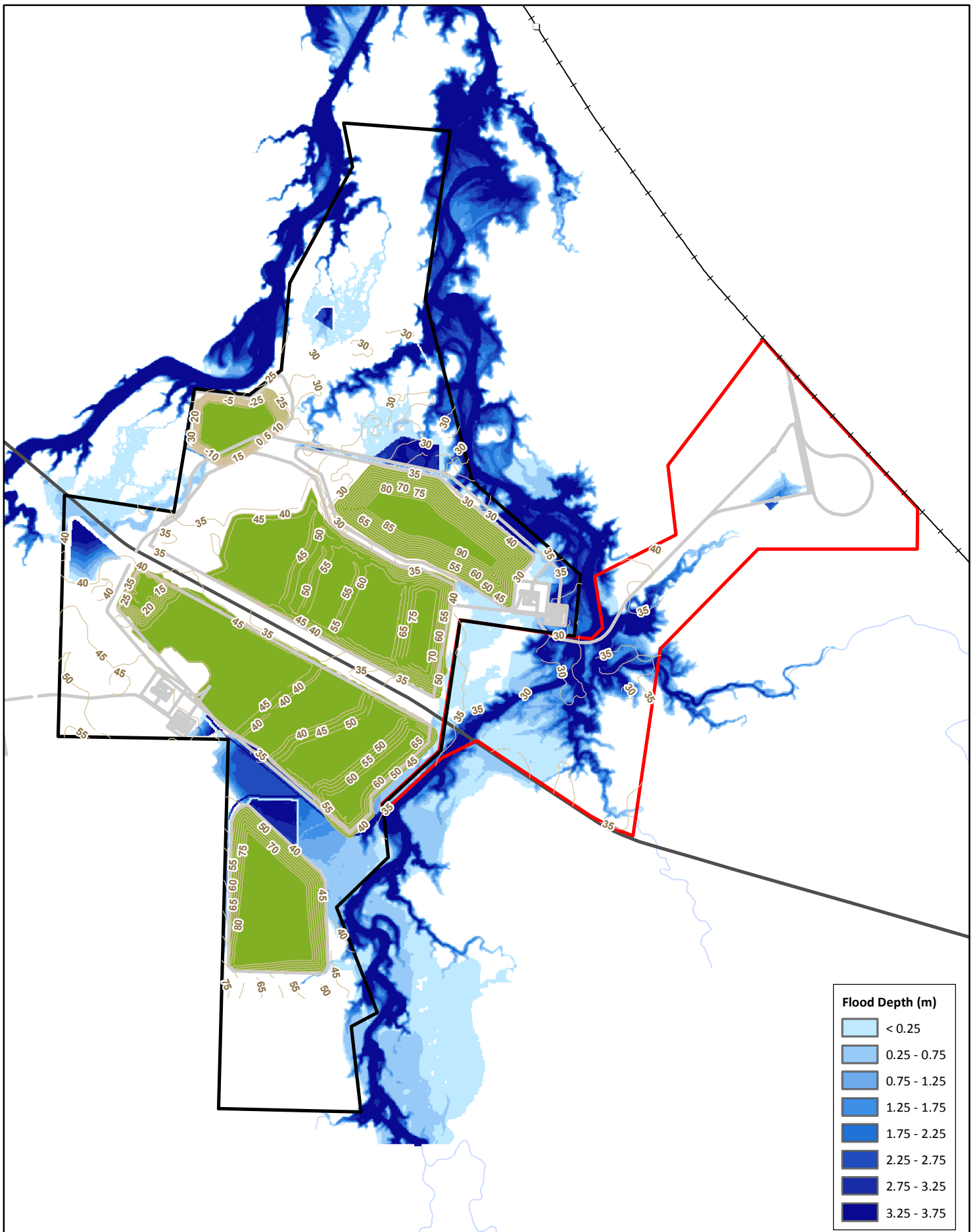


Figure 11-9
 Progressive rehabilitation –
 final landform

 	Legend	
	<ul style="list-style-type: none">  Elevation contours (mAHd)  Area of progressive rehabilitation  Cross section location  ML 80187  ML 700022  Proposed mine infrastructure 	<ul style="list-style-type: none">  North Coast Rail Line  Main road  Watercourse


DATA SOURCE
 QLD Spatial Catalogue (QSpatial), 2017
 Waratah Coal, 2017





Flood Depth (m)	
	< 0.25
	0.25 - 0.75
	0.75 - 1.25
	1.25 - 1.75
	1.75 - 2.25
	2.25 - 2.75
	2.75 - 3.25
	3.25 - 3.75

Figure 11-10
 Progressive rehabilitation with 1000 AEP
 peak flood depth – developed scenario


 Scale @ A4 1:50,000
 Date: 18/07/17
 Drawn: Gayle B.

- Legend**
- Elevation contours (mAHD)
 - Area of progressive rehabilitation
 - ML 80187
 - ML 700022
 - Proposed mine infrastructure
 - North Coast Rail Line
 - Main road
 - Watercourse

DATA SOURCE
 QLD Spatial Catalogue (QSpatial), 2017
 Waratah Coal, 2017



11.9.2 Landforming

The cumulative volume of excavated waste from open cut activities is expected to include 558 Mbcm consisting of waste rock, subsoils and fines from the CHPPs. As operations commence, waste rock from the open cuts will initially be stored in the ex-pit dumps. As mining in the open cuts progress, the stored waste rock will be backfilled in-pit as part of the progressive rehabilitation. As such it is not anticipated that extensive rehabilitation will be required of the waste rock dump areas over and above re-seeding. This will, however, be assessed as mining progresses. All dry filter press tailings have final disposal within the pit.

Expired pit areas will have the reject waste and overburden returned and will be profiled to the final desired landform specifications. Subsoil and topsoil will be replaced on the profiled landform in the reverse order to which it was stripped from the open cut domains; that is the subsoil is placed on top of the overburden and the topsoil on top of the subsoil at an appropriate thickness.

Before the topsoil is spread, the profiled landform will be scarified parallel to the contour to a nominal depth of 50 to 100 millimetres (mm) to break up any hard setting surfaces and prevent lamination of the topsoil and profiled landform. Dependant of the quantities originally recovered, topsoil will be spread to a nominal depth of between 100 to 150 mm where possible.

Where required, contour banks will be progressively installed to minimise rill erosion and direct water off the profiled landform to either a stable surface or dedicated stabilised drainage paths or flumes constructed on the final landform. The heights and depths of these contour banks will be determined through ongoing landform design. At the finalisation of this process a pre-vegetation landform will have been constructed.

Finalised landforms will initially be sown with either a cover crop or perennial native vegetation. The areas which have been identified for post-mining agricultural use will be sown with a mixture of pasture species including short and long lived perennial grasses and or legumes. Areas intended for ongoing nature conservation will be over sown with non-invasive perennial grasses as an interim measure until the area becomes available for inclusion in the ongoing revegetation program.

11.9.3 Erosion and Sediment Control

The erosion potential for all permanent and temporary landforms associated with the Project will be assessed and will focus on erosion and stability effects for all disturbed areas, including areas disturbed or exposed during decommissioning and rehabilitation. The methods to prevent or control erosion will have regard to the long-term stability of the land, preventing soil loss and preventing the degradation of waterways.

Erosion and sediment control measures will be like those applied during construction and during operations and will be outlined in the Project's Project Erosion and Sediment Control Plan (ESCP). The ESCP will be developed by a suitably qualified person in accordance with relevant legislation and guidelines. This will relate to the whole Project area and identify the risk of erosion and sedimentation within each area of the Project based on the soil type present.

Runoff from rehabilitated areas will collect in contour drains and collection drains, from where it will be directed to sediment dams and settling ponds to remove suspended sediment prior to draining from site. These drains and ponds will be maintained to ensure their proper functioning.

11.9.4 Soil Management

Topsoils and subsoils will be stripped, handled and stored to prevent excessive soil deterioration. An inventory of available soils will be maintained to ensure adequate materials are available for planned rehabilitation activities. General soil management will include the following measures.

11.9.4.1 Topsoil Stripping

- Prior to stripping, all vegetation would be progressively cleared to the minimum extent required for the impending future works;
- Supervisors and earthmoving plant operators will be trained to visually identify the topsoil layers to ensure that stripping operations are conducted in accordance with stripping plans and *in situ* soil conditions; and
- Care will be taken to ensure soil moisture conditions are appropriate for stripping and stockpiling, for example the moisture content of the topsoil material is not too dry or too wet.

11.9.4.2 Stockpiling

- Material that has been stockpiled for reuse will be protected from excessive disturbance or traffic, and stockpiled away from drainage lines;
- Drainage will be constructed to manage or divert surface water flows around stockpiles and maintained to ensure proper functioning;
- Topsoil stockpiles will be formed in low mounds with a height up to three metres and subsoil stockpiles up to six metres. Long-term stockpiles (present for greater than six months) will be deep ripped and provided with a vegetative cover to maintain the soil heath, maintain biological activity and minimise erosion potential. Stockpiled material will be constructed with batters or gradients of 1:4 wherever possible; and
- Weed and pests will be monitored and controlled as required.

11.9.4.3 Respreading

- Movement and handling from stockpiles to be conducted to minimise structural degradation such as compaction;
- Selective placement of more erodible soils on flatter areas as opposed to steeper slopes to minimise erosion potential;
- Respreading of soil in even layers at a thickness appropriate for the intended final land use;
- Avoidance of soil lamination through contour ripping to encourage soil keying, water infiltration and minimise runoff;
- Reseeding and revegetation as soon possible after respreading to establish vegetation cover;
- Installation of slope drainage control to limit slope lengths and runoff velocities; and
- Installation of collection drains and catch dams to collect runoff and remove suspended sediment.

11.9.5 Revegetation

Revegetation activities will typically commence at the completion of land forming, such as, reshaping, re-topsoiling and drainage works. The timing of these works will ideally be scheduled to enable a preferred seasonal sowing of pasture or tree seed. Where surfaces have been prepared, the nominated revegetation specification for tree, shrub and pasture species, will be sown using seed stock or planted depending on the species, slope gradients and final land use. Rehabilitation will utilise locally relevant tree and shrub species at a density and richness consistent with the desired post-mine landform. Plant selection for areas to be returned to a bushland landform will be based on the following criteria:

- The species will successfully establish on the available growth medium;
- The species will bind the soil; and
- The species diversity will result in a variety of structure and food and habitat resources.

Native flora used for rehabilitation will ideally be endemic and will be established through a combination of direct seeding or planting of tube stock from local propagules. Seed will be collected from site where possible and treated if necessary to ensure it is adapted to environmental conditions in the area. Tree and shrub establishment onsite will be dominated by the direct seeding method, currently being used at most coal mines in the Bowen Basin. An initial tree and shrub mix that could be used for rehabilitation is provided in Table 11-4 and is based on the current suite of flora species found in the Project area. The final species mix will depend on the final agreed Rehabilitation Management Plan and will be reviewed periodically depending on changes in best practice, technology and rehabilitation monitoring results.

Table 11-4 Tree and shrub species

Common name	Scientific name	Woodland	Grassland	Riparian zone
<i>Acacia bidwillii</i>	Corkwood Wattle	X		
<i>Acacia harpophylla</i>	Brigalow	X		
<i>Acacia holosericea</i>	Soap Bush	X		
<i>Acacia rhodoxylon</i>	Rosewood	X		
<i>Acacia salicina</i>	Sally Wattle	X		
<i>Acacia shirleyi</i>	Lancewood	X		
<i>Acalypha eremorum</i>	Soft Acalypha	X		
<i>Aeschynomene indica</i>	Budda Pea	X		
<i>Alloteropsis semialata</i>	Cockatoo Grass	X	X	X
<i>Alphitonia excelsa</i>	Red Ash	X		x
<i>Alstonia constricta</i>	Quinine Bush	X		X
<i>Aristida calycina</i>	Dark Wiregrass	X		
<i>Aristida inaequiglumis</i>	Feathertop Three-awn			X
<i>Artistida latifolia</i>	Feathertop Wiregrass	X		X
<i>Arundinella nepalensis</i>		X	X	X
<i>Atalaya hemiglauca</i>	Whitewood	X		X
<i>Bothriochloa decipiens</i>	Pitted Bluegrass	X	X	X
<i>Bothriochloa ewartiana</i>	Desert Bluegrass	X		
<i>Brachychiton populneus</i>	Kurrajong	X		X
<i>Breynia oblongifolia</i>	Coffee bush	X		X
<i>Bursaria spinosa</i>		X		X
<i>Carissa ovata</i>	Currant Bush	X		

Common name	Scientific name	Woodland	Grassland	Riparian zone
<i>Chloris divaricata</i>	Slender Chloris	X	X	X
<i>Chrysopogon fallax</i>	Golden Beard Grass	X		
<i>Citrus glauca</i>	Desert Lime	X		X
<i>Corymbia dallachiana</i>	Dallachy's Gum	X		X
<i>Corymbia intermedia</i>	Pink Bloodwood	X		X
<i>Corymbia tessellaris</i>	Moreton Bay Ash	X		X
<i>Croton insularis</i>	Silver Croton			X
<i>Cupaniopsis anacardioides</i>	Tuckeroo			X
<i>Cymbopogon refractus</i>	Barbed Wire Grass	X	X	X
<i>Dactyloctenium radulans</i>	Button Grass	X		
<i>Dichanthium sericeum</i>	Queensland Blue Grass	X	X	X
<i>Diospyros geminata</i>		X		X
<i>Dodonaea lanceolata</i> var. <i>lanceolata</i>	Hopbush	X		
<i>Enchylaena tomentosa</i>	Ruby Saltbush	X		X
<i>Enteropogon acicularis</i>	Curly Windmill Grass	X	X	X
<i>Entolasia stricta</i>	Wiry Panic	X		X
<i>Erythroxylum</i> sp.		X		X
<i>Eucalyptus camaldulensis</i>	Red River Gum	X		X
<i>Eucalyptus cambageana</i>	Dawson River Blackbutt	X		X
<i>Eucalyptus crebra</i>	Narrow-leaved Ironbark	X		
<i>Eucalyptus exserta</i>	Messmate	X		
<i>Eucalyptus melanophloia</i>	Silver-leaved ironbark	X		X
<i>Eucalyptus moluccana</i>	Grey Box	X		X
<i>Eucalyptus populnea</i>	Poplar Box	X		
<i>Eucalyptus tereticornis</i>	Forest Red Gum	X		X
<i>Eucalyptus tessellaris</i>	Moreton Bay Ash	X		X
<i>Ficus coronata</i>	Sandpaper Figs			X
<i>Ficus opposita</i>	Sandpaper Figs			X
<i>Fimbristylis dichotoma</i>		X		X
<i>Fimbristylis ferruginea</i>	Rusty Sedge	X		X
<i>Gahnia aspera</i>	Rough Saw-sedge	X		X
<i>Grevillea striata</i>	Beefwood	X		X
<i>Heteropogon contortus</i>	Black Speargrass	X		X
<i>Hibiscus heterophyllus</i>	Native Rosella	X		
<i>Imperata cylindrica</i>	Cogon Grass	X	X	X
<i>Lomandra longifolia</i>	Spiny-head Mat-rush	X		X
<i>Lophostemon grandiflorus</i>	Northern Swamp Mahogany			X
<i>Melaleuca bracteata</i>	Black Tea-tree			X
<i>Melaleuca leucadendra</i>	Weeping Paperbark			X
<i>Melaleuca trichostachya</i>				X
<i>Melaleuca viminalis</i>	Weeping Bottlebrush			X
<i>Melaleuca viridiflora</i>	Broad-leaved Paperbark			X
<i>Melia azedarach</i>	Persian Lilac			X
<i>Myoporum montanum</i>	Waterbush	X		X
<i>Panicum decompositum</i>	Native Millet	X	X	
<i>Panicum queenslandicum</i>		X	X	X

Common name	Scientific name	Woodland	Grassland	Riparian zone
<i>Paspalidium caespitosum</i>	Brigalow Grass	X		X
<i>Pennisetum cillare</i>	Buffel Grass	X		
<i>Petalostigma pubescens</i>	Quinine Bush	X		X
<i>Rhynchosia minima</i>		X	X	X
<i>Setaria surgens</i>	Annual Pigeon Grass	X		
<i>Sporobolus caroli</i>	Fairy Grass		X	X
<i>Stephania japonica</i>	Snake Vine			X
<i>Themeda triandra</i>	Kangaroo Grass	X	X	X

A combination of native and introduced pasture species will be used to ensure the establishment of a groundcover and reduce the likelihood of erosion. Legumes may also be selected to assist in the supply of bio-available nitrogen to the soil. If the use of introduced grasses and / or legumes is deemed necessary for erosion control in the bushland areas, pasture seed and fertilizer will be applied at a lower rate than for pasture outcomes to reduce competition with tree seed and / or seedlings.

Pasture species will be sown where the risk of erosion is less and on the more protected aspects of landforms. Aerial sowing and ground broadcasting will be conducted for pasture seed as the preferred sowing methods and grazing will be restricted whilst the vegetation is establishing.

11.9.6 Undisturbed Land

Land not impacted by mining activities will be retained for cattle grazing purposes where this does not affect mining operations or present a potential health and safety risk. Land not impacted but made inaccessible by mining activities will be returned to its pre-mining use at the completion of mining.

11.9.7 Mine Infrastructure Area

Following decommissioning, most infrastructure areas will be returned to the pre-mining landform or alternatively bench cuts will be removed and steep grades reduced and the landform returned to a profile similar to current landforms in the region. Where beneficial use of an area can be gained, such as access tracks, roads, hardstand or TLF facility, the final landform use will be negotiated and accepted in writing with the underlying landholder and EHP.

Building end use will be assessed at the time of Project closure, as alternative uses may be available. It is likely, however, that the main administration building, workshop, CHPP and fixed plant (conveyors and gantries, transfer points, thickener tank, coarse reject hopper, vehicle wash, etc.) will be dismantled or demolished and removed from the site. Where infrastructure is removed, the footprint area will be assessed and where required, reworked to facilitate the appropriate drainage of surface runoff from the site.

Where required, potentially hazardous locations will be decommissioned and or rehabilitated to an acceptable level to prevent negative environmental impacts. This may require sumps to be de-watered and the excess coal removed prior to the commencement of demolition. In addition, all items of equipment will be de-oiled, degassed, depressurised and isolated, and all hazardous materials removed from the site as per legislative requirements.

Appropriate surface water management structures (contour banks, drains and settlement ponds) will be constructed as required to minimise potential erosion of the decommissioned and rehabilitated area.

11.9.7.1 Roads and Hardstands

Where no beneficial long-term use can be provided to the final land use, road furniture and fittings will be removed from site for recycling or disposal. The roads, car parks and hardstand areas will be ripped, topsoiled and rehabilitated. Several of the internal and haul roads may be retained for use by future landowners. Several additional haul roads will also be temporarily retained following rehabilitation as access roads for rehabilitation monitoring purposes. Roads and hardstands to remain after mine closure will be determined in consultation with EHP. For those roads to be left operational, either permanently or temporarily, erosion and sediment controls will be employed to prevent and minimise sediment entering waterways.

Most haul roads and access tracks across the Project area requiring decommissioning may be highly compacted and require a combination of rehabilitation techniques such as deep ripping, profiling, topsoiling and seeding. Contaminated, carbonaceous or unsuitable material will be removed from the haul roads and hardstand surfaces, and disposed of to the low wall area and incorporated into the rehabilitation of those areas. Reshaping of roads and access tracks will be undertaken to reflect the surrounding landforms. Where not required for beneficial long-term use, creek crossings will be removed and the pre-existing drainage lines re-established. As required, drainage will be constructed where necessary. Roadside markers (tyres and guideposts) and redundant signage will also be removed from within the area once mine closure activities within the pit area have been completed.

11.9.7.2 Train Loadout Facility

The infrastructure associated with the TLF, including the rail loop, rail spur, rails and sleepers, will be removed at the end of the Project life, unless approved for use by another party. Any contaminated areas will require onsite remediation or encapsulation onsite to prevent the release of contaminants.

11.9.8 Water Infrastructure

Where no beneficial long-term use can be provided to the final land use, water storage dams will be decommissioned and rehabilitated. If not retained as water storages, water storage dams will be rehabilitated and returned to land consistent with pre-mining land uses such as low intensity beef cattle grazing. The rehabilitation process may require dewatering, removal of any sediments and embankments, and the re-establishment of original drainage paths. Rehabilitation techniques may include a combination of re-profiling, topsoiling and seeding. If water infrastructure is to be retained onsite, then this will occur following written agreement of the underlying landholder.

Rehabilitation may vary depending on the storage history during mine operations. Dams that have contained saline water may require additional remediation. This may require the membrane liner, if previously installed in the dam, to be removed. Any saline material inside the dam will be removed during rehabilitation and disposed of by appropriate methods, in accordance with the management of saline overburden material. Removal will either be through evaporation or, given the existing groundwater is already relatively saline, reinjection of the saline water. Alternatively, saline sediment will be capped using an inert clay layer and salt tolerant vegetation used to provide new plant cover. Cattle are known to graze on salt marsh species for example so it is expected that this would be successful. Dams collecting potentially contaminated runoff, for example from waste rock dumps, will be retained to control for any long-term pollution.

11.9.9 Open Pits

A single final void will remain after completion of mining at Open Cut 1. For this EIS a retained void in Open Cut 4 is also assessed. Optimisation of the mine plan is being progressed and there is potentially an option within the mine plan for Open Cut 4 to be backfilled such that no void will remain. As optimisation of the mine plan will continue over the next few months it is expected the Supplementary EIS will require updating, which may potentially indicate there will be no retained void in Open Cut 4.

The banks of the final void (i.e. the high wall, low wall and end walls) in each open cut will be reshaped to achieve long term geotechnical stability. Ramps will be levelled to similar grades as the surrounding wall slopes. The final slope gradients of each void, including the outer boxcut spoil slopes, low wall of the final voids, and high wall slopes will be assessed and recommended by a suitably qualified person based on the risk of long term geotechnical instability.

The voids will be externally drained so that water from the overburden piles drains away from the voids. Final void modelling will be conducted to establish the required parameters for long term void stability and water quality. A Final Void Plan will be prepared prior to completion of mining in the first pit, based on the final void modelling and detailing the design parameters for each final void. The Final Void Plan will include assessment of groundwater hydrology and properties, surface water hydrology and pit wall stability.

These studies will be undertaken during the life of the mine, and include detailed research and modelling. In the final five years of mine life, the capability of the void to support endemic flora and fauna will be ascertained.

Final voids are unlikely to be suitable for agricultural use, and will be investigated for alternative beneficial uses such as wetlands.

At the end of the mine life, the final voids remaining will be bunded and fenced to inhibit access to the area. The integrity of the bund will be the responsibility of the subsequent landowner.

Central Queensland Coal will investigate residual voids and a report will be submitted to the administering authority proposing acceptance criteria for final voids. The timing will be agreed with the administering authority.

11.9.10 Waste Rock Dumps

The waste rock dumps will be designed, constructed and operated to enable progressive rehabilitation during operations with the final landform objectives in mind. Thus, the dumps will be managed to prevent pollution, be stable, safe and support the final land use both during operations and in the longer term to ensure post-closure objectives will continue to meet regulatory requirements.

Optimisation of the mine plan is being progressed and there is potentially an option within the mine plan for Open Cut 4 to be backfilled such that no void will remain. Further mine planning and scheduling work is required to confirm the removal of the void in Open Cut 4, and once completed, the EIS will require updating during the Supplementary EIS stage to reflect this potential significant reduction in ex-pit waste and associated changes in final landform. Consequently, the waste volumes and final landform described in this EIS should be considered as the worst-case scenario.

The size of the final area occupied by the eastern waste dump (servicing Open Cut 2 and Open Cut 4) and western waste rock dump (servicing Open Cut 1) will be 163.7 ha and 133 ha respectively. It is estimated that 91 million bcm will be dumped in the two ex-pit dumps. Of this, 56 million bcm will

report to the eastern ex pit waste dump during years 1 to 4 and approximately 35 million bcm of waste rock will report to the western ex pit waste dump during years 10 and 11. Outside of this waste will material will report to the three open cuts. The waste schedule is discussed in detail in Chapter 3 – Description of the Project.

Geotechnical, climate, surface water and groundwater monitoring throughout the construction and operation of the Project will be used to evaluate the condition of the waste rock dumps and quantify their environmental risks. This information will then be used to determine the requirements for rehabilitation and closure control measures.

The stability of the waste rock dumps will be assessed based on the nature of: foundation materials, fill materials, and capping materials. The assessment will consider short-term, long-term and extreme conditions and meet the requirements of the Assessment and Management of Acid Drainage guideline of the Technical Guidelines for the Environmental Management of Exploration and Mining in Queensland series (DME, 1995).

Surface water flows will be prevented by capping using a low permeability material (i.e. clay), compacted and graded to limit stability issues which primarily result from water ingress and assist with directional precipitation runoff. Grading would be 2% and grade away from the crest. Side slopes would be designed to have 5% slopes. Contour grooving, channel linings, surface armour and drop structures on slopes will prevent long watercourse runs and minimise slope erosion. Certification will be obtained by Central Queensland Coal that slopes are stable in the long term and erosion rates are no greater than at comparable reference sites.

All dams receiving runoff from the waste rock dumps will retained to collect any fugitive sediment and prevent any contaminated water from entering surrounding watercourses. These dams would not overflow to surrounding watercourses. Groundwater and surface water monitoring would continue over a five-year monitoring period to demonstrate no pollution is occurring prior to relinquishment of the mining lease. Water quality levels would be required to meet the Queensland Water Quality Guidelines 2009 and *Environmental Protection Policy (Water) 2009* limits to be deemed 'non-polluting'.

The waste rock dumps will necessarily result in a higher landform than that which existed before mining, although given the landform is already hilly it will not be out of character with the surroundings. Indeed, slopes of >5% are found within the existing mine area. Top soil will be re-spread according to required depths and vegetation sown to establish cover comparable to reference sites. Soil characteristics will be measured *in situ* to confirm levels of surface roughness, aggregate stability and surface conditions as defined in the Australian Soil and Land Survey Handbook. If there is an issue of saline or sodic materials then gypsum will be obtained from a certified supplier and added to the land, or into the dump during operations.

Vegetation cover will be provided to not only assist with erosion control but to provide land usable for either low intensity cattle grazing or native vegetation, depending on what was on the land prior to mining. Vegetation completion criteria will be measured based on achieving at least 70% cover as required by Eyre *et al.*, 2015.

11.9.11 Pest and Weed Management

Weed species have the potential to negatively impact rehabilitation activities and have a major impact on both native vegetation and grazing. Fifty-three introduced weed species of which ten are classified as Restricted Matters under the *Biosecurity Act 2014* (Biosecurity Act) and five declared as weeds of national significance (WoNS) were recorded within or surrounding the Project area (see Chapter 5 – Land, Chapter 14 – Terrestrial Ecology and Chapter 17 – Biosecurity for full details).

Weed management will be a critical component of mine rehabilitation and will be conducted in conjunction with broader council and community weed management strategies where practical.

Weed control will be undertaken in a manner that minimises soil disturbance. Declared weeds will be controlled in accordance with the Biosecurity Act. A Land Use Management Plan will be developed and will incorporate a combination of control measures including:

- Herbicide spraying or scalping of weeds off soil dumps;
- Washdown and cleaning of high risk equipment prior to entering the site; and
- Monitoring and control of existing weed populations over the mine life.

11.9.12 Contaminated Land

Pursuant to the EP Act, an activity that will, or has the potential to, release contaminants into the environment and which may cause environmental harm is defined as an Environmentally Relevant Activity (ERA). In accordance with the *Environmental Protection Regulation 2008* (EP Regulation) (Schedule 6, Item 5), the development will be a site-specific EA mining project for the mining of black coal. The activities associated with the Project will require a number of ERAs (as prescribed in Schedule 2, EP Regulation). The EA is an integrated authority that allows for the carrying out of multiple ERAs that are part of a project, as such all ERAs must be listed and described in the EIS for inclusion in the EA. The EA is expected to provide approval conditions for each of the required ERAs.

The Project has the potential to involve two ERAs applicable to the construction and operational stages. These ERAs are:

- ERA 8 (1)(a) Chemical Storage (see Chapter 21 – Hazard and Risk); and
- ERA 31 (1) Mineral Processing (see Chapter 3 – Description of the Project).

As such, soil will be assessed for contamination at the following potential locations:

- Mine infrastructure area (fuel and chemical storages, belt filter press processing area); and
- Soil profile under the ex-pit waste storage area after material is returned to in-pit;

A risk assessment of these activities suggested that potential impacts can be remediated with current common contaminated land practices. In addition, these potential impacts were assessed as having relatively low residual risk following the adoption of mitigation measures. The handling of hazardous materials and dangerous goods and the associated waste management strategies are discussed in separate chapters. Mitigation or control strategies will be included in either the construction or operational Environmental Management Plan.

Onsite records will be maintained regarding any activities or incidents that have the potential to result in land contamination. An inventory will also be maintained that contains information on storage locations, personnel training and disposal procedures for all chemicals, fuel and other potential contaminants used onsite.

Finances will be set aside to rehabilitate the land in the unlikely event of land contamination. Contaminated land, should it result from the Project activities, will be rehabilitated as per the regulatory conditions and by best practices at the time of mine closure to ensure the land is suitable for its final land use. Measures to minimise the risk of spills or spread of any contamination during decommissioning and rehabilitation will be implemented including, for example: identification of risk areas, appropriate investigation of contamination risk, isolation and removal or rehabilitation of land.

11.9.12.1 Development of Specific Management Plans

The development and statutory approval of all management plans discussed above will take place ahead of any construction or operation works onsite, as appropriate, and in consultation with EHP. These plans will outline in detail how management, rehabilitation and mitigation measures will be implemented across the site. If an accelerated closure process is required, for example because of environmental, safety, economic or other external pressures, these plans will be adaptable to account for such a scenario.

11.10 Qualitative Risk Assessment

The deficiency to achieve rehabilitation goals may have the potential to cause, or may result in, adverse environmental impacts. The identification of impacts that could eventuate is critical to the selection of appropriate rehabilitation objectives or corrective action. During the detail design of the Project, prior to construction, the level of risk associated of not achieving rehabilitation goals will be determined using a Hazard Identification Matrix. This matrix will assess the likelihood and consequences to define a risk ranking.

The objectives of the risk assessment are to:

- Identify activities or outcomes that have the potential to adversely affect the local environment;
- Qualitatively evaluate and categorise each risk item;
- Assess whether risk issues can be managed by environmental protection measures; and
- Qualitatively evaluate residual risk with implementation of measures.

For each rehabilitation goal within the risk register there is a stated:

- Goal, objectives and performance criteria;
- Risk analysis negative impact occurring;
- Control measures to be implemented to meet management objectives / goals and performance; and
- Risk analysis of residual risk following the implementation of control measures.

Review and refinement of residual risk can be assessed and determined during the monitoring and implementation of the rehabilitation.

In line with the State government framework the rehabilitation process will use monitoring, targeted research and completion criteria to demonstrate ultimate success is shown in Figure 11-11. Within each rehabilitation stage, specific indicators will be monitored to determine and demonstrate the site has satisfied the completion criteria agreed between Central Queensland Coal and the administering authority.

Rehabilitation indicators are used to monitor the trending of ecological process towards the rehabilitation objectives, allowing early identification of issues requiring intervention and remedial actions. Indicators are used to demonstrate measurable effectiveness of the completion criteria to comply with community and regulatory expectations. The proposed completion criteria are

including vegetation composition, substrate characteristics, nutrient cycles, animal – plant interactions, ecosystem exchanges and habitat needs. Completion criteria will be regularly reviewed for continual improvement to reflect improved knowledge and work practices in collaboration with key stakeholders.

11.11 Post-mining Indicators and Completion Criteria

The attainment of post mining rehabilitation goals through the nomination of strict performance indicators or completion criteria during mine planning or development may not be entirely beneficial. Monitoring and reviewing of the implementation of the rehabilitation strategies as discussed previously during mine operations may provide more precise or improved indicators, enhanced completion criteria or more cost effective or alternative rehabilitation techniques.

If rehabilitation goals are anticipated to be changed, the relevant performance indicator and completion criteria may also require amendment. Proposed or anticipated changes to rehabilitation goals, performance indicators for a domain need to acknowledge the requirements as stated in the EA. Departures from the EA will require liaison with the regulatory authority for comment or approval.

Rehabilitation implementation and performance indicators will be required to be progressively monitored to collate adequate data and information towards the assessment of the risks, either positive or negative, towards archiving the completion criteria. Potential negative risks can be investigated and corrective or preventative actions developed to ensure environmental harm is minimised.

Table 11-5 Decommissioning and rehabilitation objectives and completion criteria by domain

Mine domain	Sub-domain	Rehabilitation goal	Rehabilitation objectives	Indicators	Completion criteria
Mine area	Open pit	Safe to humans and wildlife	<ul style="list-style-type: none"> No hazardous materials and structurally sound with limited slopes. 	<ul style="list-style-type: none"> Groundwater level and quality; Surface water quality; and Slope stability. 	<ul style="list-style-type: none"> Certification by an appropriately qualified person in the Rehabilitation Report that slopes are safe and exhibit characteristics for long term stability; A risk assessment has been completed and risk mitigation measures have been implemented, as appropriate; and Minimised retained voids.
		Non-polluting	<ul style="list-style-type: none"> Moderate quality but no connectivity; and Low risk of groundwater contamination or overflow but monitoring and management in place. 	<ul style="list-style-type: none"> Water Quality parameters - Salinity; Soil and land quality; and Groundwater levels and quality. 	<ul style="list-style-type: none"> Results of contaminated land survey indicate no contamination or recommendations of survey report have been implemented successfully; No degradation of water quality or significant increase in salinity over the five-year monitoring period; Dust and particulate matter indicates compliance with the EA; and Groundwater levels to remain like background variations.
		Stable	<ul style="list-style-type: none"> Long term geotechnical stability of the low and high walls. 	<ul style="list-style-type: none"> As nominated by geotechnical engineer. 	<ul style="list-style-type: none"> Low wall battered back from angle of repose; Installation of contour or graded drains to manage erosion; and High wall slopes assessed to be geotechnically stable by suitable qualified geotechnical engineer.

Mine domain	Sub-domain	Rehabilitation goal	Rehabilitation objectives	Indicators	Completion criteria
		Able to sustain an agreed post mining land use	<ul style="list-style-type: none"> ▪ Low intensity beef cattle grazing; and ▪ Natural vegetation and habitat. 	<ul style="list-style-type: none"> ▪ Stocking of cattle at same rate as prior to mining; ▪ Percentage pasture cover; ▪ Topsoil thickness; ▪ Ecosystem functioning indicators: water level and quality (dissolved oxygen, pH, temperature, salinity and nutrients (nitrogen and phosphorus); ▪ Biological: fish diversity, benthic algal growth; ▪ Habitat indicators: width, continuity, extent of shading and species composition; ▪ Native species; and ▪ Weed and pest abundance. 	<ul style="list-style-type: none"> ▪ Same land suitability class and extent prior to mining for cropping and grazing; ▪ Stock has access to water that meet accepted livestock drinking water guidelines; ▪ Pasture cover to be same as at reference sites; ▪ Land maintenance requirements are comparable to reference sites; ▪ Area is self-sustaining and has many of the attributes of the final landscape (surrounding analogue site); ▪ Soil characteristics have acceptable levels of surface roughness, infiltration capacity, aggregate stability and surface condition as defined in the Australian Soil and Land Survey Handbook; ▪ Established vegetative cover on slopes and outside bund to at least 70% cover; ▪ Native fauna identified in EIS baseline studies and at reference sites prior to mining are present or indicators of these species are recorded; ▪ Weed and pest species abundance identified in rehabilitation areas are no greater than at reference sites; and ▪ Evidence that weed and pest species management is occurring where appropriate.
	Waste rock dumps	Safe to humans and wildlife	<ul style="list-style-type: none"> ▪ Structurally safe with no hazardous materials; and ▪ Site is safe now and for foreseeable future. 	<ul style="list-style-type: none"> ▪ Safety assessment of landform; and ▪ Appropriate decommissioning 	<ul style="list-style-type: none"> ▪ Certification by an appropriately qualified person in the Rehabilitation Report that slopes are safe and exhibit characteristics for long term stability; and ▪ A risk assessment has been completed and risk mitigation measures have been implemented, as appropriate.

Mine domain	Sub-domain	Rehabilitation goal	Rehabilitation objectives	Indicators	Completion criteria
		Non-polluting	<ul style="list-style-type: none"> ▪ Mine affected water contained onsite; and ▪ No mine drainage outside of dump. 	<ul style="list-style-type: none"> ▪ Downstream surface water quality; ▪ Groundwater quality; ▪ Final land form water storages are contained onsite with no over flows to external surface waters; ▪ All diversions to meet approved design criteria; and ▪ All structures not required for post-mining land use decommissioned. 	<ul style="list-style-type: none"> ▪ Results of contaminated land; survey indicate no contamination or recommendations of survey report have been implemented successfully; ▪ No degradation of water quality or significant increase in salinity over the five-year monitoring period; ▪ Dust and particulate matter indicates compliance with the EA; and ▪ Groundwater levels to remain similar to background variations.
		Stable	<ul style="list-style-type: none"> ▪ Landform design achieves appropriate erosion rates. 	<ul style="list-style-type: none"> ▪ Engineered structures to control water flow; ▪ Appropriate rates of soil loss; ▪ Dimensions and frequency of erosion rills and gullies; and ▪ Vegetation cover sufficient to minimise erosion. 	<ul style="list-style-type: none"> ▪ Evidence that required contour banks, channel linings, surface armour, drop structures and other measures are in place and functioning; ▪ Certification that erosion activities are not greater than at comparable reference site; ▪ Dimension and occurrence of rills and gullies are no greater than at comparable reference site; and ▪ Evidence that vegetation type and density are of species suitable to the site and for erosion minimisation.

Mine domain	Sub-domain	Rehabilitation goal	Rehabilitation objectives	Indicators	Completion criteria
		Able to sustain an agreed post-mining land use	<ul style="list-style-type: none"> ▪ Low intensity beef cattle grazing; and ▪ Natural vegetation and habitat. 	<ul style="list-style-type: none"> ▪ Stocking of cattle at same rate as prior to mining; ▪ Percentage pasture cover; ▪ Topsoil thickness; ▪ Ecosystem functioning indicators: water level and quality (dissolved oxygen, pH, temperature, salinity and nutrients (nitrogen and phosphorus); ▪ Biological: fish diversity, benthic algal growth; ▪ Habitat indicators: width, continuity, extent of shading and species composition; ▪ Native species; and ▪ Weed and pest abundance. 	<ul style="list-style-type: none"> ▪ Same land suitability class and extent prior to mining for cropping and grazing; ▪ Stock has access to water that meet accepted livestock drinking water guidelines; ▪ Pasture cover to be same as at reference sites; ▪ Land maintenance requirements are comparable to reference sites; ▪ Area is self-sustaining and has many of the attributes of the final landscape (surrounding analogue site); ▪ Topsoil respread according to depths required in Land Use Management Plan; ▪ Soil characteristics have acceptable levels of surface roughness, infiltration capacity, aggregate stability and surface condition as defined in the Australian Soil and Land Survey Handbook; ▪ Established vegetative cover on slopes and outside bund to at least 70% cover; ▪ Native fauna identified in EIS baseline studies and at reference sites prior to mining are present or indicators of these species are recorded; ▪ Weed and pest species abundance identified in rehabilitation areas are no greater than at reference sites; and ▪ Evidence that weed and pest species management is occurring where appropriate.
	Mine infrastructure	Safe to humans and wildlife	<ul style="list-style-type: none"> ▪ Area safe for cattle access. 	<ul style="list-style-type: none"> ▪ Presence / absence of infrastructure and wastes. 	<ul style="list-style-type: none"> ▪ All infrastructure removed; ▪ Bench cuts removed; ▪ Steep grades reduced; and ▪ Similar surrounding landform profile.

Mine domain	Sub-domain	Rehabilitation goal	Rehabilitation objectives	Indicators	Completion criteria
		Non-polluting	<ul style="list-style-type: none"> No residual pollutants that could mobilise in environment. 	<ul style="list-style-type: none"> Soil sample result – hydrocarbon and metal levels. 	<ul style="list-style-type: none"> Post contamination assessment complete on areas where notifiable activities occurred and recommendations of assessment implemented; and Runoff and seepage will be good quality water that is unlikely to affect known environmental values.
		Stable	<ul style="list-style-type: none"> No erosion and sediment loss above surrounding area. 	<ul style="list-style-type: none"> Water turbidity in watercourses; Sediment loss - visual inspection; Presence of scouring or erosion; and Percentage vegetative ground cover. 	<ul style="list-style-type: none"> Stable site with adequate cover and permanent drainage with no erosion issues.

Mine domain	Sub-domain	Rehabilitation goal	Rehabilitation objectives	Indicators	Completion criteria
		Able to sustain an agreed post mining land use	<ul style="list-style-type: none"> ▪ Surface suitable for cattle grazing; and ▪ Minimal weed infestation and outbreaks. 	<ul style="list-style-type: none"> ▪ Weed presence; and ▪ Percentage pasture cover. 	<ul style="list-style-type: none"> ▪ Same land suitability class and extent prior to mining for cropping and grazing; ▪ Stock has access to water that meet accepted livestock drinking water guidelines; ▪ Land maintenance requirements are comparable to reference sites; ▪ Area is self-sustaining and has many of the attributes of the final landscape (surrounding analogue site). ▪ Soil characteristics have acceptable levels of surface roughness, infiltration capacity, aggregate stability and surface condition as defined in the Australian Soil and Land Survey Handbook; ▪ Established vegetative cover on slopes and outside bund to at least 70% cover; ▪ Native fauna identified in EIS baseline studies and at reference sites prior to mining are present or indicators of these species are recorded; ▪ Weed and pest species abundance identified in rehabilitation areas are no greater than at reference sites; and ▪ Evidence that weed and pest species management is occurring where appropriate.
	Water infrastructure (dams and drains)	Safe to humans and wildlife	<ul style="list-style-type: none"> ▪ Structurally safe with no hazardous materials and safe for the foreseeable future. 	<ul style="list-style-type: none"> ▪ Safety assessment of landform; and ▪ Appropriate decommissioning and rehabilitation. 	<ul style="list-style-type: none"> ▪ A risk assessment has been completed and risk mitigation measures have been implemented, as appropriate; and ▪ Landform design certified as meeting design requirements of rehabilitation.

Mine domain	Sub-domain	Rehabilitation goal	Rehabilitation objectives	Indicators	Completion criteria
		Non-polluting	<ul style="list-style-type: none"> Mine affected water is contained onsite or released according to EA conditions. 	<ul style="list-style-type: none"> Downstream surface water quality; Groundwater quality; Final land form water storages are contained onsite with no over flows to external surface waters; All diversions to meet approved design criteria; and All structures not required for post-mining land use decommissioned. 	<ul style="list-style-type: none"> Results of contaminated land survey indicate no contamination or recommendations of survey report have been implemented successfully; No degradation of water quality or significant increase in salinity over the five-year monitoring period; Dust and particulate matter indicates compliance with the EA; and Groundwater levels to remain similar to background variations
		Stable	<ul style="list-style-type: none"> Landform design achieves appropriate erosion rates. 	<ul style="list-style-type: none"> Engineered structures to control water flow; Appropriate rates of soil loss; Dimensions and frequency of erosion rills and gullies; and Vegetation cover sufficient to minimise erosion. 	<ul style="list-style-type: none"> Evidence that required contour banks, channel linings, surface armour, drop structures and other measures are in place and functioning; Certification that erosion activities are not greater than at comparable reference site; Dimension and occurrence of rills and gullies are no greater than at comparable reference site; and Evidence that vegetation type and density are of species suitable to the site and for erosion minimisation.

Mine domain	Sub-domain	Rehabilitation goal	Rehabilitation objectives	Indicators	Completion criteria
		Able to sustain an agreed post mining land use	<ul style="list-style-type: none"> To rehabilitate and return to low intensity beef cattle grazing where not required for ongoing use. 	<ul style="list-style-type: none"> Administering Authority determined that a water licence under the <i>Water Act 2000</i> is no longer required; No increase in flood risk; Water quality parameters; Weed presence; and Habitat indicators: width, continuity, extent of shading and species composition. 	<ul style="list-style-type: none"> Confirmation from the administering authority that a water licence under the <i>Water Act 2000</i> is no longer required; Dewatered, embankments removed, drainage paths re-established and pasture cover established; Certification that the Project area has an adequate flood risk level; and Remaining dams to be stable and enhanced to provide ecological habitat with water quality meeting criteria for aquatic protection.
Haul Road	All areas (road furniture, haul road, drainage, cut and fill areas)	Safe to humans and wildlife	<ul style="list-style-type: none"> No objects remaining which could cause injury. 	<ul style="list-style-type: none"> Presence / absence of infrastructure and wastes. 	<ul style="list-style-type: none"> All road furniture removed; Bench cuts removed; Steep grades reduced; and Similar surrounding landform profile.
		Non-polluting	<ul style="list-style-type: none"> No residual pollutants that could mobilise in environment. 	<ul style="list-style-type: none"> Soil sample result – salinity, hydrocarbon and metal levels. 	<ul style="list-style-type: none"> Runoff and seepage will be good quality water that is unlikely to affect known environmental values.
		Stable	<ul style="list-style-type: none"> No erosion and sediment loss above surrounding area. 	<ul style="list-style-type: none"> Water turbidity in watercourses; Sediment loss - visual inspection; Presence of scouring or erosion; and Percentage vegetative ground cover. 	<ul style="list-style-type: none"> Stable site with adequate cover and permanent drainage with no erosion issues.

Mine domain	Sub-domain	Rehabilitation goal	Rehabilitation objectives	Indicators	Completion criteria
		Able to sustain an agreed post mining land use	<ul style="list-style-type: none"> ▪ Revegetation and reconnection of wildlife corridor in previously RE areas; and ▪ Pasture for low intensity grazing in areas previously subject to grazing. 	<ul style="list-style-type: none"> ▪ Stocking of cattle at same rate as prior to mining; and ▪ Ecosystem Function Analysis. 	<ul style="list-style-type: none"> ▪ Same land suitability class and extent prior to mining for cropping and grazing; ▪ Stock has access to water that meet accepted livestock drinking water guidelines; ▪ Land maintenance requirements are comparable to reference sites; ▪ Area is self-sustaining and has many of the attributes of the final landscape (surrounding analogue site); ▪ Soil characteristics have acceptable levels of surface roughness, infiltration capacity, aggregate stability and surface condition as defined in the Australian Soil and Land Survey Handbook; ▪ Established vegetative cover on slopes and outside bund to at least 70% cover; ▪ Native fauna identified in EIS baseline studies and at reference sites prior to mining are present or indicators of these species are recorded; ▪ Weed and pest species abundance identified in rehabilitation areas are no greater than at reference sites; and ▪ Evidence that weed and pest species management is occurring where appropriate.
Train Loadout Facility	Environmental dams, rail loop, train loader and conveyer, stock piles	Safe to humans and wildlife	<ul style="list-style-type: none"> ▪ Soil sample result – salinity, hydrocarbon and metal levels. 	<ul style="list-style-type: none"> ▪ Soil sample result – salinity, hydrocarbon and metal levels. 	<ul style="list-style-type: none"> ▪ All infrastructure removed, land re-profiled, ripped and pasture cover established.
		Non-polluting	<ul style="list-style-type: none"> ▪ No residual pollutants that could mobilise in environment. 	<ul style="list-style-type: none"> ▪ Soil sample result – salinity, hydrocarbon and metal levels. 	<ul style="list-style-type: none"> ▪ Post contamination assessment complete on areas where notifiable activities occurred; and ▪ Runoff and seepage will be good quality water that is unlikely to affect known environmental values.

Mine domain	Sub-domain	Rehabilitation goal	Rehabilitation objectives	Indicators	Completion criteria
		Stable	<ul style="list-style-type: none"> Removal and rehabilitation of environmental dam and stable ground cover reduce erosion from surface water runoff. 	<ul style="list-style-type: none"> Water turbidity in watercourses; Sediment loss - visual inspection; Presence of scouring or erosion; and Percentage vegetative ground cover. 	<ul style="list-style-type: none"> Stable site with adequate cover and permanent drainage with no erosion issues.
		Able to sustain an agreed post mining land use	<ul style="list-style-type: none"> Low intensity beef cattle grazing; and Natural vegetation and habitat. 	<ul style="list-style-type: none"> Stocking of cattle at same rate as prior to mining; Percentage pasture cover; Soil structure; and Soil sample results – salinity, sodicity, N, P etc. 	<ul style="list-style-type: none"> Same land suitability class and extent prior to mining for cropping and grazing; Stock has access to water that meet accepted livestock drinking water guidelines; Land maintenance requirements are comparable to reference sites; Area is self-sustaining and has many of the attributes of the final landscape (surrounding analogue site); Topsoil respread according to depths required in Land Use Management Plan; Soil characteristics have acceptable levels of surface roughness, infiltration capacity, aggregate stability and surface condition as defined in the Australian Soil and Land Survey Handbook; Established vegetative cover on slopes and outside bund to at least 70% cover; Native fauna identified in EIS baseline studies and at reference sites prior to mining are present or indicators of these species are recorded; Weed and pest species abundance identified in rehabilitation areas are no greater than at reference sites; and Evidence that weed and pest species management is occurring where appropriate.

11.12 Rehabilitation Monitoring and Measurement

Monitoring will be carried out to ensure Central Queensland Coal obtains a representative dataset to enable progressive certification of rehabilitation under Chapter 5A of the EP Act. The responsibility for all environmental monitoring and management will be undertaken by Central Queensland Coal's Environment Manager. Attainment of the site's rehabilitation performance and completion criteria will be the responsibility of Central Queensland Coal.

The scope of environmental work will be based on the Project's Environmental Management System (EMS) and the plans and procedures that the EMS provides for, including rehabilitation measures. Key management plans which will provide for comparative reference monitoring sites (against which the results of the Project will be compared), monitoring methods and reporting that relate to rehabilitation are:

- Rehabilitation Management Plan;
- Erosion and Sediment Control Plan;
- Receiving Environment Monitoring Plan;
- Water Management Plan;
- Land Use Management Plan; and
- Mine Closure Plan.

Rehabilitation monitoring will comprise permanent monitoring locations at which visual and photographic surveys, transects / quadrats, ecosystem function analysis and remote sensing will be applied to determine change. It will specify the location of monitoring sites on disturbed areas and reference sites undisturbed by mining, as well monitoring frequency, tools, personnel and reporting protocols.

Rehabilitation monitoring will also include recording the history of rehabilitation activities in any one area so that the performance of a rehabilitation practice can be related to its results. This would include, for example, ground preparation measures, topsoil source, handling and respreading rates, seeding source and application, and meteorological information such as rainfall, temperature and wind speed.

The ongoing monitoring of the management measures and assessment of attainment of performance indicators will possibly identify departures from the intended goals. Progressive risk assessments will be undertaken towards the degree of the achievement of the rehabilitation goal and long-term sustainability of the rehabilitation, and will consider the probability of causing environmental harm. Corrective or preventative actions can be identified and developed to achieve the stated goals. Alternatively, if a corrective action cannot be defined or developed, alternative goals can be established.

Conversely, where monitoring provides evidence of the attainment of the intended goals or negligible potential for potential environmental harm, the monitoring may become unnecessary. Any reduced monitoring will be required to be negotiated and approved by the regulatory authority prior to implementation.

11.13 Relinquishment

An objective of rehabilitation is to facilitate relinquishment of the mining lease and EA, and release Central Queensland Coal from ongoing liability for the land. The relinquishment of the mining lease and surrender of the EA requires the appropriate application forms to be completed and adequate information to be provided within a final rehabilitation report. The rehabilitation report prepared for this will be based on the results of Central Queensland Coal's rehabilitation monitoring and will include evidence that the rehabilitation meets the completion criteria.

The attainment of completion criteria is an important component of the certification process and will be comprehensively discussed within the rehabilitation report. The rehabilitation report will provide definitive information on the assessment of performance indicators and the overall success of the rehabilitation for the duration of the rehabilitation. The rehabilitation report will include interpretation or discussion by appropriately qualified people, relevant to the scope of the rehabilitation and an overall statement of compliance with the stated performance criteria. Rehabilitation must be to the satisfaction of the administering agencies and at a state where there will be no residual risk before any financial assurance held against the Project will be released.

11.14 Conclusion

Specific rehabilitation and decommissioning measures to avoid or minimise any impacts will be identified in the EA and ultimately the Plan of Operations and the Mine Closure Plan that will be finalised prior to the commencement of mine closure activities. It may be the case that the best beneficial use of some of the supporting infrastructure is to leave the infrastructure in place to support the region. This will be discussed with the relevant authorities and landholders prior to formalising the decommissioning strategy. If the preferred outcome is to leave some of the infrastructure components *in situ* as operating infrastructure, Central Queensland Coal will facilitate the transfer of operating licences and obligations to the relevant parties.

Rehabilitation will occur progressively throughout the life of the Project to create a low maintenance, geotechnically stable landform commensurate with the agreed final land use.

11.15 Commitments

In relation to rehabilitation, Central Queensland Coal's commitments are provided in Table 11-6.

Table 11-6 Commitments – rehabilitation and decommissioning

Commitment
Rehabilitation to be consistent with the principles of Ecologically Sustainable Development.
Provide landforms with the same or similar land use capabilities and / or suitability prior to the disturbance, unless other beneficial land uses are pre-determined and agreed with key stakeholders (post-mining land owners, managers and relevant regulators).
Rehabilitate disturbed land so that it presents a negligible safety or environmental risk in terms of stability.
Provide land that is self-sustaining to agriculture or ecosystem processes where maintenance requirements are negligible and consistent with an agreed post-mining land use.
Maintain the water quality, leaving waterways and aquifers with water quality and quantity acceptable for existing and future users within or surrounding the site.
Continuation and / or restoration of biodiversity and ecological integrity of areas affected by mining within the mining lease.
Preservation of downstream water quality for ecological and existing beneficial uses.
Establishment of a low maintenance, geotechnically stable landform commensurate with grazing and nature conservation land uses.
Shape the created landforms to the extent practical to appear as a natural extension with the surrounding landforms.
Provide habitat for fauna and corridors for fauna movement within the final landform.
Monitor rehabilitation success in terms of physical and biological parameters.

11.16 ToR Cross-reference Table

Table 11-7 ToR Cross reference

Terms of Reference	Section of the EIS
8.2.1 Rehabilitation	
Conduct impact assessment in accordance with the EHP's <i>EIS information guideline— Rehabilitation</i> .	Section 11.10
The EIS must provide information based on relevant guidelines (including the departmental 'Guideline: Rehabilitation requirements for mining resource activities ¹), current best practice approaches and legislative requirements about the strategies and methods for progressive and final rehabilitation of the environment disturbed by construction, operation, and decommissioning of the project.	Section 11.2
The EIS must propose completion criteria and a rehabilitation strategy which addresses the following considerations:	Section 11.7
a) develop rehabilitation criteria for disturbed areas and post mining land uses across the mine as outlined in <i>EHP Guideline: Rehabilitation requirements for mining projects (EM1122)</i>	
b) specify spoil characteristics, soil analysis, soil separation for use on rehabilitation	Chapter 8
c) explain any planned native vegetation rehabilitation areas and corridors	Section 11.9.5
d) explain development and rehabilitation of improved pastures and grazing landforms	Sections 11.9.5, 11.9.6 and 11.11
e) detail rehabilitation methods applied to disturbed areas, including map(s) to identify proposed rehabilitation types and methods in different areas	Section 11.9
f) describe landform design criteria including end of mine design	Section 11.9.2
g) where suitable remnant vegetation sites are available, identify an appropriate number for the development of rehabilitation success criteria and comparison with progressive rehabilitation at the mine.	Section 11.12
h) identify success criteria for rehabilitation areas	Section 11.11
i) detail how landform design will be consistent with the surrounding topography	Section 11.9
j) include detailed flood modelling for two year Average Recurrence Interval (ARI), 50 year ARI (i.e. 1 in 50), 100 year ARI (i.e. 1 in 100), 1,000 year ARI (i.e. 1 in 1,000) and the Probable Maximum Flood (PMF). Maps must illustrate the final landform and where mined areas and uncompacted overburden would lie in relation to all of these flood levels up to and including the PMF. Maps must illustrate the final landform and where mined areas and uncompacted overburden would lie in relation to all of these flood levels up to and including the PMF	Section 11.9.1 and Chapter 9 – Surface Water
k) detail how surrounding environmental values will be protected	Section 11.9
l) describe rehabilitation indicators, projected progressive rehabilitation, and the monitoring program to be used	Sections 11.9, 11.11 and 11.12

¹ <https://www.ehp.qld.gov.au/land/mining/guidelines.html>

Terms of Reference	Section of the EIS
m) develop a contingency plan for rehabilitation maintenance or design.	To be prepared as part of the Rehabilitation Management Plan that will form paper of the EA Condition
n) assess waste in terms of acid forming potential; describe risks and proposed management	Sections 11.3.2 and 11.3.3 and Chapter 8 – Waste Rock and Rejects
o) provide rehabilitation goals, rehabilitation objectives, indicators of success and completion criteria for each mining domain for the agreed post mining land use	Sections 11.9.1 and 11.11
p) details and commits to a progressive rehabilitation schedule for the life of mine which: <ul style="list-style-type: none"> • minimise the amount of land disturbed at any one time • minimise the residual loss of land and water bodies with ecological or productive value • quantifies the milestones that would be met during the progressive rehabilitation of the project site including a table that specifies goals, timing and minimum quantities of the progressive rehabilitation to be achieved for each mining domain at different stages over the life of the mine • specifies the timing, criteria and definition for successfully achieving the progressive rehabilitation goals for all relevant domains 	Sections 11.9.1 and 11.11
q) include rehabilitation methods, topsoil requirements for rehabilitation, the proposed cover designs for encapsulation of waste material, including performance and completion criteria, geotechnical, geochemical and hydrological studies that support their design and proposed rehabilitation monitoring program	Sections 11.9 and 11.11
r) provide detailed description of the topsoil resources on site and how topsoil storage will be quantitatively and qualitatively managed (stripped, salvaged and stockpiled) for the life of the project to prevent topsoil loss from any disturbance areas and to ensure successful progressive revegetation and rehabilitation	Section 11.9.4
s) describe and illustrate the proposed final landforms including landform type, slope, regional ecosystem, retained voids, drainage design, and post mining land or infrastructure use agreed with background landholders. Maps of the proposed final topography should have contours at suitable intervals, and show waste dumps, and any dams that would not be removed and rehabilitated	Section 11.9
t) describe rehabilitation completion criteria that would be used to measure progress and completion in relation to the final land uses and wildlife habitat areas. Describe how the achievement of the objectives would be monitored, audited and reported, and how corrective actions would be managed	Sections 11.11 and 11.12

Terms of Reference	Section of the EIS
u) include the staged design of the voids over the life of mine, including the estimated timing that works will commence and be completed, post mining land use, topography, geotechnical rehabilitation stability, post-mining hydrological interactions	Section 11.9
v) Notwithstanding that management techniques may improve over the life of the project, and legislative requirements may change, the EIS must give confidence that all potential high-impact elements of the project (e.g. spoil dumps, voids, tailings and water management dams, creek diversions or crossings, borrow pits) are capable of being managed and rehabilitated to achieve acceptable land suitability, to be safe, stable, non-polluting and self-sustaining, and to prevent upstream and downstream surface and groundwater contamination	Section 11.9