EMGA Mitchell McLennan

Carmichael coal mine
Closure and rehabilitation strategy

Prepared for Adani Mining Pty Ltd | 26 July 2013

Planning + Environment + Acoustics

Adani Mining Pty Ltd

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Adani Mining Pty Ltd

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1 Introduction

1.1 Project overview

Adani Mining Pty Ltd (Adani) is proposing to develop a 60 million tonne per annum (Mtpa) thermal coal mine in the north Galilee Basin approximately 160 kilometres (km) north-west of the town of Clermont, Central Queensland (Figure 1.1). Coal from the Project will be transported by rail to the existing Goonyella and Newlands rail systems, operated by Aurizon Operations Limited (Aurizon). The coal will be exported via the Port of Hay Point and the Port of Abbot Point over the 60 year (90 years in the EIS) mine life.

Project components are as follows:

- The Project (Mine) - a greenfield coal mine over EPC 1690 and the eastern portion of EPC 1080, which includes both open cut and underground mining, on mine infrastructure and associated mine processing facilities (the Mine) and the Mine (offsite) infrastructure including a workers accommodation village and associated facilities, a permanent airport site, an industrial area and water supply infrastructure.

- The Project (Rail) - a greenfield rail line connecting to mine to the existing Goonyella and Newlands rail systems to provide for the export of coal via the Port of Hay Point (Dudgeon Point expansion) and the Port of Abbot Point, respectively including:

    - Rail (west) - a 120 kilometre (km) dual gauge portion running west from the Mine site east to Diamond Creek.

    - Rail (east) - a 69 km narrow gauge portion running east from Diamond Creek connecting to the Goonyella rail system south of Moranbah.

- Quarries - The use of five local quarries to extract quarry materials for construction and operational purposes.

1.2 Purpose and scope

For the purposes of preparing the closure and rehabilitation strategy, Carmichael Coal Mine and Rail Project has been divided into four discrete components. These components include the:

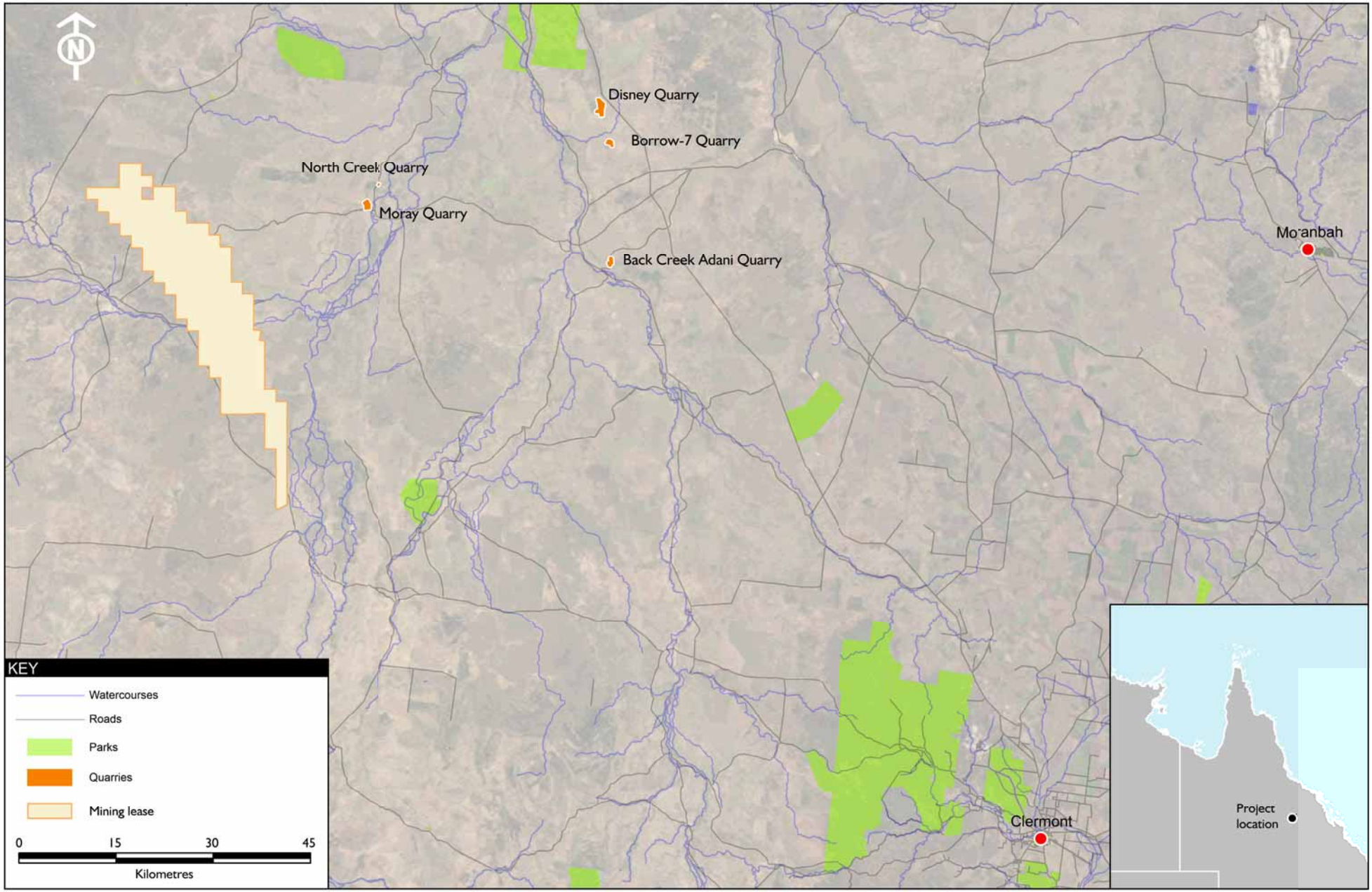
- mine site (including all activities carried out within the mining leases);

- offsite infrastructure area (including workers accommodation village, dedicated airport, off-site industrial area, water supply, storage and transfer infrastructure and access roads;

- railway activities and associated infrastructure; and

- quarries.

EMGA Mitchell McLennan (EMM) was commissioned by Adani to complete a closure and rehabilitation strategy for each component. The closure and rehabilitation strategies implement the management controls and methods outlined in the Carmichael Coal Mine and Rail Project Environmental Management Plan (EMP).



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Project location

Rehabilitation management plan (mine)

Figure 1.1

The objectives of the closure and rehabilitation strategies are to:

- ensure compliance with the requirements of all relevant environmental legislation, best practice guideline, conditions of any applicable licence, approval or permit;
- provide conceptual rehabilitation management and mitigation procedures for site personnel;
- describe indicators and rehabilitation completion criteria where they can be identified, where they cannot be identified, document this so that future iterations of the strategy can include a schedule for continuous improvement;
- provide methods and process to allow the site to be rehabilitated to a safe and stable condition;
- describe progressive and interim rehabilitation procedures;
- establish a monitoring program for rehabilitation assessment; and
- describe the procedure to be used to revegetate the post-mine landscape to achieve the relevant performance outcomes and completion criteria.

This closure and rehabilitation strategy covers rehabilitation of all operational activities and associated infrastructure being undertaken as part of the Project on the mine site. Construction activities requiring rehabilitation at the Project site will be managed via the *Construction Mining Operations Plan* with guidance from this closure and rehabilitation strategy.

The closure and rehabilitation strategy will evolve over time as activities progress and additional technical studies and investigations are completed. It is envisaged that with each review a continuous improvement schedule will be developed to include new items resulting from the review process.

1.3 Strategy structure

This closure and rehabilitation strategy incorporates rehabilitation objectives, an overall management strategy and general rehabilitation methods for the Project structured around eight domains within the mine area (Figure 1.2). The closure and rehabilitation strategy is structured as follows:

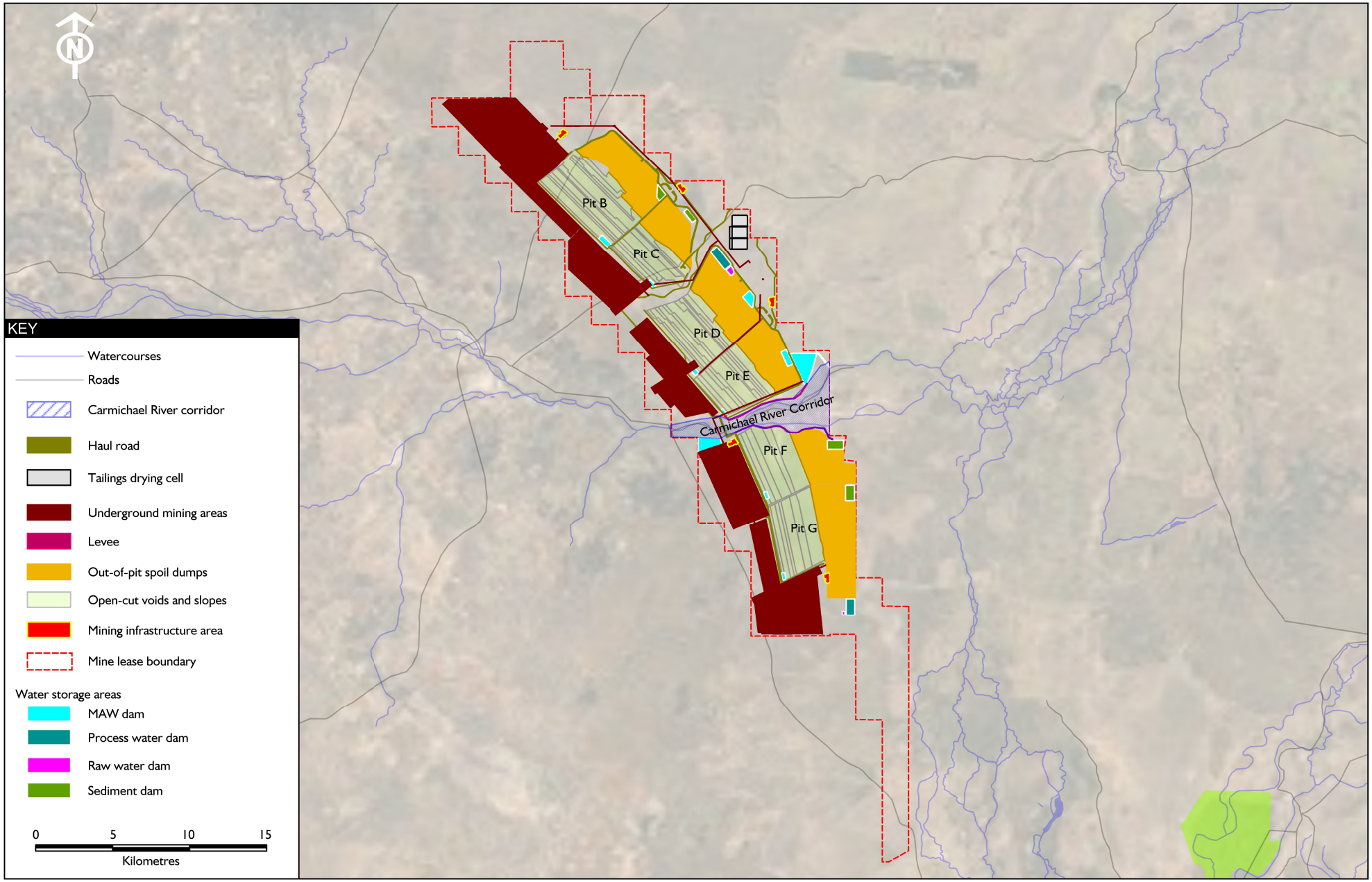
- Chapter 2 describes responsibilities, delegations and review.
- Chapter 3 describes the rehabilitation objectives. The objectives are staged as a continuum between short and long-term reflecting the changing nature of the Project as it evolves through rehabilitation.

- Chapter 4 describes the preferred rehabilitation strategy for each of the eight domains. The chapter also describes how the preferred closure strategy differs from the pre-mining land capability/suitability assessment.

- Chapter 5 describes general rehabilitation activates that are common to all domains.

- Chapter 6 describes the final land use objectives and presents simple strategies and drawings for the final landform of each domain. The completion criteria presented in this chapter are intended to be used to measure and describe whether the final landforms are meeting the objectives described in Chapter 3.

- Chapter 7 describes the monitoring and maintenance program.



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Mine domains

Rehabilitation management plan (mine)

Figure 1.2

2 Delegation and review

2.1 Roles and responsibilities

Table 2.1 Role and responsibilities

Role	Responsibility
Mine Manager or representative	Ensure that adequate resources are available within Adani and ensure that contractors meet all compliance requirements.
	Implement the closure and rehabilitation strategy.
	Facilitate rehabilitation planning review.
Environment Manager or representative	Implement the closure and rehabilitation strategy.
	Review, update and further develop the closure and rehabilitation strategy annually as a minimum throughout the life of the quarries.
	Train staff in environmental awareness, site issues and requirements of the monitoring program.
	Facilitate the monitoring and implementation of measures outlined in this closure and rehabilitation strategy.
	Report non-conformances to Mine Manager or representative and ensure corrective actions are closed out.
	Advise Mine Manager or representative and other management on environmental permit requirements and provide advice to assist with achieving compliance.
	Investigate environmental incidents and liaise with EHP where necessary/as requested by the Mine Manager or representative.
Employees	Be familiar with the contents of this closure and rehabilitation strategy.
	Ensure works are completed in accordance with the closure and rehabilitation strategy.
	Report all incidents or non-compliance with the closure and rehabilitation strategy to the Mine Manager or representative immediately.
Contractors	Be familiar with this closure and rehabilitation strategy.
	Ensure works are completed in accordance with the closure and rehabilitation strategy.
	Report all incidents or non-compliance with the closure and rehabilitation strategy to the Mine Manager or representative immediately.

2.2 Review

This closure and rehabilitation strategy will be reviewed every three years throughout the life of the Project. As the operational plan changes or rehabilitation activities are completed, the strategy will be updated to reflect these changes. Five years prior to the confirmed closure date, the final closure and rehabilitation strategy will be developed to properly address the post-mining landscape for the project area.

3 Rehabilitation overview

3.1 Rehabilitation hierarchy

Adani intends to use the rehabilitation hierarchy from the department of Environment and Heritage Protection (DEHP) *Rehabilitation requirements for mining projects* to guide rehabilitation choices where possible. The rehabilitation hierarchy, in order of decreasing capacity to prevent or minimise environmental harm, is:

- avoid disturbance that will require rehabilitation to prevent of minimise future environmental harm;
- reinstate the original natural ecosystem;
- develop an alternative outcome with a higher economic value than the previous land use;
- reinstate previous land use (eg grazing); and
- develop lower value land use (if this is acceptable to the relevant stakeholders).

3.2 Rehabilitation objectives

Adani intends to return the Project site to a stable landform capable of supporting similar land uses to pre-disturbance in a manner which is consistent with the rehabilitation hierarchy in *Rehabilitation requirements for mining projects*.

The nominated post-mine land-use includes grazing on a mosaic of native pasture and woodland habitat. For areas disturbed by the Project the following overarching objectives will apply:

- The mine site will be safe to humans and fauna.
- Mining and rehabilitation will aim to create a landform that is stable and with similar land use capabilities and/or suitability that existed prior to the disturbance, unless other end uses are pre-determined and agree.
- Mine wastes and disturbed land will be rehabilitated so that they are non-polluting and self-sustaining or to a condition where the maintenance requirements are limited.
- Surface and ground waters leaving the project area will not be degraded compared to their condition prior to the commencement of mining operations. Current and future water quality will be maintained at levels that are acceptable for users downstream of the site and meet environmental needs.
- Potential acid mine drainage will be determined and management measures implemented (eg encapsulation of sulphides or treatment systems), if required.
- Vegetation cover will be established to reduce rates of erosion and sediment loss so that it is comparable to surrounding undisturbed landscapes.
- Soil suitability for use in rehabilitation will be assessed and soils will be ameliorated as required.

It is important that the closure and rehabilitation strategy recognises the limit of how the above described overarching objectives can be applied during rehabilitation. The following continuum of objectives describes how these objectives will be met during and after rehabilitation.

3.2.1 Short-term

Rehabilitation objectives in the short term are to:

- progressively reshape and stabilise disturbed areas;
- provide short-term erosion control measures;
- mange soil to ensure suitability and beneficial reuse during rehabilitation;
- ameliorate wastes and soils as necessary to address physical and chemical constraints to revegetation and erosion stability; and
- refine rehabilitation methods through continuing review and update of this closure and rehabilitation strategy.

3.2.2 Medium-term

Rehabilitation objectives in the medium term will focus on:

- establishing functionally important and structurally dominant species from the relevant native vegetation communities;
- demonstrating rehabilitation succession in comparison with analogue sites; and
- reducing reliance on structural drainage and erosion control methods through landform design and construction that lends itself to the surrounding fluvial and landscape processes.

3.2.3 Long-term

The long-term rehabilitation objectives are to:

- monitor rehabilitation areas to ensure succession of planted native vegetation with functionality trending toward analogue native vegetation communities;
- apply adaptive management measures if natural succession is not occurring; and
- demonstrate rehabilitation performance.

3.3 Rehabilitation schedule

A conceptual mine rehabilitation schedule based on current approved dates of mine closure is provided in Table 3.1. Many of the decommissioning closure tasks will be undertaken concurrently and the duration shown is indicative of each specific task only. Any infrastructure including dams, levee banks, roads and buildings, which has beneficial future use by post-mine landowners, will be left in place.

Table 3.1 Summary of rehabilitation schedule

Mine	Disturbance area (ha)	Year disturbance starts	Year progressive rehabilitation starts	Year progressive rehabilitation ends	Total area rehabilitated (ha)
Open-cut voids and slopes.[1]	8685.88	2015	2029	2074	8685.88
Underground mining area (subsidence).	6826.58	2019	TBA	2074	6826.58
Mine infrastructure area.	1539.43	2014	2071	2074	1539.43
Out-of-pit spoil dumps.	6869.20	2014	2029	2074	6869.20
Water storage areas, including MAW dams, raw water dams and sediment ponds.	823.87	2014	2071	2074	823.87
Stream diversions.	To be determined	2014	2071	2074	To be determined
Tailings drying cell.	270.00	2014	2071	2074	270.00
Carmichael River corridor.	1823.10	2014	2071	2074	1823.10

Notes: [1]*progressive rehabilitation of this domain is discussed in Section 4.3*

3.3.1 Unplanned closure

Site closure may be initiated in a number of different scenarios including: planned closure, unplanned or imminent closure and temporary closure.

In the event of unplanned closure some of the objectives, processes and implementation timeframes may vary. However, the practice of progressive rehabilitation and mine closure planning including adequate financial provisioning will be in place. This forms a strong foundation, in the event of unplanned closure, to provide the highest chance of a successful closure to the satisfaction of the relevant agencies and stakeholders.

4 Preferred rehabilitation strategy

4.1 Domains

For the purposes of rehabilitation management and planning, this closure and rehabilitation strategy applies to the following eight domains of the mine site:

- open-cut voids and slopes;
- underground mining area;
- mine infrastructure area;
- out-of-pit spoil dumps;
- water storage areas, including MAW dams, raw water dams and sediment ponds;
- stream diversions;
- tailings drying cell; and
- Carmichael River corridor.

The preferred rehabilitation strategies for each domain are discussed below. The preferred rehabilitation strategies for the offsite infrastructure area and the rail corridor are addressed in the *Closure and rehabilitation strategy (Offsite Infrastructure Area)* and the *Closure and rehabilitation strategy (Rail corridor)*. Additional detail will be provided when the Plan of operations is prepared and EA conditions are issued.

4.1.1 Open-cut voids and slopes

Open-cut voids will be progressively backfilled from the low-wall with overburden and mine waste. Backfilling will include selective handling and management of potentially acid forming, saline or sodic materials including encapsulation if necessary.

Pre-strip materials from development of adjacent open-cuts will also be placed in finished open-cuts where possible to reduce the volume and slopes of any final void.

The final landform for each open-cut and void will be achieved through:

- initial geotechnical appraisal of high-wall stability and suitable final slope angle;
- blasting and dozing of the high-wall to achieve a stable slope with safe edges;
- assessing the potential for spontaneous combustion to occur from exposed coal seams and ameliorative works as required to reduce risk;
- re-profiling the low-wall to final angle of 12° to 14°. Potential overland flow from incident rainfall which could cause scouring and erosion will be managed by the construction of water retention or diversion structures on slopes and in the catchment above open-cut voids as required;

- accident prevention by effective bunding and/or fencing of the perimeter and the erection of danger signs; and
- minimising the amount of inflow of overland flow caused by rainfall and eroded soil into the void were feasible.

Void slope revegetation will be achieved where possible by:

- ripping or otherwise de-compacting compacted surfaces, provided machinery can safely access the slope;
- placing topsoil by either pushing from the crest using a dozer or by end-dumping and allowing successive rainfall to wash topsoil into and down the slope;
- planting vegetation provided there is safe access or aerial seeding where safe access is not available;
- watering vegetation using void water provided it is of suitable quality;
- corrective actions for pH, nutrients, organic matter and salinity to ensure that vegetation is self-sustaining; and
- managing weeds and revegetation until >70% cover is achieved.

Water quality in final voids is not expected to cause degradation of adjacent or downstream surface or ground water resources. Testing will be carried out prior to, during and after rehabilitation to establish whether water quality meets relevant guideline levels. If water quality is degraded, a more detailed assessment of risk to water resources will be undertaken, including groundwater monitoring and modelling and mitigation or treatment.

4.1.2 Underground mining area

The final landform for underground mine workings will be achieved by:

- permanently sealing access to underground mine workings;
- re-profiling tension cracks and areas of abrupt level changes, ripping, topsoiling and seeding;
- planting vegetation provided there is safe access or aerial seeding where safe access is not available;
- watering vegetation using void water, if of suitable quality;
- corrective actions for pH, nutrients, organic matter and salinity to ensure vegetation is self-sustaining; and
- managing weeds and revegetation until >70% cover is achieved.

Subsidence from underground mining will cause differential settlement which may lead to undulation in the subsided landscape. Where practical, Adani will re-profile the subsidence zone to prevent future ponding of water. Ponding however may persistent in some areas of the post-mining landform even after re-profiling.

4.1.3 Mine infrastructure area

The mining infrastructure area includes the coal handling and washing facilities, the train load-out facility, buildings, car park, MIA pad and the ROM Pad.

All components suitable for reuse at other mining or industrial operations will be reused. Otherwise, recyclable materials will be recovered and non-recyclable components will be disposed of at authorised facilities.

A risk assessment of all below ground infrastructure and components will be completed to determine what can be removed (for reuse and/or disposal) and what can be left in place. Surface disturbance and impacts associated with the removal of below ground infrastructure and components will be considered in addition to the potential for contamination. Below ground infrastructure that is to be left in place will be made safe (eg depressurising, draining and sealing of pipelines) and the location of all infrastructure and other components will be recorded.

Contaminated soil assessments will be conducted as required (Section 4.2). Contaminated soils or other potential sources of contamination will be preferentially treated on site. If contamination cannot be treated then it may be disposed of at an authorised facility. Incident registers will be used to identify locations where spills have occurred. Treatment versus off-site disposal will depend on whether domains are listed on the Contaminated Land Register (CLR) and Environmental Management Register (EMR) and whether it is deemed appropriate to have them removed as part of the rehabilitation process.

Compacted surfaces will be ripped/ de-compacted and topsoil will be placed in accordance with the topsoil management plan and topsoil register. Soil will be seeded or planted and watered. Weeds will be managed until >70% cover is achieved.

De-compacted areas may be graded and re-profiled such that surface drainage is restored and ponding and scouring is reduced to as low as reasonable possible.

4.1.4 Out-of-pit spoil dumps

Material will be placed in the out-of-pit spoil dumps in such a way as to achieve profiles as close as possible to the final landform. This will reduce the volume of cut-and-fill required during re-profiling earthworks. Potential acid forming, saline or sodic material and coarse and fine reject from the tailings drying cells placed in the out-of-pit spoil dumps will be selectively managed which may include encapsulation.

The rehabilitation of out-of-pit spoil dumps will be completed progressively and will consist of:

- re-profiling dumps to achieve slopes angles not exceeding 7° on outer faces and 12-14° on inner faces (ie within voids);
- shaping and contouring to manage overland flow from rainfall such that this reduces scouring or erosion (this may include the placement of retention structures) to as low as reasonable possible;
- ripping or otherwise de-compacting compacted surfaces, provided safe machinery access is possible;
- placing topsoil as per topsoil management plan and topsoil register, provided safe machinery access is possible;

- seeding or planting vegetation, provided safe machinery access is possible;
- watering vegetation, provided safe machinery access is possible;
- corrective actions for pH, nutrients, organic matter and salinity to ensure that vegetation is self-sustaining; and
- managing weeds and revegetation until 70% cover is achieved.

4.1.5 Water storage areas, including MAW dams, raw water dams and sediment ponds

The rehabilitation approach for all water storages will consist of:

- testing of water quality in all dams, and sediment quality in sediment ponds, MAW dams and other dams that may have received mine affected or contaminated water;
- disposing of contaminated water to final voids if appropriate, if this is not possible then contaminated water will be treated to an acceptable level prior to discharge or disposal;
- determining whether any water storages may be of beneficial use for ongoing rehabilitation requirements. This is subject to meeting water quality and dam safety requirements.
- determining, in consultation with the landholder, whether any water storages may be of beneficial use for ongoing grazing. Only water storages where water quality and sediment quality meets stock watering criteria will be used.

For those storages that are to be removed:

- water will be treated as required to meet water quality requirements for either discharge to a final void or to the Carmichael River;
- contaminated sediments will be encapsulated in active open-cut mining areas during operation (if this can be done without compromising final void water quality) or removed for disposal at an authorised waste disposal facility.
- walls will be breached so that the storage can no longer contain water;
- the area will be graded and re-profiled to ensure that surface drainage is restored and ponding and scouring potential is reduced to as low as reasonably possible;
- compacted surfaces will be ripped or otherwise de-compacted;
- topsoil will be placed as per the topsoil management plan and topsoil register;
- soil will be seeded or planted
- vegetation will be watered;
- corrective actions for pH, nutrients, organic matter and salinity to ensure that vegetation is self-sustaining; and
- weeds will be managed until 70% revegetation cover is achieved.

Contaminated soil assessments will be conducted as required (Section 4.2). Contaminated soils or other potential sources of contamination will be preferentially treated on site. If contamination cannot be treated then it may be disposed of at an authorised facility. Incident registers will be used to identify locations where spills have occurred. Treatment versus off-site disposal will depend on whether domains are listed on the CLR/EMR and whether it is deemed appropriate to have them removed as part of the rehabilitation process.

4.1.6 Stream diversions

Permanent changes to the landform will result from mining activities. Permanent changes only occur in minor ephemeral watercourses. It is not intended to restore original flow paths.

For the ephemeral watercourses that are diverted, the condition of the stream will be assessed against stream diversion and/or stream assessment guidelines in place at the time of rehabilitation. Action will be taken to rehabilitate the diversions to satisfy these guidelines.

4.1.7 Tailings drying cells

The Project will operate a number of tailings drying cells. The cells will receive up to 65% of the washed fines which will be deposited into the cells as thinly as practical. Once deposited process water will be recycled via a decant. The deposited tailings will be allowed to dry for a period (2 years) by evaporation. Once the tailings have desiccated sufficiently to allow removal by excavator and truck they will be hauled and deposited into managed cells in the out-of-pit spoil dumps.

The managed cells on the out-of-pit spoil dumps will be encapsulated. A contaminated soil assessment will be conducted as required (Section 4.2). The purpose of the contaminated soil assessment is prove that the encapsulation is effective and that the site is being managed appropriately and can be removed from the CLR/EMR.

The tailings drying cells will have their sides pushed in to produce a low flat-top structure sitting above the landscape. Outer slope angles will be less than six degrees and the flat top surface will be covered with a store and release cover.

The site of the tailings drying cells will be topsoiled, ripped and seeded. If the natural contour is sloped then consideration will be given to constructing contour banks and other erosion and sediment control structures.

4.1.8 Carmichael River corridor

Habitat maintenance and restoration for the Carmichael River corridor will be undertaken from the commencement of mining and will include:

- amelioration or augmentation of topsoil as required to facilitate revegetation with native species;
- seeding and planting of native species using local seed;
- maintenance of revegetated areas until vegetation cover criteria are achieved;
- weed control as required before and during revegetation; and
- placement of artificial micro-habitat as required to support species known or likely to use the area.

Where not required for flood protection of voids, rehabilitation of the levees (Carmichael River South Levee, Carmichael River North Levee and Eight Mile Creek Levee) will involve:

- removal of levee walls;
- removal of levee fill material;
- re-graded and re-profile to ensure that surface drainage is restored and ponding and scouring potential is reduced to as low as reasonably possible;
- ripping compacted surfaces or otherwise de-compacting;
- placing topsoil as per the topsoil management plan and topsoil register;
- seeding soil;
- watering vegetation;
- corrective actions for pH, nutrients, organic matter and salinity to ensure that vegetation is self-sustaining; and
- managing weeds until 70% revegetation cover is achieved.

Where levees will be retained for flood protection of voids:

- inspections and checks in accordance with dam safety guidelines in place at the time of decommissioning;
- levee maintenance (if required during the operational life of the mine);
- revegetation of exposed surfaces; and
- provision of information on levee dam design and safety to the landholder.

4.2 Management of contaminated land

Areas of the mine and associated facilities are likely to be deemed contaminated under the *Environmental Protection* (EP) *Act 1994*. The Contaminated Land Register (CLR) and Environmental Management Register (EMR) are administered by the Department of Environment, Heritage and Planning (EHP) under Chapter 7, Part 8 of the EP Act.

The process for assessing and removing land from the CLR will need to be confirmed with EHP at the time of rehabilitation.

Under the current EHP system the following general phases will need to be completed by a suitable qualified person:

1. Have a suitable qualified person complete a stage 1 or stage 2 contaminated land assessments.
2. If there is no contamination then the suitable qualified person will produce a report for submission to EHP requesting that the site be removed from the CLR.

3. If the contaminated site still contains contaminated soil, but it is being appropriately managed then the suitable qualified person can reflect this in their report. This may still allow the land to be removed from the CLR.

The process for assessing and removing land from the EMR will need to be confirmed with EHP at the time of rehabilitation. The system is currently under review by EHP. It is however likely that in addition to a report from a suitable qualified person an additional review and report will be required from a third-party-reviewer to verify the suitable qualified person report.

4.3 Post-mine land use strategy

Mining is a temporary use of land. This section of the closure and rehabilitation strategy outlines Adani commitments to a sustainable post-mining land use of the proposed areas of disturbance from the Project. Where possible the proposed post-mining land use strategy seeks to return the final landform as closely as possible to its original condition; ie having a similar suitability and range of land use options as existed prior to mining. The basic strategy for how this will be achieved is described in the previous section (Section 4.1).

There will be areas of the project, such as the final void, in which rehabilitation to a similar condition as pre-mining is impractical, and other areas where land has existed in a degraded condition or was subject to poor land management. In such cases, other beneficial post-mining land use options have been identified.

All areas significantly disturbed by mining activities will be rehabilitated in accordance with Table 4.1.

Figure 4.1 illustrates the post-mining good quality agricultural land (GQAL) assessment, presented in Table 4.1.

Table 4.2 presents an early conceptual post-mine land use strategy.

Figure 4.2 is a conceptual rehabilitation and final land use strategy cross section for each of the final voids and out-of-pit spoil dumps.

Detailed design for each domain is described in Chapter 6 and includes where available:

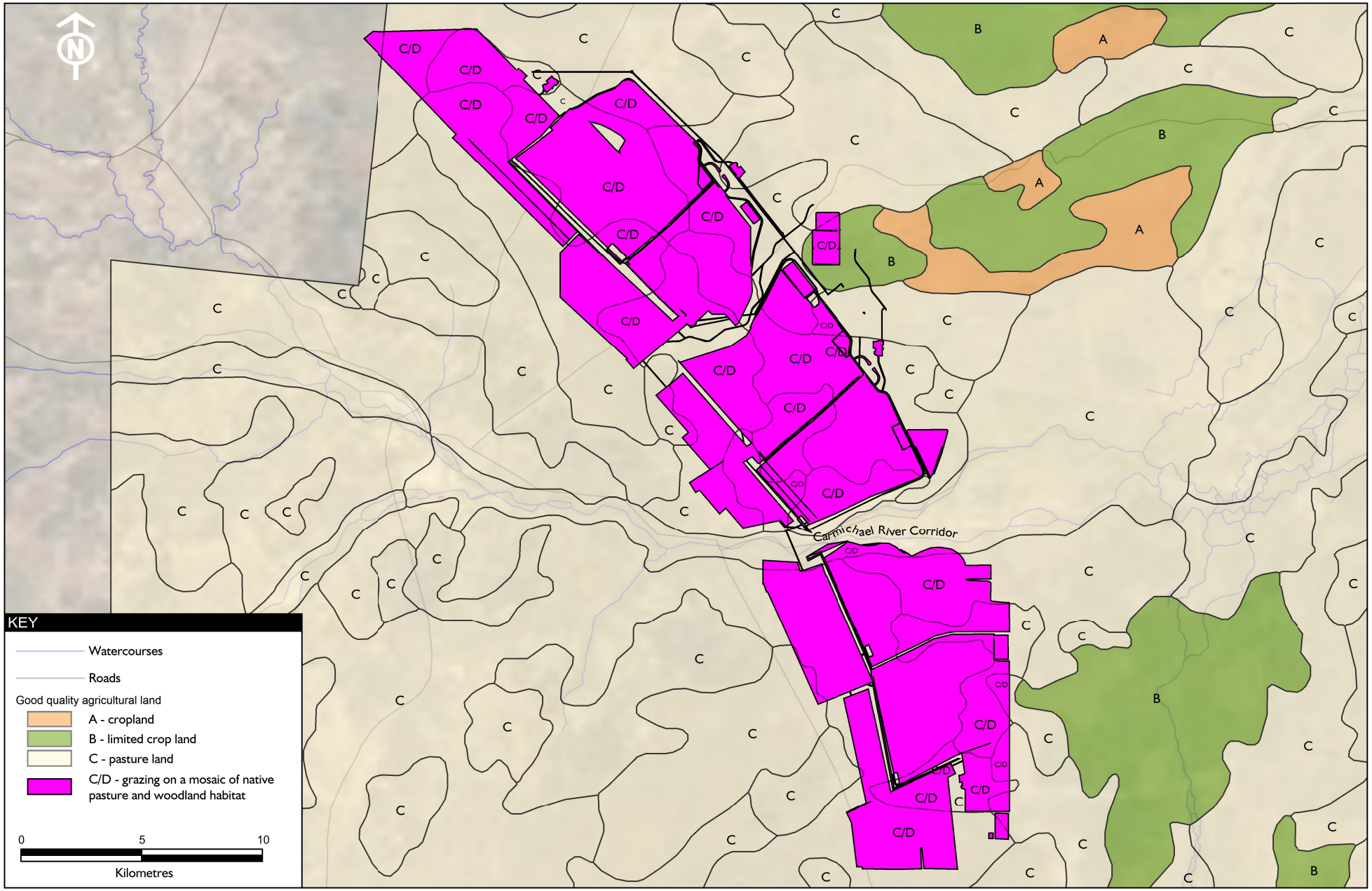
- schematic representation of final land form inclusive of slope and cover design;
- drainage design; and
- erosion controls proposed on reformed land.

Table 4.1 Summary of final land use and rehabilitation

	Domain							
	Pits and mine waste		Underground mining area (subsidence areas)	Mine infrastructure area	Water storage areas	Stream diversions	Tailings drying cells	Carmichael River corridor
	slopes and voids	Out-of-pit overburden dumps						
Approximate surface area (ha)	8685.88	6869.20	6826.58	1539.43	823.87	not available	270.00	1,823.10
Pre-mining land use	Combination of grazing on a mosaic of native pasture and woodland habitat							
Post-mining land use	Water body / dry void with stable slopes (suitability for grazing to be determined.	suitability for grazing to be determined.	Grazing on a mosaic of native pasture and woodland habitat.		Farm water supply OR Combination of grazing on a mosaic of native pasture and woodland habitat.	Stable watercourses.	Combination of grazing on a mosaic of native pasture and woodland habitat.	Wildlife corridor and wildlife habitat (grazing as consistent with management of wildlife habitat.
Project cover range	N/A				>70% cover of grasses.			
Target slope range	High-wall slopes are stable and angled at a maximum slope angles of of 22° (to be determined from geotechnical investigations) Low-wall slopes are stable with slope angles not exceeding 12° to 14°.	Outer face slope angle does not exceed 7 °. Inner face slope angle is 12°- 14° and forms a smooth profile with adjacent open cut areas.	Slope angles not to exceed 5°-6°.	Slope angles not to exceed 5°-6°.	Walls left in place will be graded where necessary such that slope angles do not exceed 10°.	Down-stream slope angles not to exceed 6°.	External slope angles less than 10°. Surface slope angles less than 3°.	N/A

Table 4.2 Conceptual post-mine land use summary

Domain	Pre-mining GQAL (ha)	Post-mining GQAL (ha)	Description/reason for loss/gain of GQAL
open-cut voids and slopes	C – 8,685.88	C/D – 8,685.88	No net gain of class A or class B GQAL. Aim is to return land to low ranking class C or class D land.
underground mining area	B – 3.37 C – 6823.21	C/D – 6826.58	No net gain of class A or class B GQAL. Aim is to return land to low ranking class C or class D land.
mine infrastructure area	C - 1539.43	C/D – 1539.43	No net gain of class A or class B GQAL. Aim is to return land to low ranking class C or class D land.
out-of-pit overburden dumps	C – 6,869.20	C/D – 6,869.20	No net gain of class A or class B GQAL. Aim is to return land to low ranking class C or class D land.
water storage areas, including MAW dams, raw water dams and sediment ponds	C – 823.87	C/D – 823.87	No net gain of class B GQAL. Aim is to return land to low ranking class C or class D land.
stream diversions	To be advised	To be advised	to be advised.
tailings storage facility	B – 203.40 C – 66.60	C/D – 270.00	to be advised.
Carmichael River corridor	C – 1,823.10	C/D – 1,823.10	No net gain of class C GQAL. Aim is to return land to low ranking class C or class D land.



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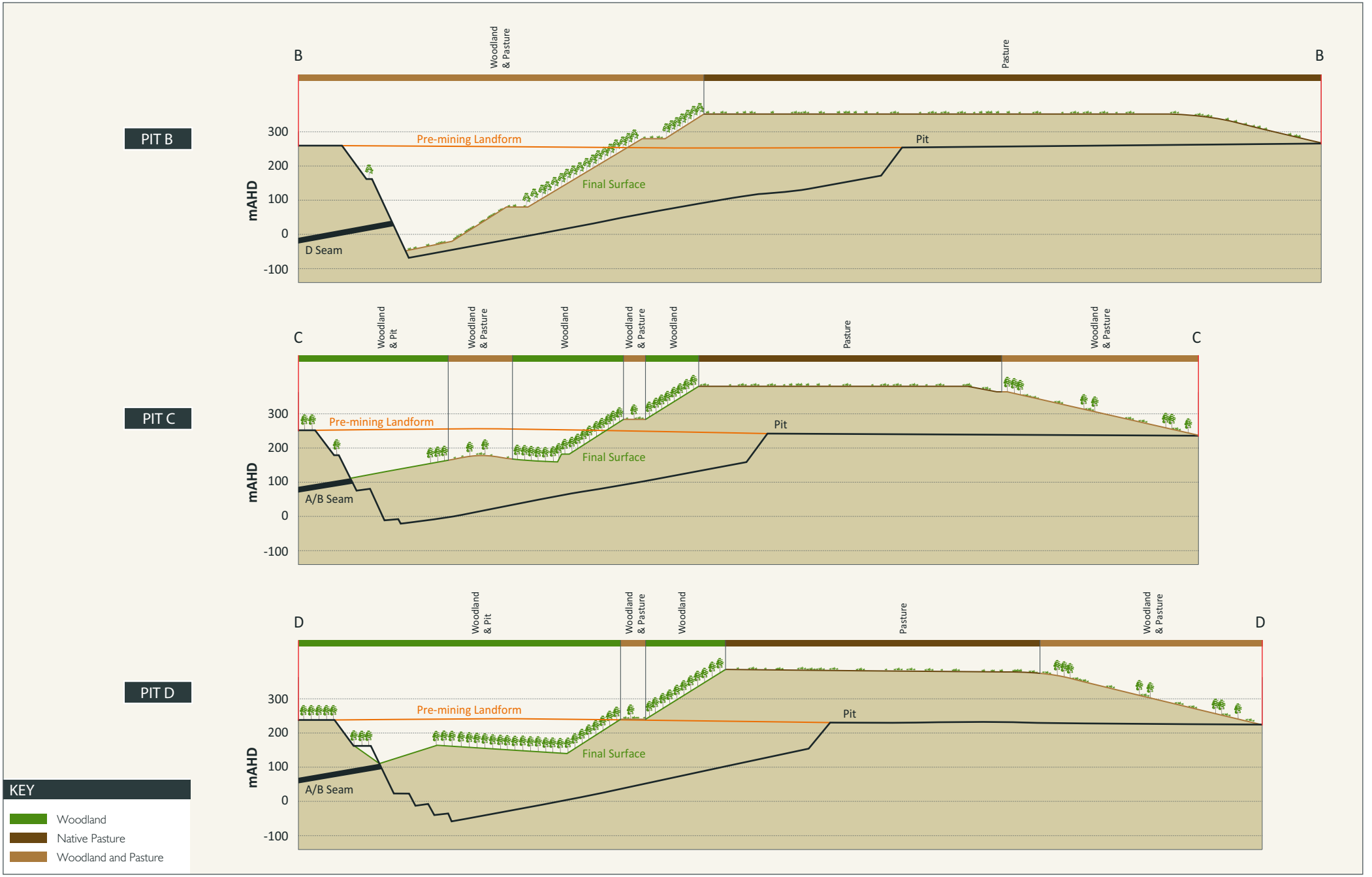
Post-mining good quality agricultural land (GQAL)

Rehabilitation management plan (mine)

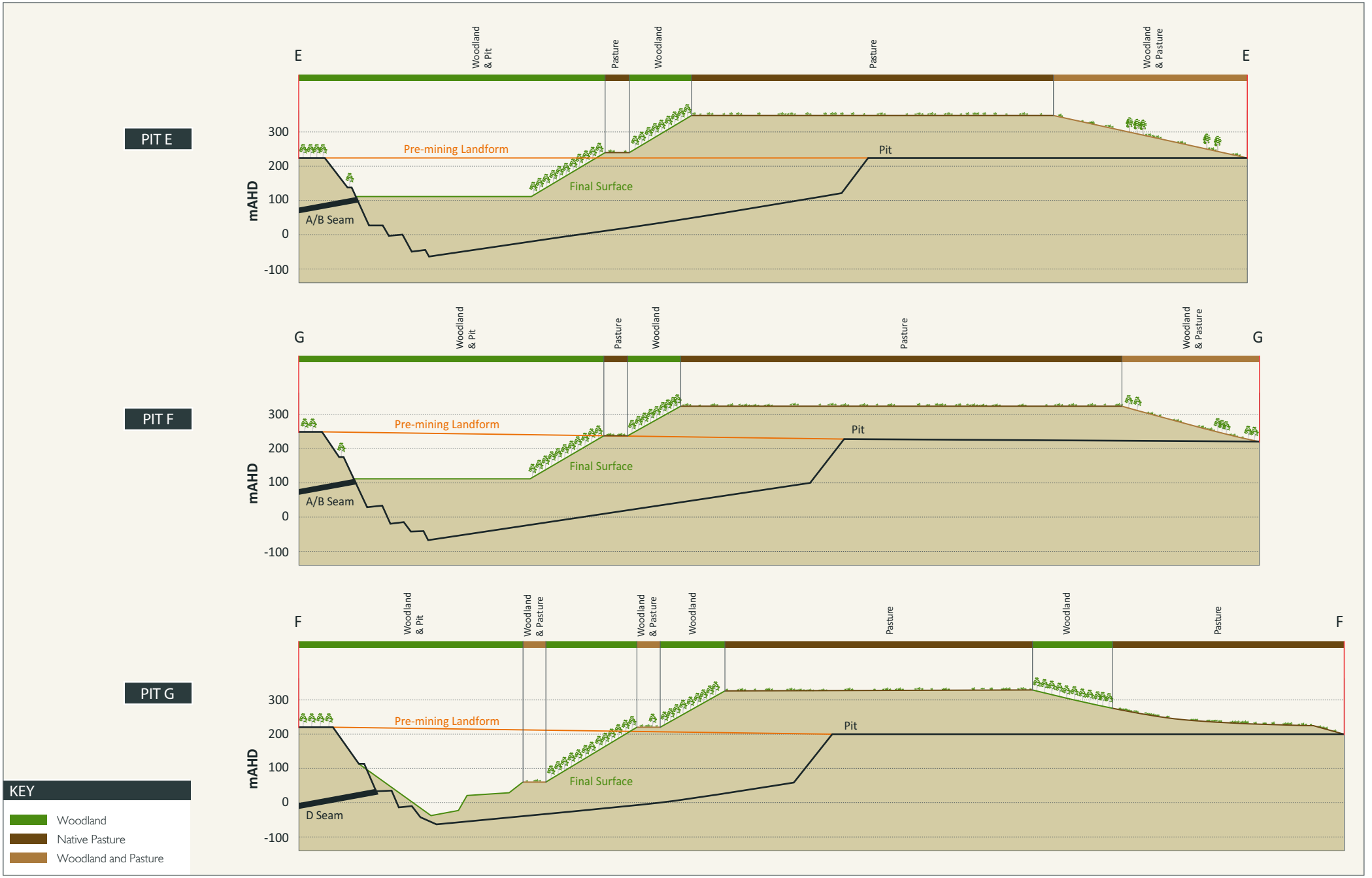
Figure 4.1



Conceptual final landuse plan

Adani Mining Pty Ltd

Figure 4.2 (sheet 1)



EMM

Conceptual final landuse plan

Adani Mining Pty Ltd

Figure 4.2 (sheet 2)

5 General rehabilitation activities

The operational life of the Carmichael Coal Rail Project site is over 60 years, therefore a general overview of rehabilitation is provided based on current legislative and other potential requirements, noting that such requirements may be different at the time of rehabilitation. Relevant legislative and other obligation and their potential impact on rehabilitation is summarised in Appendix A.

The general rehabilitation methods and principles detailed in this chapter are common across all domains. Specific rehabilitation methods for landforms for each domain are presented in Chapter 6 .

5.1 Decommissioning

The overall philosophy is to reinstate the site to natural vegetation or an agreed alternate land use. The following decommissioning strategy will be used:

- Adani will appoint a deconstructing contractor at closure.
- It is assumed that there will be a phased shutdown of large sections of the site. The size and complexity of the operations make it unlikely that the whole site will close simultaneously.
- Prior to commencing full scale removal of plant and equipment and structural demolition; the following will be carried out by Adani personnel who are familiar with the process and equipment:
    - all operations completed and equipment isolated and left in a safe condition;
    - main plant area electrically isolated, and checked;
    - all chemical and materials storages emptied and purged;
    - all services isolated, purged and tested; and
    - handover to deconstructing contractor.
- Issues that impact on the deconstructing method will be further considered in a decommissioning management plan and may include:
    - how to deal with live services that cross the demolition site that are being maintained for operations;
    - lay down and storage areas for scrap; and
    - the requirements of legislation of the day.

5.1.1 Scrap and salvage items

It is likely that across the site there will be a significant number of items that may have some residual salvage value that could be realised at a sale or auction. Other items that may have significant scrap or salvage value include:

- aluminium cladding;

- copper from electrical services and some service pipework;
- overhead cranes;
- steel from the coal handling plant and conveyors;
- mobile equipment; and
- pump parts.

5.2 Environmental management

5.2.1 Topsoil stockpiling and application

Appropriate topsoil management during construction and rehabilitation is critical to the successful rehabilitation of disturbed areas. Topsoil management during the construction and operation of the mine will include activities such as vegetation clearing, topsoil stripping, subsoil removal, stockpiling, re-profiling, ripping and de-compacting and soil conditioning/amelioration.

A topsoil management plan (TMP) will be developed to maximise the recovery and reuse of topsoil. The TMP will include:

- all relevant aspects for topsoil retrieval such as stripping, stockpiling, erosion prevention and re-spreading procedures, stockpile locations and inventory;
- topsoil stripping quantities formulated from pre-mining soil survey information;
- stripping and stockpile management; and
- a procedure for identifying and selectively managing poor quality soil and subsoil, to improve its quality by conditioning eg the addition of organic matter or amelioration and/or the addition of gypsum.

5.2.2 Erosion and sediment control

During construction activities, erosion and sediment control plans (ESCPs) will be developed for each work area. General principles for erosion and sediment control will be drawn from the International Erosion Control Association (Australasia) (IECA) *Best Practice Erosion and Sediment Control*.

During operations, control of erosion caused by runoff from spoil dumps will be through the construction of sediment ponds and through progressive rehabilitation. If ground disturbing activities are required, the controls presented in the relevant ESCPs will be followed.

5.2.3 Surface water management

Information on surface water conditions and proposed surface water management at the site is provided in detail in Volume 4 Appendices B and K5 of the Supplementary EIS. Surface water run-off at the site will be captured in sediment dams and environmental dams. Surface water conditions and surface water management measures undertaken onsite will be important for closure planning and rehabilitation design as they help identify conditions to be maintained post-closure, and identify potential surface water management issues that may need to be considered in rehabilitation design. It is therefore recommended

that additional information regarding surface water management is included in future iterations of this strategy.

The potential for flooding is considered to be high and closure planning will have to consider whether the flood levee will remain in perpetuity or whether it can be removed.

5.2.4 Groundwater management (the potential for contamination)

A groundwater monitoring program for the operational phase of the Project will be developed and will be described in detail in the groundwater monitoring and management plan (GWMP). The GWMP will be updated on a regular basis throughout the operational phase of the Project. The GWMP will present rehabilitation objectives for Groundwater and describe an ongoing monitoring program to ensure compliance. Refer to Volume 4 Appendix K1 of the Supplementary EIS for further details.

5.2.5 Revegetation

Revegetation will be completed preferentially using seeds collected from local plant stocks and will likely include a mixture of pasture seed with a selection of native trees and shrubs. The specific species mix for each rehabilitation area will be based on:

- the end land use including, for designated native vegetation areas and habitat requirements;
- slope and drainage characteristics; and
- the available topsoil for placement in rehabilitation areas.

Revegetation will take place soon after the placement of topsoil. Revegetation may be by seeding or planting of tube stock.

Revegetated areas will be watered regularly until established. Weed inspections and control will be undertaken regularly until vegetation cover criteria are met (70% coverage).

5.2.6 Weed control

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

- all vehicles and equipment must be cleaned at an approved weed wash down station and certified before being allowed on site;
- all offsite soil and materials of plant origin will be certified as weed free by the supplier using the Queensland Government weed hygiene declaration form or similar;
- regular inspections of disturbed areas for weed proliferation (including within subsided areas where ponding occurs and at key water resource locations) will be completed;
- a weed and pest control program will be developed and implemented if required.

6 Final landform strategy

6.1 Open-cut voids and slopes

Open-cut voids and slopes will undergo major earthworks and will not be returned to their original landforms. Rehabilitation will be consistent with the rehabilitation objectives in Section 3.2 and the final land use objectives for open-cut slopes and voids in Section 6.1.1.

A conceptual PMLUP, which includes this domain, is described in Section 4.3.

6.1.1 Final land use objectives

Open-cut voids and slopes will not cause any serious environmental harm to land, surface waters or any recognised groundwater aquifer, other than the environmental harm constituted by the existence of the residual void itself. The post-mining land use proposed for open-cut voids and slopes are dry voids or water bodies with stable slopes. The suitability for revegetation and grazing will be determined prior to closure.

6.1.2 Landform design

The open-cut voids and slopes will be designed and managed to avoid environmental harm to land, surface waters and groundwaters. Detailed landform designs will be developed prior to mine closure.

i Drainage

Surface water drainage will be restricted from entering the open-cut voids and slopes. The residual voids will be protected from probable maximum floods from nearby watercourses. Engineered protection will be sustainable for the foreseeable future. Closure planning will consider whether the flood levee will remain in perpetuity or whether it will be removed.

ii Slope

Slopes will be designed to be stable and angled at a maximum slope angle of 22°(high walls) and 14° (low walls) based on geotechnical study recommendations. Prior to closure, investigations will be undertaken to specify the design criteria and appropriate action will be taken to ensure long-term stability, safety and management of the domain.

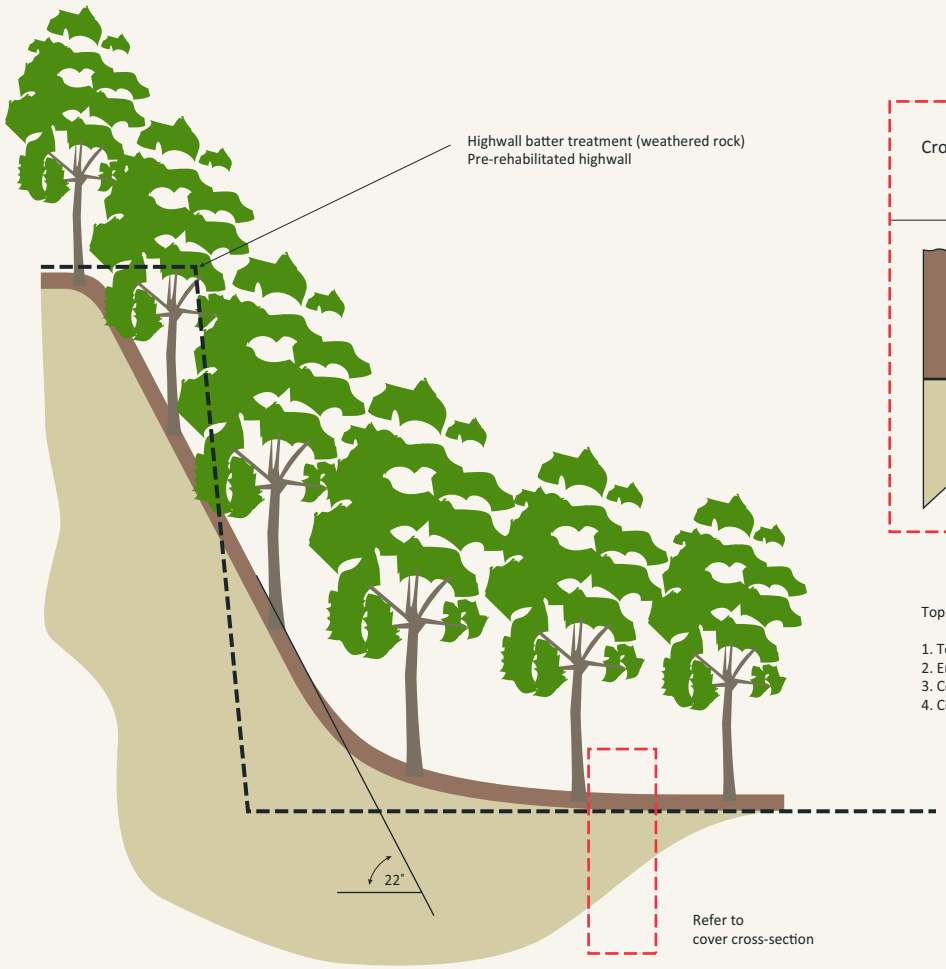
Exposed A and B coal seams in the high walls will be backfilled with spoil to 110 mAHD to reduce the potential for spontaneous combustion.

iii Cover

Where the slope angle will allow machinery access, topsoil will be spread 0.2 m thick along the entire slope length.

Where slope access will not allow machinery access topsoil will be end-dumped from the crest and allowed to wash into and down the slope with each successive rainfall. This will result in partial revegetation of the final slope.

Conceptual landform design features for open-cut voids is shown in Figure 6.1.



Cross section of cover

Profile	Dimensions	Material source	Placement and treatment	Construction tolerance	Notes
topsoil	0.2 m	Topsoil stockpile	End dumped, pushed by dozer, deep ripped to remove compaction.	+ 20 mm / - 0 mm	Topsoil thickness will be subject to topsoil availability in stockpiles.
spoil		Spoil	Blasted/reprofiled by dozer.	–	

Topsoil Placement requirements:

1. Topsoil will be placed in a dry state.
2. End-dumped and spread in a uniform thickness by dozer.
3. Compaction removed by ripping.
4. Conditoning / ameloriation as required.

Conceptual landform design features for open-cut voids (not to scale)

EMM

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Figure 6.1

6.1.3 Completion criteria and monitoring

The proposed monitoring schedule for open-cut voids and slopes is described in Table 6.1.

Table 6.1 Proposed monitoring of open-cut voids and slopes

Monitoring[1]	Frequency[2]	Period of monitoring after rehabilitation is completed
Erosion	half-yearly	5 years
Surface water	quarterly and event based	5 years
Groundwater	quarterly and event based	5 years
Geotechnical (stability)	half-yearly	5 years
Rehabilitation (Ecology)	annually	5 years
Dust-monitoring	during closure earthworks	-

Notes: [1] *monitoring is described in detail in Chapter 7.*

[2] *the frequency of monitoring will be subject to the environmental authority (EA) conditions for the Carmichael Coal Mine and Rail project. This closure and rehabilitation strategy will be updated to reflect the EA conditions if they are different to what is indicated in this closure and rehabilitation strategy.*

i Interpretation of completion criteria and monitoring table (Table 6.2)

All reporting is to be completed as an annual rehabilitation monitoring report unless otherwise specified in Table 6.2. Further detail on reporting will be documented in the rehabilitation monitoring management plan.

Quantified indicators will be developed at the first annual review of the closure and rehabilitation strategy incorporating criteria from the environmental authority.

Monitoring and reporting will be completed for five years post-rehabilitation as per Table 6.1.

Table 6.2 makes reference to Landform Function Analysis. The procedure for this analysis will be documented in the rehabilitation monitoring management plan.

It should be noted that Table 6.2 makes reference to comparison to an analogue site. An analogue site is defined as a site of similar environment features eg slope, soil, vegetation that can be compared to a representative rehabilitated area to compare whether the rehabilitated area is performing similarly to the undisturbed analogue site.

Completion criteria for open-cut voids and slopes are presented as Table 6.2. The completion criteria have been presented aligning to the phase of closure relevant to the domain. That is:

- decommissioning – cleaning the site up;
- landform establishment - earthworks;
- vegetation establishment – seeding and planting; and
- sustainable final landform – a functioning landscape with minimal intervention.

Table 6.2 Summary of completion criteria for the open-cut voids and slopes

Phase	Objective	Completion criteria	Indicator that completion criteria is being met
Decommissioning.	All surface infrastructure removed.	Buildings and foundations removed.	Buildings removed.
	Clean-up of potential/actual contamination.	Hydrocarbons less than assessment criteria. Heavy metals less than assessment criteria.	Hazardous material audit and contamination at acceptable level. Site is assessed by a suitable qualified person and removed from CLR, EMR or both.
		spontaneous combustion potential is minimised.	As-built reports to show that adequate cover and selective placement.
	Dust generation below acceptable limits.	Dust below than assessment criteria.	Evidence in reporting that dust monitoring results at sensitive receptors have complied.
Landform establishment.	Slopes are stable. Long-term safety.	High wall slopes are stable and angled at a maximum slope angle of 22°.	As built design reports. No evidence of slumping of slopes. Certification of slopes and void by an appropriately qualified person. Geotechnical stability of high-walls, end-walls and low-walls has been achieved and geotechnical investigations demonstrate that this has been achieved and reported.
		Low-wall slopes are stable with slopes angles not exceeding 12° - 14°.	As built design reports. No evidence of slumping of slopes.
	Site is safe for humans and animals now and in the foreseeable future.	Risks assessment has been completed and risk mitigation measures have been implemented.	As above. Sufficient egress to allow escape from void.
	The diversions and run-off drainage lines mirror natural stream functions.	Stable at closure and likely to remain that way into the foreseeable future.	Designed and constructed in accordance with the Queensland Government Natural Resources and Mines, *Central West Water Management and Use Regional Guideline: Watercourse Diversions – Central Queensland Mining Industry*, (2008).
	Appropriate management of surface water.	All permanent diversion channels/drains meet approved design criteria. All regulated structures meet design criteria. All non-permanent structures are decommissioned in accordance with regulating authority requirements.	Certification by an appropriately qualified person.

Table 6.2 Summary of completion criteria for the open-cut voids and slopes

Phase	Objective	Completion criteria	Indicator that completion criteria is being met
	Topsoil replacement consistent with pre-mining conditions.	Soil based criteria typical with analogue sites or fall within desirable ranges provided by the agricultural industry (to be determined based on sampling results). Depth - = 0.2 m.	Monitoring and comparison to analogue site.
	Dust levels below thresholds.	Dust based criteria typical with analogue sites.	Monitoring and comparison to analogue site.
	No exposure to heavy metals, acid mine drainage and other toxic substances.	Surface and groundwater quality is as predicted and stable.	Downstream surface and groundwater monitoring. Certification by an appropriately qualified person that the specified cover is in place (as-built report) and predictive modelling to determine future cover performance.
Vegetation establishment.	Establishment of the functionally important and structurally dominant species from the relevant native vegetation communities.	The diversity of shrubs and juvenile trees with a stem less than 5 cm is comparable to that of the analogue sites.	On-going monitoring and comparison to analogue site.
		Number of weeds species and surface area cover ≤ analogue site.	Monitoring and comparison to analogue site.
		Equal or greater proportion of overstorey species occurring as regeneration.	Monitoring and comparison to analogue site.
	Vegetation cover to minimise erosion.	Evidence that the vegetation type and density are of species suited to the spoil composition, slope, aspect, climate and other factors.	Vegetation type and density.
		Vegetation types and density are comparable with the relevant reference site.	Vegetation type and density.
		Minimum of 70% vegetation cover is present.	Foliage cover.
		Foliage cover is comparable with the relevant reference site.	Foliage cover.

Table 6.2 Summary of completion criteria for the open-cut voids and slopes

Phase	Objective	Completion criteria	Indicator that completion criteria is being met
		Nutrient cycling is occurring and the presence of leaf litter is assisting in limiting erosion of the soil /spoil surface.	Leaf litter, humus, depth of growing medium.
		Leaf litter, humus, depth of growing medium comparable with the relevant reference site.	Leaf litter, humus, depth of growing medium.
	Demonstrating rehabilitation succession.	The number of tree species, shrub species, herbes and forbes and grasses species regardless of age comprising the vegetation community is comparable to that of the analogue sites.	Monitoring and comparison to analogue site.
Sustainable landscape.	Landform generally blends in with surrounding landscape and is stable ie no sodic saline soil or spoil at the surface of the landform and minimal erosion.	Soils surface cover ≥70%.	Monitoring and reporting.
		Exchangeable Sodium Percentage (ESP) ≤6% for surface soil and spoil.	Monitoring and reporting.
		Absence of gullies >300mm wide or deep and gullies stable.	Erosion monitoring and reporting.
		Land function stability analysis based on key characteristics including: Soil cover; Litter cover; Cryptogam cover; Crust broken-ness; Erosion type and severity; Deposited materials; Surface resistance to disturbance; Slake test; Compaction; and Surface roughness.	Landform function analysis and reporting.

Table 6.2 Summary of completion criteria for the open-cut voids and slopes

Phase	Objective	Completion criteria	Indicator that completion criteria is being met
		Nutrient recycling based on key characteristics including: Soil fertility; Soil organic matter; Litter cover; and Perennial grass basal and tree and shrub foliage cover.	Landform function analysis and reporting.
	Agricultural cattle grazing	Determination of safe carrying capacity for future land use and future management strategies/agreements in place.	Cattle stocking trials indicate areas nominated for cattle grazing as a post-mining land use are sustaining an equal to or better stocking rate that that calculated for relevant reference site.
		Land maintenance requirements are comparable to reference sites.	Landform stability when grazed. Safety of landform for stock and for undertaking management activities associated with stock.
	Weed infestation less then pre-mining conditions	Equal or lesser proportion of weed species occurring in regeneration by comparison to analogue site.	Rehabilitation monitoring and reporting.

6.2 Underground mining area

The underground mining area will not be subject to any major earthworks, but will be prone to surface subsidence as a result of underground mining. A detailed subsidence management plan (SMP) will be developed setting out monitoring and management actions. Refer to Volume 4 Appendix J of the Supplementary EIS for further detail on predicted subsidence.

Access to underground workings will be sealed so that they cannot be accessed.

A conceptual PMLUP, which includes this domain, is described in Section 4.3.

6.2.1 Final land use objectives

Most subsidence will not alter land suitability and the area will continue to be used for grazing activities (outside of voids and out-of-pit dump areas). Works will be implemented to ensure suitable ponding and/or free draining landscapes are maintained. The final post-mining land use objectives for the underground mining area are for grazing or a mosaic of native pasture and woodland.

6.2.2 Landform design

Landform design will achieve a safe and stable landform with stable slopes exhibiting no signs of slumping and no cracking that will pose a risk to cattle and to humans. Subsided areas will be free of active rill, gully or sheet erosion.

Openings to underground workings will be sealed to prevent access.

i Drainage

Subsidence may cause subsurface effects by affecting the level of the watertable, water flows and perched aquifers. This may in-turn impact stream flows and sediment loading. This will be further assessed as part of the subsidence management plan. Where possible:

- interrupted stream flows will be corrected; and
- ponds created by subsidence will be re-profiled to remove or reduce ponding so that impacts on environmental values and/or agricultural potential is minimised.

ii Slope

Tension cracks in the surface and abrupt changes in level need to be addressed where natural re-vegetation is unlikely. Where re-profiling is required the re-profiled slope angle will not exceed 6°. The protection of people and stock may be required using fencing, stock management and signs.

iii Cover

Where tension cracks and abrupt level changes have been re-profiled they will have:

- 0.2 m of topsoil respread on the surface;
- ripping to remove compaction; and
- grass and tree species consistent with the final land use.

6.2.3 Completion criteria and monitoring

The proposed monitoring schedule for open-cut voids and slopes is described in Table 6.3.

Table 6.3 Proposed monitoring of underground and subsidence areas

Monitoring[1]	Frequency[2]	Period of monitoring after rehabilitation is completed
Erosion	half-yearly	5 years
Surface water	quarterly and event based	5 years
Groundwater	quarterly and event based	5 years
Geotechnical (stability)	half-yearly	5 years
Dust-monitoring	during closure earthworks	-

Notes: [1] *monitoring is described in detail in Chapter 7.*

[2] *the frequency of monitoring will be subject to the environmental authority (EA) conditions for the Carmichael Coal Mine and Rail project. This closure and rehabilitation strategy will be updated to reflect the EA conditions if they are different to what is indicated in this closure and rehabilitation strategy.*

i Interpretation of completion criteria and monitoring table (Table 6.4)

All reporting is to be completed as an annual rehabilitation monitoring report unless otherwise specified in Table 6.4. Further detail on reporting will be documented in the rehabilitation monitoring management plan.

Quantified indicators will be developed at the first annual review of the closure and rehabilitation strategy incorporating criteria from the environmental authority.

Monitoring and reporting will be completed for five years post-rehabilitation as per Table 6.3.

Table 6.4 makes reference to Landform Function Analysis. The procedure for how to complete this analysis will be documented in the rehabilitation monitoring management plan.

It should be noted that Table 6.4 makes reference to comparison to an analogue site. An analogue site is defined as a site of similar environment features eg slope, soil, vegetation that can be compared to a representative rehabilitated area to compare whether the rehabilitated area is performing similarly to the undisturbed analogue site.

Completion criteria for underground and subsidence areas are presented as Table 6.4. The completion criteria have been presented aligning to the phase of closure relevant to the domain. That is:

- decommissioning – cleaning the site up;
- landform establishment – earthworks for landform and surface water management;
- vegetation establishment – seeding and planting; and
- sustainable final landform – a functioning landscape with minimal intervention and agro-economic value.

Table 6.4 Summary of completion criteria for underground and subsidence areas

Phase	Objective	Completion criteria	Indicator that completion criteria is being met
Decommissioning.	All underground infrastructure (on ground surface) removed.	Buildings and foundations removed.	Buildings removed.
	Clean-up of potential/actual contamination.	Hydrocarbons less than assessment criteria. Heavy metals less than assessment criteria.	Hazardous material audit and contamination at acceptable level. Site is assessed by a suitable qualified person and removed from CLR, EMR or both.
	Dust generation below acceptable limits	Dust below than assessment criteria.	Evidence in reporting that dust monitoring results at sensitive receptors has complied.
Landform establishment *(tension cracks and areas of abrupt level change).*	Slopes are stable.	Re-profiled areas are stable with slopes not exceeding 6°.	As built design reports. No evidence of slumping of slopes.
	Topsoil replacement consistent with pre-mining conditions.	Soil based criteria typical with analogue sites or fall within desirable ranges provided by the agricultural industry (to be determined based on sampling results). Depth - ≥ 0.2 m.	Monitoring and comparison to analogue site.
Landform establishment *(surface water).*	Dust levels below thresholds. Interrupted stream flows will be corrected.	Dust based criteria typical with analogue sites. Stream flows in reinstated creeks / diversions is comparable to a suitable analogue site.	Monitoring and comparison to analogue site. Surface water monitoring and reporting.
	Appropriate management of surface water.	All permanent diversion channels/drains meet approved design criteria. All regulated structures meet design criteria. All non-permanent structures are decommissioned in accordance with regulating authority requirements.	Certification by an appropriately qualified person.
	Non-polluting	Not contributing excess sediment load to downstream watercourses when compared to a suitable analogue sites.	Surface water monitoring and reporting.
	Ponds, where possible, are re-profiled to remove/reduce ponding so that impact on agricultural potential is minimised.	Subsidence area agricultural potential post-mining is similar to the pre-mining potential.	Agro-economic assessment reporting.

Table 6.4 Summary of completion criteria for underground and subsidence areas

Phase	Objective	Completion criteria	Indicator that completion criteria is being met
	Plant available water capacity in areas that become sloped as a result of subsidence does not impact significantly on agricultural potential.	Subsidence area plant available water potential post-mining is similar to the pre-mining potential.	Agro-economic assessment reporting.
Vegetation establishment.	Establishment of the functionally important and structurally dominant species from the relevant native vegetation communities.	The diversity of shrubs and juvenile trees with a stem less than 5 cm is comparable to that of the analogue sites.	Monitoring and comparison to analogue site.
		Number of weeds species and surface area cover ≤ analogue site.	Monitoring and comparison to analogue site.
		Equal or greater proportion of overstorey species occurring as regeneration.	Monitoring and comparison to analogue site.
	Demonstrating rehabilitation succession.	The number of tree species, shrub species, herbes and forbes and grasses species regardless of age comprising the vegetation community is comparable to that of the analogue sites.	Monitoring and comparison to analogue site.
	Vegetation cover to minimise erosion.	Evidence that the vegetation type and density are of species suited to the spoil composition, slope, aspect, climate and other factors.	Vegetation type and density.
		Vegetation types and density are comparable with the relevant reference site.	Vegetation type and density.
		Minimum of 70% vegetation cover is present.	Foliage cover.
		Foliage cover is comparable with the relevant reference site.	Foliage cover.
		Nutrient cycling is occurring and the presence of leaf litter is assisting in limiting erosion of the soil /spoil surface.	Leaf litter, humus, depth of growing medium.
		Leaf litter, humus, depth of growing medium comparable with the relevant reference site.	Leaf litter, humus, depth of growing medium.

Table 6.4 Summary of completion criteria for underground and subsidence areas

Phase	Objective	Completion criteria	Indicator that completion criteria is being met
Sustainable landscape.	Landform generally blends in with surrounding landscape and is stable ie no sodic saline soil or spoil at the surface of the landform and minimal erosion.	Soils surface cover ≥70%.	Monitoring and reporting.
		Exchangeable Sodium Percentage (ESP) ≤6% for surface soil and spoil.	Monitoring and reporting
		Absence of gullies >300mm wide or deep and gullies stable.	Erosion monitoring and reporting.
		Land function stability analysis based on key characteristics including: Soil cover; Litter cover; Cryptogam cover; Crust broken-ness; Erosion type and severity; Deposited materials; Surface resistance to disturbance; Slake test; Compaction; and Surface roughness.	Landform function analysis and reporting.
		Nutrient recycling based on key characteristics including: Soil fertility; Soil organic matter; Litter cover; and Perennial grass basal and tree and shrub foliage cover.	Landform function analysis and reporting.

Table 6.4 Summary of completion criteria for underground and subsidence areas

Phase	Objective	Completion criteria	Indicator that completion criteria is being met
	Weed infestation less then pre-mining conditions.	Equal or lesser proportion of weed species occurring in regeneration by comparison to analogue site.	Rehabilitation monitoring and reporting.
	Grazing.	Determination of safe carrying capacity for future land use and future management strategies/agreements in place.	Cattle stocking trials indicate areas nominated for cattle grazing as a post-mining land use are sustaining an equal to or better stocking rate that that calculated for relevant reference site.
		Land maintenance requirements are comparable to reference sites.	Landform stability when grazed. Safety of landform for stock and for undertaking management activities associated with stock.

6.3 Mining infrastructure area

6.3.1 Final land use objectives

The final land use proposed for the mine infrastructure area is for grazing on a mosaic of native pasture and woodland habitat.

A conceptual PMLUP, which includes this domain, is described in Section 4.3.

6.3.2 Landform design

Landform design will achieve a safe and stable landform with drainage restored such that ponding and scouring is avoided. Detailed land form designs will be developed prior to mine closure and detailed plans prepared.

All infrastructure will be removed from the site.

i Drainage

Compaction of soils during construction and demolition of infrastructure may affect drainage patterns and water quality. Where possible interrupted stream flows will be restored such that ponding and scouring (concentration of flow) is avoided.

ii Slope

Landform design will ensure slopes do not exceed 6°.

iii Cover

The mining infrastructure area will have:

- 0.2 m of topsoil respread on the surface;
- ripping to remove compaction; and
- grass and tree species consistent with the final land use.

6.3.3 Completion criteria and monitoring

The proposed monitoring schedule for the mining infrastructure area is described in Table 6.5.

Table 6.5 Proposed monitoring of mining infrastructure area

Monitoring[1]	Frequency[2]	Period of monitoring after rehabilitation is completed
Erosion	half-yearly	5 years
Surface water	quarterly and event based	5 years
Groundwater	quarterly and event based	5 years
Geotechnical (stability)	half-yearly	5 years
Rehabilitation (Ecology)	annually	5 years
Dust-monitoring	during closure earthworks	-

Notes: [1] *monitoring is described in detail in Chapter 7.*

[2] *the frequency of monitoring will be subject to the environmental authority (EA) conditions for the Carmichael Coal Mine and Rail project. This closure and rehabilitation strategy will be updated to reflect the EA conditions if they are different to what is indicated in this closure and rehabilitation strategy.*

i Interpretation of completion criteria and monitoring table (Table 6.6)

All reporting is to be completed as an annual rehabilitation monitoring report unless otherwise specified in Table 6.6. Further detail on reporting will be documented in the rehabilitation monitoring management plan.

Quantified indicators will be developed at the first annual review of the closure and rehabilitation strategy incorporating criteria from the environmental authority.

Monitoring and reporting will be completed for five years post-rehabilitation as per Table 6.5.

Table 6.6 makes reference to Landform Function Analysis. The procedure for how to complete this analysis will be documented in the rehabilitation monitoring management plan.

It should be noted that Table 6.6 makes reference to comparison to an analogue site. An analogue site is defined as a site of similar environment features eg slope, soil, vegetation that can be compared to a representative rehabilitated area to compare whether the rehabilitated area is performing similarly to the undisturbed analogue site.

Completion criteria for the mining infrastructure area are presented in Table 6.6. The completion criteria have been presented aligning to the phase of closure relevant to the domain. That is:

- decommissioning – cleaning the site up;
- landform establishment – earthworks for landform and surface water management;
- vegetation establishment – seeding and planting; and
- sustainable final landform – a functioning landscape with minimal intervention and agro-economic value.

Table 6.6 Summary of completion criteria for mining infrastructure area

Phase	Objective	Completion criteria	Indicator that completion criteria is being met
Decommissioning	All infrastructure removed.	Buildings, buried services and foundations removed.	Buildings removed.
	Clean-up of potential/actual contamination.	Hydrocarbons less than assessment criteria. Heavy metals less than assessment criteria.	Hazardous material audit and contamination at acceptable level. Site is assessed by a suitable qualified person and removed from CLR, EMR or both.
	Dust generation below acceptable limits.	Dust below than assessment criteria.	Evidence in reporting that dust monitoring results at sensitive receptors has complied.
Landform establishment	Slopes are stable.	Re-profiled areas are stable with slopes not exceeding 6°.	As built design reports. No evidence of slumping of slopes.
	Topsoil replacement consistent with pre-mining conditions.	Soil based criteria typical with analogue sites or fall within desirable ranges provided by the agricultural industry (to be determined based on sampling results). Depth - ≥ 0.2 m.	Monitoring and comparison to analogue site.
	Dust levels below thresholds.	Dust based criteria typical with analogue sites.	Monitoring and comparison to analogue site.
	Appropriate management of surface water.	All permanent sediment traps and drains meet approved design criteria. All regulated structures meet design criteria. All non-permanent structures are decommissioned in accordance with regulating authority requirements.	Certification by an appropriately qualified person.
	Non-polluting.	Not contributing excess sediment load to downstream watercourses when compared to a suitable analogue sites.	Surface water monitoring and reporting.
	Plant available water capacity does not impact significantly on agricultural potential.	Subsidence area plant available water potential post-mining is similar to the pre-mining potential.	Agro-economic assessment reporting.

Table 6.6 Summary of completion criteria for mining infrastructure area

Phase	Objective	Completion criteria	Indicator that completion criteria is being met
Vegetation establishment	Establishment of the functionally important and structurally dominant species from the relevant native vegetation communities.	The diversity of shrubs and juvenile trees with a stem less than 5 cm is comparable to that of the analogue sites.	Monitoring and comparison to analogue site.
		Number of weeds species and surface area cover ≤ analogue site.	Monitoring and comparison to analogue site.
		Equal or greater proportion of overstorey species occurring as regeneration.	Monitoring and comparison to analogue site.
	Demonstrating rehabilitation succession.	The number of tree species, shrub species, herbes and forbes and grasses species regardless of age comprising the vegetation community is comparable to that of the analogue sites.	Monitoring and comparison to analogue site.
	Vegetation cover to minimise erosion.	Evidence that the vegetation type and density are of species suited to the spoil composition, slope, aspect, climate and other factors.	Vegetation type and density.
		Vegetation types and density are comparable with the relevant reference site.	Vegetation type and density.
		Minimum of 70% vegetation cover is present.	Foliage cover.
		Foliage cover is comparable with the relevant reference site.	Foliage cover.
		Nutrient cycling is occurring and the presence of leaf litter is assisting in limiting erosion of the soil /spoil surface.	Leaf litter, humus, depth of growing medium.
		Leaf litter, humus, depth of growing medium comparable with the relevant reference site.	Leaf litter, humus, depth of growing medium.
Sustainable landscape	Landform generally blends in with surrounding landscape and is stable ie no sodic saline soil or spoil at the surface of the landform and minimal erosion.	Soils surface cover ≥70%.	Monitoring and reporting.

Table 6.6 Summary of completion criteria for mining infrastructure area

Phase	Objective	Completion criteria	Indicator that completion criteria is being met
		Exchangeable Sodium Percentage (ESP) ≤6% for surface soil and spoil.	Monitoring and reporting
		Absence of gullies >300mm wide or deep and gullies stable.	Erosion monitoring and reporting.
		Land function stability analysis based on key characteristics including: Soil cover; Litter cover; Cryptogam cover; Crust broken-ness; Erosion type and severity; Deposited materials; Surface resistance to disturbance; Slake test; Compaction; and Surface roughness.	Landform function analysis and reporting.
		Nutrient recycling based on key characteristics including: Soil fertility; Soil organic matter; Litter cover; and Perennial grass basal and tree and shrub foliage cover.	Landform function analysis and reporting.
	Weed infestation less then pre-mining conditions.	Equal or lesser proportion of weed species occurring in regeneration by comparison to analogue site.	Rehabilitation monitoring and reporting.

Table 6.6 Summary of completion criteria for mining infrastructure area

Phase	Objective	Completion criteria	Indicator that completion criteria is being met
	Agricultural cattle Grazing.	Determination of safe carrying capacity for future land use and future management strategies/agreements in place.	Cattle stocking trials indicate areas nominated for cattle grazing as a post-mining land use are sustaining an equal to or better stocking rate that that calculated for relevant reference site.
		Land maintenance requirements are comparable to reference sites.	Landform stability when grazed. Safety of landform for stock and for undertaking management activities associated with stock.

6.4 Out-of-pit spoil dumps

6.4.1 Final land use objectives

The post-mining land use proposed for the out-of-pit spoil dumps is for grazing on a mosaic of native pasture and woodland habitat. The suitability of the area for grazing use will be determined at a later date.

A conceptual PMLUP, which includes this domain, is described in Section 4.3.

6.4.2 Landform design

Landforms will tie into natural landscapes where possible. Selective management and handling of spoil will ensure out-of-pit spoil dumps will not affect beneficial uses of surface water and groundwater.

i Drainage

Drainage structures will be constructed to capture runoff and seepage from the out-of-pit spoil dumps. Geomorphic fluvial design will be used in preference to inter-bench drains and drop structures. For example slope length will be reduced by incorporating different slope angles on a single slope profile to create zones of erosion deposition.

ii Slope

Out-of-pit spoil dumps will be designed to be safe and stable and will not exceed 7° slope angle on outer surface slopes and 12° - 14° slope angle on inner face slopes.

iii Cover

The out-of-pit spoil dump slopes will have:

- 0.2 m of topsoil respread on the surface; and
- grass and tree species supported by soil conditions and consistent with the final land use objectives.

Flat top areas of out-of-pit spoil dumps may require an engineered cover to reduce infiltration into potentially contaminating spoil.

Slopes will be topsoiled and seeded or treated with rock armouring to prevent erosion.

Conceptual landform design features for out-of-pit spoil dumps is shown in Figure 6.2.

Dry tailings from the tailings drying cell and coarse reject will also be hauled and placed into managed cells with the out-of-pit spoil dumps at pit D and pit E. The construction of these cells will be under flat-top surfaces (Figure 6.3) and will covered using the conceptual designs illustrated in Figure 6.3. Flat top areas of out-of-pit spoil dumps where dry tailings are disposed may require an engineered cover to reduce infiltration into potentially contaminating spoil.

6.4.3 Completion criteria and monitoring

The proposed monitoring schedule for out-of-pit spoil dumps is described in Table 6.7.

Table 6.7 Proposed monitoring of out-of-pit spoil dump areas

Monitoring[1]	Frequency[2]	Period of monitoring after rehabilitation is completed
Erosion	half-yearly	5 years
Surface water	quarterly and event based	5 years
Groundwater	quarterly and event based	5 years
Geotechnical (stability)	half-yearly	5 years
Rehabilitation (Ecology)	annually	5 years
Dust-monitoring	during closure earthworks	-

Notes: [1] *monitoring is described in detail in Chapter 7.*

[2] *the frequency of monitoring will be subject to the environmental authority (EA) conditions for the Carmichael Coal Mine and Rail project. This closure and rehabilitation strategy will be updated to reflect the EA conditions if they are different to what is indicated in this closure and rehabilitation strategy.*

i Interpretation of completion criteria and monitoring table (Table 6.8)

All reporting is to be completed as an annual rehabilitation monitoring report unless otherwise specified in Table 6.8. Further detail on reporting will be documented in the rehabilitation monitoring management plan.

Quantified indicators will be developed at the first annual review of the closure and rehabilitation strategy incorporating criteria from the environmental authority.

Monitoring and reporting will be completed for five years post-rehabilitation as per Table 6.7.

Table 6.8 makes reference to Landform Function Analysis. The procedure for how to complete this analysis will be documented in the rehabilitation monitoring management plan.

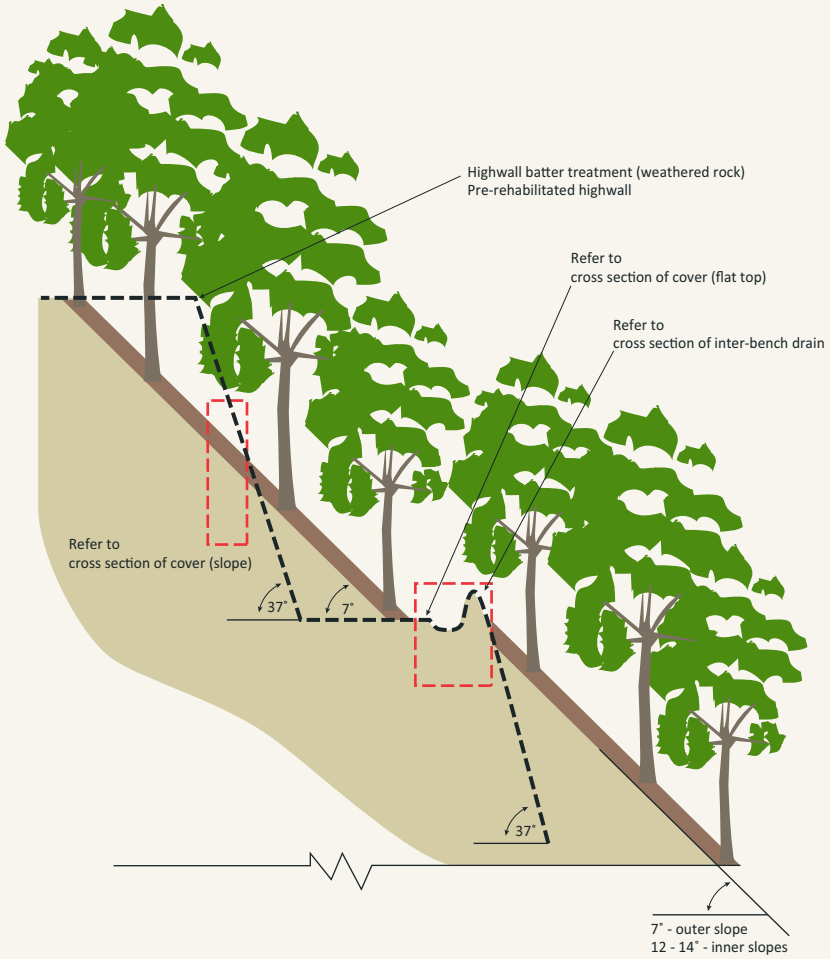
It should be noted that Table 6.8 makes reference to comparison to an analogue site. An analogue site is defined as a site of similar environment features eg slope, soil, vegetation that can be compared to a representative rehabilitated area to compare whether the rehabilitated area is performing similarly to the undisturbed analogue site.

Completion criteria for out-of-pit spoil dumps are presented in Table 6.8.The completion criteria have been presented aligning to the phase of closure relevant to the domain. That is:

- landform establishment - earthworks;
- vegetation establishment – seeding and planting; and
- sustainable final landform – a functioning landscape with minimal intervention.

Future iterations of this closure and rehabilitation strategy will incorporate criteria described in:

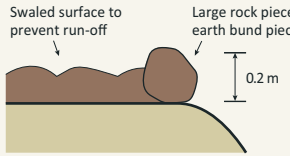
- ACARP project C8038 – completion criteria for pasture based rehabilitation; and
- ACARP project C12045 – completion criteria for native ecosystem establishment.



Cross section of cover (slope)

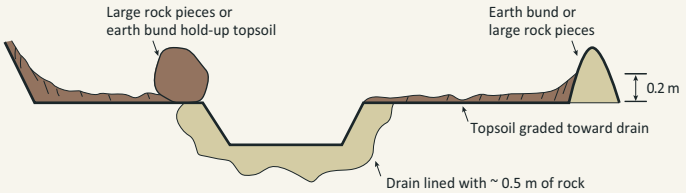
Profile	Dimensions	Material source	Placement and treatment	Construction tolerance	Notes
topsoil	0.2 m	Topsoil stockpile	End dumped, pushed by dozer, deep ripped to remove compaction.	+ 20 mm / - 0 mm	Topsoil thickness will be subject to topsoil availability in stockpiles.
spoil		Spoil	Blasted/reprofiled by dozer.	–	

Cross section of cover (flat top)



Flat top surfaces

Cross section of inter-bench drain



Topsoil Placement requirements:

1. Topsoil will be placed in a dry state.
2. End-dumped and spread in a uniform thickness by dozer.
3. Compaction removed by ripping.
4. Conditoning / ameloriation as required.

Drain construction requirements:

1. Use competent / unweathered rock.
2. Place using excavator and compact using excavator bucket.
3. Grade at 1% towards drop-drain structure (not shown)
4. Culvert drains.

Conceptual landform design features for out-of-pit dumps (not to scale)

EMM

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Figure 6.2

Table 6.8 Summary of completion criteria for the out-of-pit spoil dump areas

Phase	Objective	Completion criteria	Indicator that completion criteria is being met
Landform establishment.	Slopes are stable. Long-term safety.	slopes are stable with slopes not exceeding 7°.	As built design reports. No evidence of slumping of slopes. Certification of slopes by an appropriately qualified person. Geotechnical stability has been achieved and geotechnical investigations demonstrate that this has been achieved and reported.
	Site is safe for humans and animals now and in the foreseeable future.	Risks assessment has been completed and risk mitigation measures have been implemented.	As above. Sufficient egress to allow escape from void.
	The diversions and run-off drainage lines mirror natural stream functions.	Stable at closure and likely to remain that way into the foreseeable future.	Designed and constructed in accordance with the Queensland Government Natural Resources and Mines*, Central West Water Management and Use Regional Guideline: Watercourse Diversions – Central Queensland Mining Industry*, (2008).
	Appropriate management of surface water.	All permanent diversion channels/drains meet approved design criteria. All regulated structures meet design criteria. All non-permanent structures are decommissioned in accordance with regulating authority requirements.	Certification by an appropriately qualified person.
	Topsoil replacement consistent with pre-mining conditions.	Soil based criteria typical with analogue sites or fall within desirable ranges provided by the agricultural industry (to be determined based on sampling results). Depth - ≥ 0.2 m.	Monitoring and comparison to analogue site.
	Dust levels below thresholds.	Dust based criteria typical with analogue sites.	Monitoring and comparison to analogue site.
	No exposure to heavy metals, acid mine drainage and other toxic substances.	Surface and groundwater quality is as predicted and stable.	Downstream surface and groundwater monitoring. Certification by an appropriately qualified person that the specified cover is in place (as-built report) and predictive modelling to determine future cover performance.

Table 6.8 Summary of completion criteria for the out-of-pit spoil dump areas

Phase	Objective	Completion criteria	Indicator that completion criteria is being met
Vegetation establishment.	Establishment of the functionally important and structurally dominant species from the relevant native vegetation communities.	The diversity of shrubs and juvenile trees with a stem less than 5 cm is comparable to that of the analogue sites.	Monitoring and comparison to analogue site.
		Number of weeds species and surface area cover ≤ analogue site.	Monitoring and comparison to analogue site.
		Equal or greater proportion of overstorey species occurring as regeneration.	Monitoring and comparison to analogue site.
	Vegetation cover to minimise erosion.	Evidence that the vegetation type and density are of species suited to the spoil composition, slope, aspect, climate and other factors.	Vegetation type and density.
		Vegetation types and density are comparable with the relevant reference site.	Vegetation type and density.
		Minimum of 70% vegetation cover is present.	Foliage cover.
		Foliage cover is comparable with the relevant reference site.	Foliage cover.
		Nutrient cycling is occurring and the presence of leaf litter is assisting in limiting erosion of the soil /spoil surface.	Leaf litter, humus, depth of growing medium.
		Leaf litter, humus, depth of growing medium comparable with the relevant reference site.	Leaf litter, humus, depth of growing medium.
	Demonstrating rehabilitation succession.	The number of tree species, shrub species, herbes and forbes and grasses species regardless of age comprising the vegetation community is comparable to that of the analogue sites.	Monitoring and comparison to analogue site.
Sustainable landscape.	Landform generally blends in with surrounding landscape and is stable ie no sodic saline soil or spoil at the surface of the landform and minimal erosion.	Soils surface cover ≥70%.	Monitoring and reporting.

Table 6.8 Summary of completion criteria for the out-of-pit spoil dump areas

Phase	Objective	Completion criteria	Indicator that completion criteria is being met
		Exchangeable Sodium Percentage (ESP) ≤6% for surface soil and spoil.	Monitoring and reporting.
		Absence of gullies >300mm wide or deep and gullies stable.	Erosion monitoring and reporting.
		Land function stability analysis based on key characteristics including: Soil cover; Litter cover; Cryptogam cover; Crust broken-ness; Erosion type and severity; Deposited materials; Surface resistance to disturbance; Slake test; Compaction; and Surface roughness.	Landform function analysis and reporting.
		Nutrient recycling based on key characteristics including: Soil fertility; Soil organic matter; Litter cover; and Perennial grass basal and tree and shrub foliage cover.	Landform function analysis and reporting.
	Grazing.	Determination of safe carrying capacity for future land use and future management strategies/agreements in place.	Cattle stocking trials indicate areas nominated for cattle grazing as a post-mining land use are sustaining an equal to or better stocking rate that that calculated for relevant reference site.
		Land maintenance requirements are comparable to reference sites.	Landform stability when grazed. Safety of landform for stock and for undertaking management activities associated with stock.

Table 6.8 Summary of completion criteria for the out-of-pit spoil dump areas

Phase	Objective	Completion criteria	Indicator that completion criteria is being met
	Weed infestation less then pre-mining conditions.	Equal or lesser proportion of weed species occurring in regeneration by comparison to analogue site.	Rehabilitation monitoring and reporting.

6.5 Water storage areas, including MAW dams, raw water dams and sediment ponds

6.5.1 Final land use objectives

Water storage areas, including MAW dams, raw water dams and sediment ponds will either be retained at the request of the landholder and used for farm water supply or otherwise removed and rehabilitated to allow grazing.

A conceptual PMLUP, which includes this domain, is described in Section 4.3.

6.5.2 Landform design

Landform design will achieve a safe and stable landform that is non-polluting and is suitable for grazing.

Any water storages that are retained (at the request of the landholder) will be inspected and certified as safe and stable. The landholder will be made aware of any ongoing inspection and maintenance requirements in relation to ongoing use of the storages.

i Drainage

Water storage walls will be breached such that water can no longer be retained and that ponding does not occur. Drainage channels will be established to mimic natural landscapes and avoid erosion and scouring so that the impact on agricultural potential is minimised.

ii Slope

Walls left in place will be graded where necessary such that slopes do not exceed 10°.

iii Cover

Walls and empty water storage infrastructure (where required) will be revegetated to allow grazing.

Empty water storages and remaining dam walls will have:

- 0.2 m of topsoil respread on the surface; and
- seeded with grass and tree species supported by soil conditions and consistent with the final land use objectives.

6.5.3 Completion criteria and monitoring

The proposed monitoring schedule for water storage areas, including MAW dams, raw water dams and sediment ponds is described in Table 6.9.

Table 6.9 Proposed monitoring of water storage areas, including MAW dams, raw water dams and sediment ponds

Monitoring[1]	Frequency[2]	Period of monitoring after rehabilitation is completed
Erosion	half-yearly	5 years
Surface water	quarterly and event based	5 years
Groundwater	quarterly and event based	5 years
Geotechnical (stability)	half-yearly	5 years
Dust-monitoring	during closure earthworks	-

Notes: [1] *monitoring is described in detail in Chapter 7.*

[2] *the frequency of monitoring will be subject to the environmental authority (EA) conditions for the Carmichael Coal Mine and Rail project. This closure and rehabilitation strategy will be updated to reflect the EA conditions if they are different to what is indicated in this closure and rehabilitation strategy.*

i Interpretation of completion criteria and monitoring table (Table 6.10)

All reporting is to be completed as an annual rehabilitation monitoring report unless otherwise specified in Table 6.10. Further detail on reporting will be documented in the rehabilitation monitoring management plan.

Quantified indicators will be developed at the first annual review of the closure and rehabilitation strategy incorporating criteria from the environmental authority.

Monitoring and reporting will be completed for five years post-rehabilitation as per Table 6.9 .

Table 6.10 makes reference to Landform Function Analysis. The procedure for how to complete this analysis will be documented in the rehabilitation monitoring management plan.

It should be noted that Table 6.10 makes reference to comparison to an analogue site. An analogue site is defined as a site of similar environment features eg slope, soil, vegetation that can be compared to a representative rehabilitated area to compare whether the rehabilitated area is performing similarly to the undisturbed analogue site.

Completion criteria for water storage areas, including MAW dams, raw water dams and sediment ponds are presented in Table 6.10. The completion criteria have been presented aligning to the phase of closure relevant to the domain. That is:

- decommissioning – cleaning the site up;
- landform establishment - earthworks;
- vegetation establishment – seeding and planting; and
- sustainable final landform – a functioning landscape with minimal intervention.

Table 6.10 Summary of completion criteria for water storage areas, including MAW dams, raw water dams and sediment ponds

Phase	Objective	Completion criteria	Indicator that completion criteria is being met
Decommissioning.	No retention of water in decommissioned dams and ponds.	Decommission dams and pond wall breached and no ponding of water.	Decommissioning report and no ponding.
Landform establishment.	Slopes are stable. Long-term safety.	Remaining wall slopes are stable and angled at a maximum slope of 10°.	As built design reports. No evidence of slumping of slopes. Certification of slopes and void by an appropriately qualified person. Geotechnical stability has been achieved and geotechnical investigations demonstrate that this has been achieved and reported.
	Site is safe for humans and animals now and in the foreseeable future.	Risks assessment has been completed and risk mitigation measures have been implemented.	As above Sufficient egress to allow escape from void.
	Appropriate management of surface water.	All permanent diversion channels/drains meet approved design criteria. All regulated structures meet design criteria. All non-permanent structures are decommissioned in accordance with regulating authority requirements.	Certification by an appropriately qualified person.
	Topsoil replacement consistent with pre-mining conditions.	Soil based criteria typical with analogue sites or fall within desirable ranges provided by the agricultural industry (to be determined based on sampling results). Depth - ≥ 0.2 m.	Monitoring and comparison to analogue site.
	Dust levels below thresholds.	Dust based criteria typical with analogue sites.	Monitoring and comparison to analogue site.
Vegetation establishment.	Establishment of the functionally important and structurally dominant species from the relevant native vegetation communities.	The diversity of shrubs and juvenile trees with a stem less than 5 cm is comparable to that of the analogue sites.	Monitoring and comparison to analogue site.
		Number of weeds species and surface area cover ≤ analogue site.	Monitoring and comparison to analogue site.

Table 6.10 Summary of completion criteria for water storage areas, including MAW dams, raw water dams and sediment ponds

Phase	Objective	Completion criteria	Indicator that completion criteria is being met
		Equal or greater proportion of overstorey species occurring as regeneration.	Monitoring and comparison to analogue site.
	Vegetation cover to minimise erosion.	Evidence that the vegetation type and density are of species suited to the spoil composition, slope, aspect, climate and other factors.	Vegetation type and density.
		Vegetation types and density are comparable with the relevant reference site.	Vegetation type and density.
		Minimum of 70% vegetation cover is present.	Foliage cover.
		Foliage cover is comparable with the relevant reference site.	Foliage cover.
		Nutrient cycling is occurring and the presence of leaf litter is assisting in limiting erosion of the soil /spoil surface.	Leaf litter, humus, depth of growing medium.
		Leaf litter, humus, depth of growing medium comparable with the relevant reference site.	Leaf litter, humus, depth of growing medium.
	Demonstrating rehabilitation succession.	The number of tree species, shrub species, herbes and forbes and grasses species regardless of age comprising the vegetation community is comparable to that of the analogue sites.	Monitoring and comparison to analogue site.
Sustainable landscape.	Landform generally blends in with surrounding landscape and is stable ie no sodic saline soil or spoil at the surface of the landform and minimal erosion.	Soils surface cover ≥70%.	Monitoring and reporting.
		Exchangeable Sodium Percentage (ESP) ≤6% for surface soil and spoil.	Monitoring and reporting.
		Absence of gullies >300mm wide or deep and gullies stable.	Erosion monitoring and reporting.
		Land function stability analysis based on key characteristics including: Soil cover;	Landform function analysis and reporting.

Table 6.10 Summary of completion criteria for water storage areas, including MAW dams, raw water dams and sediment ponds

Phase	Objective	Completion criteria	Indicator that completion criteria is being met
		Litter cover; Cryptogam cover; Crust broken-ness; Erosion type and severity; Deposited materials; Surface resistance to disturbance; Slake test; Compaction; and Surface roughness.	
		Nutrient recycling based on key characteristics including: Soil fertility; Soil organic matter; Litter cover; and Perennial grass basal and tree and shrub foliage cover.	Landform function analysis and reporting.
	Grazing.	Determination of safe carrying capacity for future land use and future management strategies/agreements in place.	Cattle stocking trials indicate areas nominated for cattle grazing as a post-mining land use are sustaining an equal to or better stocking rate that that calculated for relevant reference site.
		Land maintenance requirements are comparable to reference sites.	Landform stability when grazed. Safety of landform for stock and for undertaking management activities associated with stock.
	Weed infestation less then pre-mining conditions	Equal or lesser proportion of weed species occurring in regeneration by comparison to analogue site.	Rehabilitation monitoring and reporting.

6.6 Stream diversions

6.6.1 Final land use objectives

The final land use objective for stream diversions is the establishment of stable watercourses.

A conceptual PMLUP, which includes this domain, is described in Section 4.3.

6.6.2 Landform design

As permanent changes to the landform will have occurred as a result of mining, and given that only minor, ephemeral watercourses are to be diverted, it is not intended to restore original flow paths.

i Drainage

When developed, the drainage network and stream diversions will be able to pass flows from significant rain events without jeopardising human safety. Stream diversions will not be eroding and will meet criteria for stability as defined in *Watercourse Diversions – Central Queensland Mining Industry* or similar guidelines in place at the time of closure.

ii Slope

Stream diversions will be stable enough for cattle access. If stream diversions are not stable than cattle access will be restricted.

iii Cover

Where required to ensure stability:

- stream banks will have 0.2 m of topsoil respread on the surface; and
- stream banks will be seeded with grass and tree species consistent with the final landform.

6.6.3 Completion criteria and monitoring

The proposed monitoring schedule for stream diversions is described in Table 6.11.

Table 6.11 Proposed monitoring of stream diversions

Monitoring[1]	Frequency[2]	Period of monitoring after rehabilitation is completed
Erosion	half-yearly	5 years
Surface water	quarterly and event based	5 years
Groundwater	quarterly and event based	5 years
Geotechnical (stability)	half-yearly	5 years
Rehabilitation (Ecology)	annually	5 years
Dust-monitoring	during closure earthworks	-

Notes: [1] *monitoring is described in detail in Chapter 7.*

[2] *the frequency of monitoring will be subject to the environmental authority (EA) conditions for the Carmichael Coal Mine and Rail project. This closure and rehabilitation strategy will be updated to reflect the EA conditions if they are different to what is indicated in this closure and rehabilitation strategy.*

i Interpretation of completion criteria and monitoring table (Table 6.12)

All reporting is to be completed as an annual rehabilitation monitoring report unless otherwise specified in Table 6.12 . Further detail on reporting will be documented in the rehabilitation monitoring management plan.

Quantified indicators will be developed at the first annual review of the closure and rehabilitation strategy incorporating criteria from the environmental authority.

Monitoring and reporting will be completed for five years post-rehabilitation as per Table 6.11.

Table 6.12 makes reference to Landform Function Analysis. The procedure for how to complete this analysis will be documented in the rehabilitation monitoring management plan.

It should be noted that Table 6.12 makes reference to comparison to an analogue site. An analogue site is defined as a site of similar environment features eg slope, soil, vegetation that can be compared to a representative rehabilitated

Completion criteria for stream diversions are presented in Table 6.12. The completion criteria have been presented aligning to the phase of closure relevant to the domain. That is:

- decommissioning – cleaning the site up;
- landform establishment – earthworks for landform and surface water management;
- vegetation establishment – seeding and planting; and
- sustainable final landform – a functioning landscape with minimal intervention and agro-economic value.

Table 6.12 Summary of completion criteria for stream diversions

Phase	Objective	Completion criteria	Indicator that completion criteria is being meet
Decommissioning.	Clean-up of potential/actual contamination.	Hydrocarbons less than assessment criteria. Heavy metals less than assessment criteria.	Hazardous material audit and contamination at acceptable level. Site is assessed by a suitable qualified person and removed from CLR, EMR or both.
Landform establishment.	Drainage network restored.	Drainage network and stream diversions will be able to pass flows from significant rain events without jeopardising human safety.	Monitoring and comparison to analogue site.
	Topsoil replacement consistent with pre-mining conditions.	Soil based criteria typical with analogue sites or fall within desirable ranges provided by the agricultural industry (to be determined based on sampling results). Depth - ≥ 0.2 m.	Monitoring and comparison to analogue site.
	Dust levels below thresholds	Dust based criteria typical with analogue sites.	Monitoring and comparison to analogue site.

Table 6.12 Summary of completion criteria for stream diversions

Phase	Objective	Completion criteria	Indicator that completion criteria is being meet
Vegetation establishment.	Establishment of the functionally important and structurally dominant species from the relevant native vegetation communities.	The diversity of shrubs and juvenile trees with a stem less than 5 cm is comparable to that of the analogue sites.	Monitoring and comparison to analogue site.
		Number of weeds species and surface area cover ≤ analogue site.	Monitoring and comparison to analogue site.
		Equal or greater proportion of overstorey species occurring as regeneration.	Monitoring and comparison to analogue site.
	Demonstrating rehabilitation succession.	The number of tree species, shrub species, herbes and forbes and grasses species regardless of age comprising the vegetation community is comparable to that of the analogue sites.	Monitoring and comparison to analogue site.
	Vegetation cover to minimise erosion.	Evidence that the vegetation type and density are of species suited to the spoil composition, slope, aspect, climate and other factors.	Vegetation type and density.
		Vegetation types and density are comparable with the relevant reference site.	Vegetation type and density.
		Minimum of 70% vegetation cover is present.	Foliage cover.
		Foliage cover is comparable with the relevant reference site.	Foliage cover.
		Nutrient cycling is occurring and the presence of leaf litter is assisting in limiting erosion of the soil /spoil surface.	Leaf litter, humus, depth of growing medium.
		Leaf litter, humus, depth of growing medium comparable with the relevant reference site.	Leaf litter, humus, depth of growing medium.
Sustainable landscape.	Landform generally blends in with surrounding landscape and is stable ie no sodic saline soil or spoil at the surface of the landform and minimal erosion.	Soils surface cover ≥70%.	Monitoring and reporting.

Table 6.12 Summary of completion criteria for stream diversions

Phase	Objective	Completion criteria	Indicator that completion criteria is being meet
		Exchangeable Sodium Percentage (ESP) ≤6% for surface soil and spoil.	Monitoring and reporting.
		Absence of gullies >300mm wide or deep and gullies stable.	Erosion monitoring and reporting.
		Land function stability analysis based on key characteristics including: Soil cover; Litter cover; Cryptogam cover; Crust broken-ness; Erosion type and severity; Deposited materials; Surface resistance to disturbance; Slake test; Compaction; and Surface roughness.	Landform function analysis and reporting.
		Nutrient recycling based on key characteristics including: Soil fertility; Soil organic matter; Litter cover; and Perennial grass basal and tree and shrub foliage cover.	Landform function analysis and reporting.
	Weed infestation less then pre-mining conditions.	Equal or lesser proportion of weed species occurring in regeneration by comparison to analogue site.	Rehabilitation monitoring and reporting.

6.7 Tailings drying cell

6.7.1 Final land use objectives

The final land use objectives for the rehabilitated tailings drying cell sites is for grazing on a mosaic of native pasture and woodland habitat.

A conceptual PMLUP, which includes this domain, is described in Section 4.3.

6.7.2 Landform design

The final landform will be returned as closely as possible to the pre-existing topography prior to construction of the tailings drying cell. Re-profiling will occur after the desiccated tailings and cell walls have been completely removed and the area tested for potential contamination.

i Drainage

Depending on slope angle the final re-profiled site may include contour banks and other erosion and sediment control structures.

ii Slope

The final slope angle will be reinstated as close to the pre-existing contours as possible and will not exceed 7 °.

iii Cover

The final landform will be covered with a 0.2 m cover of topsoil.

Consideration may be given to an engineered store and release cover if the foundation is found to be contaminated from the tailings.

Conceptual landform design features for the tailings drying cells are shown in Figure 6.3.

Dry tailings from the tailings drying cell and coarse reject will also be hauled and placed into managed cells within the out-of-pit spoil dumps at pit D and pit E. The construction of these cells will be under flat-top surfaces (Figure 6.3) and will be covered using the conceptual designs illustrated in Figure 6.3.

6.7.3 Completion criteria and monitoring

The proposed monitoring schedule for the tailings drying cells is described in Table 6.13.

Table 6.13 Proposed monitoring of tailings drying cells

Monitoring[1]	Frequency[2]	Period of monitoring after rehabilitation is completed
Erosion	half-yearly	5 years
Surface water	quarterly and event based	5 years
Groundwater	quarterly and event based	5 years
Geotechnical (stability)	half-yearly	5 years
Rehabilitation (Ecology)	annually	5 years
Dust-monitoring	during closure earthworks	-

Notes: [1] *monitoring is described in detail in Chapter 7.*

[2] *the frequency of monitoring will be subject to the environmental authority (EA) conditions for the Carmichael Coal Mine and Rail project. This closure and rehabilitation strategy will be updated to reflect the EA conditions if they are different to what is indicated in this closure and rehabilitation strategy.*

i Interpretation of completion criteria and monitoring table (Table 6.14)

All reporting is to be completed as an annual rehabilitation monitoring report unless otherwise specified in Table 6.14. Further detail on reporting will be documented in the rehabilitation monitoring management plan.

Quantified indicators will be developed at the first annual review of the closure and rehabilitation strategy incorporating criteria from the environmental authority.

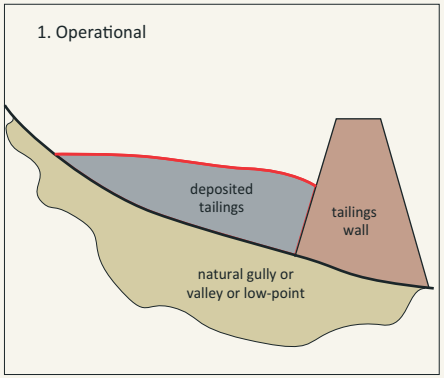
Monitoring and reporting will be completed for five years post-rehabilitation as per Table 6.13.

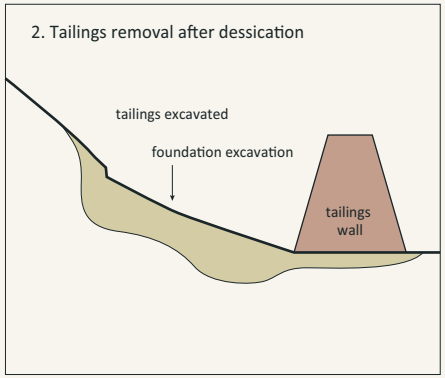
Table 6.14 makes reference to Landform Function Analysis. The procedure for how to complete this analysis will be documented in the rehabilitation monitoring management plan.

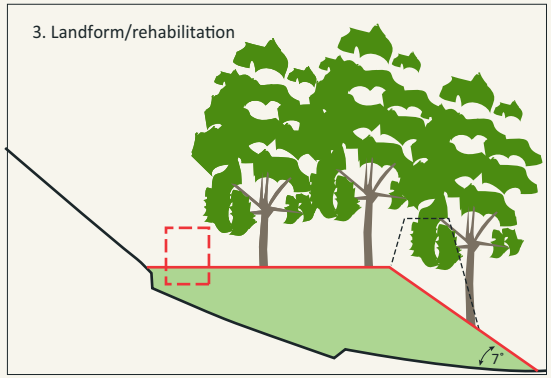
It should be noted that Table 6.14 makes reference to comparison to an analogue site. An analogue site is defined as a site of similar environment features eg slope, soil, vegetation that can be compared to a representative rehabilitated

Completion criteria for the tailings drying cells is presented as Table 6.14. The completion criteria have been presented aligning to the phase of closure relevant to the domain. That is:

- decommissioning – cleaning the site up;
- landform establishment – earthworks for landform and surface water management;
- vegetation establishment – seeding and planting; and
- sustainable final landform – a functioning landscape with minimal intervention and agro-economic value.







Tailings excavation requirements:

1. Foundation excavated if required.

Landform requirements:

1. Landform constructed from tailings wall.
2. Landform to follow natural landscape.
3. Landform traffic compacted.
4. Fill imported to site if necessary.

4. Cross section of cover (option 1)

Profile	Dimensions	Material source	Placement and treatment	Construction tolerance	Notes
topsoil	0.2 m	Topsoil stockpile	End dumped, pushed by dozer, deep ripped to remove compaction.	+ 20 mm / - 0 mm	Topsoil thickness will be subject to topsoil availability in stockpiles.
spoil		Spoil	Blasted/reprofiled by dozer.	–	

5. Cross section of cover (option 2)

Profile	Dimensions	Material source	Placement and treatment	Construction tolerance	Notes
topsoil	~ 1 m	Topsoil stockpile	End dumped to create a swaled final surface.	+ 200 mm / - 200 mm	Topsoil maybe substituted with weathered oxide spoil, subject to topsoil availability.
compact clay	~ 0.5 m				
foundation		Tailings wall core	Pushed in uniform thickness by dozer and compacted to 0.5% of maximum standard compction.	+ 100 mm / - 0 mm	

Conceptual landform design features for the tailings drying cell (not to scale)

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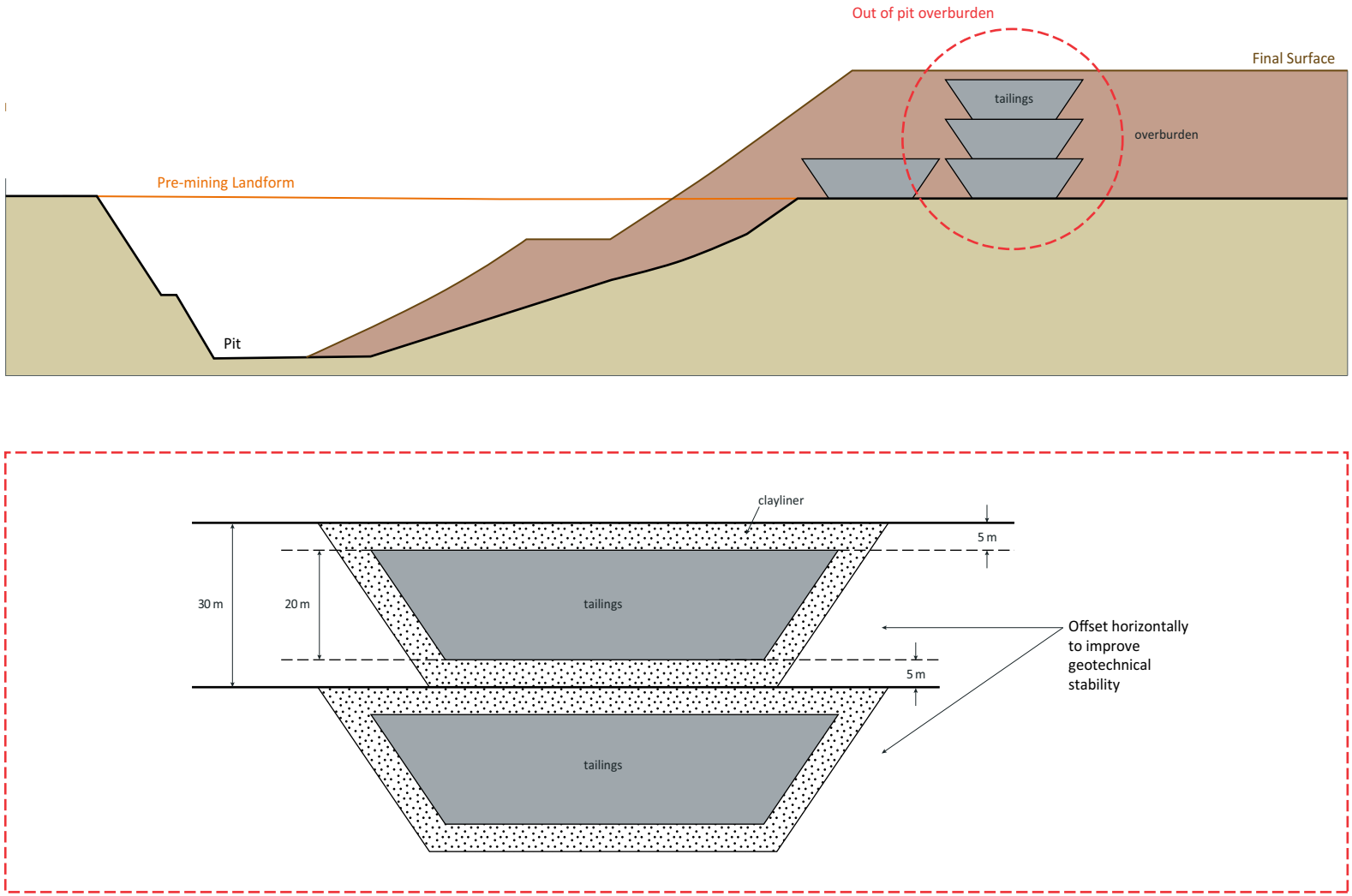
Figure 6.3 (sheet 1)



Conceptual landform design features for tailings placement in the out-of-pit spoil dumps (not to scale)

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Figure 6.3 (sheet 2)

Table 6.14 Summary of completion criteria for the tailings drying cells

Phase	Objective	Completion criteria	Indicator that completion criteria is being meet
Decommissioning.	Clean-up of potential/actual contamination.	Hydrocarbons less than assessment criteria. Heavy metals less than assessment criteria.	Hazardous material audit and contamination at acceptable level. Site is assessed by a suitable qualified person and removed from CLR, EMR or both.
Landform establishment.	Slopes are stable.	Equal to pre-existing contour or does not exceed 7°.	As built design reports. No evidence of slumping of slopes.
	Topsoil replacement consistent with pre-mining conditions.	Soil based criteria typical with analogue sites or fall within desirable ranges provided by the agricultural industry (to be determined based on sampling results). Depth - = 0.2 m.	Monitoring and comparison to analogue site.
	Dust levels below thresholds.	Dust based criteria typical with analogue sites.	Monitoring and comparison to analogue site.
		Surface is able to support heavy vehicles, cattle and residential or small farm buildings OR an exclusion zone has been established and clearly marked and all relevant stakeholders notified of restrictions.	Certification by a suitable qualified person.
	Design and placement of engineered cover (*if deemed to be required*).	Single capillary break and reduced percolation layer. Store and release cover.	Certification by an appropriately qualified person that the specified cover is in place (as-built report) and predictive modelling to determine future cover performance.
Vegetation establishment.	Establishment of the functionally important and structurally dominant species from the relevant native vegetation communities.	The diversity of shrubs and juvenile trees with a stem less than 5 cm is comparable to that of the analogue sites.	Monitoring and comparison to analogue site.
		Number of weeds species and surface area cover ≤ analogue site.	Monitoring and comparison to analogue site.
		Equal or greater proportion of overstorey species occurring as regeneration.	Monitoring and comparison to analogue site.
	Demonstrating rehabilitation succession.	The number of tree species, shrub species, herbes and forbes and grasses species regardless of age comprising the vegetation community is comparable to that of the analogue sites.	Monitoring and comparison to analogue site.

Table 6.14 Summary of completion criteria for the tailings drying cells

Phase	Objective	Completion criteria	Indicator that completion criteria is being meet
	Vegetation cover to minimise erosion.	Evidence that the vegetation type and density are of species suited to the spoil composition, slope, aspect, climate and other factors.	Vegetation type and density.
		Vegetation types and density are comparable with the relevant reference site.	Vegetation type and density.
		Minimum of 70% vegetation cover is present.	Foliage cover.
		Foliage cover is comparable with the relevant reference site.	Foliage cover.
		Nutrient cycling is occurring and the presence of leaf litter is assisting in limiting erosion of the soil /spoil surface.	Leaf litter, humus, depth of growing medium.
		Leaf litter, humus, depth of growing medium comparable with the relevant reference site.	Leaf litter, humus, depth of growing medium.
Sustainable landscape.	Landform generally blends in with surrounding landscape and is stable ie no sodic saline soil or spoil at the surface of the landform and minimal erosion.	Soils surface cover ≥70%.	Monitoring and reporting.
		Exchangeable Sodium Percentage (ESP) ≤6% for surface soil and spoil.	Monitoring and reporting.
		Absence of gullies >300mm wide or deep and gullies stable.	Erosion monitoring and reporting.

Table 6.14 Summary of completion criteria for the tailings drying cells

Phase	Objective	Completion criteria	Indicator that completion criteria is being meet
		Land function stability analysis based on key characteristics including: Soil cover; Litter cover; Cryptogam cover; Crust broken-ness; Erosion type and severity; Deposited materials; Surface resistance to disturbance; Slake test; Compaction; and Surface roughness.	Landform function analysis and reporting.
		Nutrient recycling based on key characteristics including: Soil fertility; Soil organic matter; Litter cover; and Perennial grass basal and tree and shrub foliage cover.	Landform function analysis and reporting.
	Weed infestation less then pre-mining conditions.	Equal or lesser proportion of weed species occurring in regeneration by comparison to analogue site.	Rehabilitation monitoring and reporting.
	Grazing.	Determination of safe carrying capacity for future land use and future management strategies/agreements in place.	Cattle stocking trials indicate areas nominated for cattle grazing as a post-mining land use are sustaining an equal to or better stocking rate that that calculated for relevant reference site.
		Land maintenance requirements are comparable to reference sites.	Landform stability when grazed. Safety of landform for stock and for undertaking management activities associated with stock.

6.8 Carmichael River corridor

6.8.1 Final land use objectives

The final land use proposed for the Carmichael River corridor is for the establishment of a wildlife corridor and wildlife habitat. Any grazing will be consistent with the management of the proposed wildlife habitat.

A conceptual PMLUP, which includes this domain, is described in Section 4.3.

Flood protection levees will be removed where not required for flood protection of voids.

6.8.2 Landform design

Further studies are required for the development of the final landform design but habitat management and restoration for the Carmichael River corridor will be undertaken from the commencement of mining.

i Drainage

Stream beds and banks will be stable compared to reference sites upstream and levees will be stable and vegetated.

ii Slope

Stream bed and banks will be geomorphologically stable.

Levees will be inspected and certified against dam safety guidelines in place at the time of decommissioning.

iii Cover

Amelioration or conditioning of topsoil will be undertaken as required to facilitate revegetation with native grass and tree species. Revegetated areas will be maintained until vegetation cover criteria are achieved including weed control as required. Artificial micro-habitat will be placed as required to support species known or likely to use the area.

6.8.3 Completion criteria and monitoring

The proposed monitoring schedule for the Carmichael River corridor is described in Table 6.15.

Table 6.15 Proposed monitoring of the Carmichael River corridor

Monitoring[1]	Frequency[2]	Period of monitoring after rehabilitation is completed
Erosion	half-yearly	5 years
Surface water	quarterly and event based	5 years
Groundwater	quarterly and event based	5 years
Geotechnical (stability)	half-yearly	5 years
Rehabilitation (Ecology)	annually	5 years
Dust-monitoring	during closure earthworks	-

Notes: [1] *monitoring is described in detail in Chapter7.*

[2] *the frequency of monitoring will be subject to the environmental authority (EA) conditions for the Carmichael Coal Mine and Rail project. This closure and rehabilitation strategy will be updated to reflect the EA conditions if they are different to what is indicated in this closure and rehabilitation strategy.*

i Interpretation of completion criteria and monitoring table (Table 6.16)

All reporting is to be completed as an annual rehabilitation monitoring report unless otherwise specified in Table 6.16. Further detail on reporting will be documented in the rehabilitation monitoring management plan.

Quantified indicators will be developed at the first annual review of the closure and rehabilitation strategy incorporating criteria from the environmental authority.

Monitoring and reporting will be completed for five years post-rehabilitation as per Table 6.15.

Table 6.16 makes reference to Landform Function Analysis. The procedure for how to complete this analysis will be documented in the rehabilitation monitoring management plan.

It should be noted that Table 6.16 makes reference to comparison to an analogue site. An analogue site is defined as a site of similar environment features eg slope, soil, vegetation that can be compared to a representative rehabilitated

Completion criteria for the Carmichael River corridor are presented in Table 6.16. The completion criteria have been presented aligning to the phase of closure relevant to the domain. That is:

- decommissioning – cleaning the site up;
- landform establishment – earthworks for landform and surface water management;
- vegetation establishment – seeding and planting; and
- sustainable final landform – a functioning landscape with minimal intervention and agro-economic value.

Table 6.16 Summary of completion criteria for the Carmichael River corridor

Phase	Objective	Completion criteria	Indicator that completion criteria is being meet
Decommissioning.	Clean-up of potential/actual contamination.	Hydrocarbons less than assessment criteria. Heavy metals less than assessment criteria.	Hazardous material audit and contamination at acceptable level. Site is assessed by a suitable qualified person and removed from CLR, EMR or both.
Landform establishment.	Topsoil replacement consistent with pre-mining conditions.	Amelioration or augmentation of topsoil as required to facilitate revegetation with native species Depth - ≥ 0.2 m.	Monitoring and comparison to analogue site.
Vegetation establishment.	Establishment of the functionally important and structurally dominant species from the relevant native vegetation communities.	The diversity of shrubs and juvenile trees with a stem less than 5 cm is comparable to that of the analogue sites.	Monitoring and comparison to analogue site.
		Number of weeds species and surface area cover ≤ analogue site.	Monitoring and comparison to analogue site.
		Equal or greater proportion of overstorey species occurring as regeneration.	Monitoring and comparison to analogue site.
	Demonstrating rehabilitation succession.	The number of tree species, shrub species, herbes and forbes and grasses species regardless of age comprising the vegetation community is comparable to that of the analogue sites.	Monitoring and comparison to analogue site.
	Placement of artificial habitat to support species known or likely to use the area.	Placement of artificial habitat.	Monitoring and reporting.
	Vegetation cover to minimise erosion.	Evidence that the vegetation type and density are of species suited to the spoil composition, slope, aspect, climate and other factors.	Vegetation type and density.
		Vegetation types and density are comparable with the relevant reference site.	Vegetation type and density.
		Minimum of 70% vegetation cover is present.	Foliage cover.
		Foliage cover is comparable with the relevant reference site.	Foliage cover.

Table 6.16 Summary of completion criteria for the Carmichael River corridor

Phase	Objective	Completion criteria	Indicator that completion criteria is being meet
		Nutrient cycling is occurring and the presence of leaf litter is assisting in limiting erosion of the soil /spoil surface.	Leaf litter, humus, depth of growing medium.
		Leaf litter, humus, depth of growing medium comparable with the relevant reference site.	Leaf litter, humus, depth of growing medium.
Sustainable landscape.	Landform generally blends in with surrounding landscape and is stable ie no sodic saline soil or spoil at the surface of the landform and minimal erosion.	Soils surface cover ≥70%.	Monitoring and reporting.
		Exchangeable Sodium Percentage (ESP) ≤6% for surface soil and spoil.	Monitoring and reporting.
		Absence of gullies >300mm wide or deep and gullies stable.	Erosion monitoring and reporting.
		Land function stability analysis based on key characteristics including: Soil cover; Litter cover; Cryptogam cover; Crust broken-ness; Erosion type and severity; Deposited materials; Surface resistance to disturbance; Slake test; Compaction; and Surface roughness.	Landform function analysis and reporting.

Table 6.16 Summary of completion criteria for the Carmichael River corridor

Phase	Objective	Completion criteria	Indicator that completion criteria is being meet
		Nutrient recycling based on key characteristics including: Soil fertility; Soil organic matter; Litter cover; and Perennial grass basal and tree and shrub foliage cover.	Landform function analysis and reporting.
	Weed infestation less then pre-mining conditions.	Equal or lesser proportion of weed species occurring in regeneration by comparison to analogue site.	Rehabilitation monitoring and reporting.

7 Monitoring and maintenance

This section of the strategy describes conceptual monitoring and maintenance activities that will be undertaken post-rehabilitation.

The post-rehabilitation phase commences upon completion of the strategy. During post-rehabilitation, monitoring will be conducted to assess whether the closure objectives and criteria are being met, while maintenance will be undertaken to address those areas where rehabilitation objectives and criteria are not being successfully met. At this stage, the identified monitoring and maintenance activities are conceptual and will need to be refined as the strategy develops in the future.

Upon completion of rehabilitation activities, maintenance and monitoring will be conducted at various intervals.

Post-rehabilitation monitoring strategies will need to be confirmed with relevant government authorities.

7.1 Surface water and groundwater

Detailed information on surface water and groundwater monitoring requirements will be outlined in the receiving environment management plan (REMP).

7.2 Geotechnical monitoring and soil testing

Geotechnical monitoring and soil testing will be undertaken by a qualified geotechnical engineer who will assess the stability and quality of post-rehabilitation features in the mine area. Monitoring frequency is presented in Chapter 6.

The requirement for erosion monitoring will be addressed closer to closure.

7.3 Dust monitoring and analyses

Dust monitoring and analyses will be conducted to assess the quality of post-closure corrective action to control dust generation. This will be conducted as part of a dust control program to identify and quantify airborne dust concentrations. Monitoring frequency is presented in Chapter 6.

7.4 Rehabilitation monitoring

A rehabilitation monitoring schedule is presented in Chapter 6.

A procedure is yet to be developed describing the specific monitoring methodologies to determine statistical adequacy of the sample population. These methodologies will entail but not be limited to: transect location determination, floral and faunal sampling and identification, and biodiversity assessments.

7.5 Weed and feral animal control and inspection

Weed and feral animal control will be conducted annually during the first five years after closure.

Weed and feral animal inspections will be conducted in all areas of the Project, and control will be performed as required.

7.6 Tailings drying cell monitoring

Specific monitoring will be conducted at the tailings drying cell to examine possible seepage sources, groundwater discharges, and cover performance. The monitoring will be conducted annually for five years after rehabilitation.

7.7 Maintenance

Maintenance will encompass post-rehabilitation monitoring to identify areas requiring maintenance, and identify and address deviations from the expected outcomes.

Maintenance activities will include the maintenance of new vegetation (eg addition of fertiliser, re-planting of significant areas of failed vegetation) prior to its establishment within the ecosystem; upkeep of water management structures; regular checking, replacement and probable repairs, where necessary, to newly fenced areas and signage in the event they become compromised after rehabilitation.

Appendix A

Legal and other requirements

A critical factor in defining the scope and context of rehabilitation is to identify and evaluate the legal and other obligations that affect rehabilitation. Legal requirements for rehabilitation are general found in legislation or in the Development Approval conditions which are established in the early stages of project development. Other obligations include internal standards, external commitments and industry codes and guidelines. In most cases, the other obligations that influences decisions are often far more onerous and comprehensive than regulatory requirements.

A.1 Legal Requirements

A summary of potential issues and related legislation and best practice guidelines that may apply at closure or rehabilitation and the potential obligation that may arise is summarised in **Table A.1**.

Table A.1 Summary of Legalisation and best practice and potential Project obligation

Issue	legislation	Objective	Obligation
Flora and Fauna	Environmental Protection and Biodiversity Conservation Act 1999	To provide a federal environmental protection framework as well as determining nationally endangered species and communities.	Not to undertake action that may have a significant impact on a "matter of national environmental significance" or on the environment within Commonwealth land without approval under the Act.
Due Diligence	Environmental Protection Act 1994	To protect the environment while allowing development that improves the total quality of life and ecologically sustainable development.	General environmental 'duty of care' to be observed to ensure that any potential environmental impact from the Project is minimised.
Contamination	Environmental Protection Regulation 1998	Lists Environmentally Relevant Activities, which are activities that may potentially cause environmental harm and require approval. Also gives effect to National Environmental Protection Measure (NEPMs).	The NEPM contamination allows the development site specific clean-up criteria to determine the required level of remediation. These criteria are known as Health Investigation Levels (HIL's).
Waste	Environmental Protection (Waste) Regulation 2000	Provides waste management strategies to limit impact of waste on the environment.	Management of regulated wastes will be subject to this legislation.
Water	Environmental Protection (Waters)Policy 2009	Provides a framework to develop water quality guidelines to protect Queensland waters and prevent pollution.	Water quality measurement parameters may be sort from relevant guidelines.
Air	Environmental Protection (Air) Policy 2008	Specifies air quality indicators and goals to protect the environmental values and provides a framework for making consistent and fair decisions about managing the air environment and involving the community.	Air quality measurement parameters may be sort from relevant guidelines.

Table A.1 Summary of Legalisation and best practice and potential Project obligation

Issue	legislation	Objective	Obligation
Safety	Work Health and Safety Act 2011	To prevent a person's death, injury or illness being caused by a workplace, by a relevant workplace area, by work activities, or by plant or substances for use at a workplace.	Compliance with safety requirements throughout the closure period to be incorporated into the closure plan.
Industrial Relations	Workplace Relations Act 1996	The principal object of this Act is to provide a framework for cooperative workplace relations which promotes the economic prosperity and welfare of the people of Australia.	Closure plan to consider impact on employees of the operation.
Water	ANZECC Guidelines	Provide guidelines for the monitoring and management of water ways	Guidelines to provide details of water monitoring requirements.
Land Use	Land Act 1994	Relates to the administration and management of nonfreehold land and deeds of grant in trust and the creation of freehold land, and for related purpose	Regulates the opening and closing of road reserves and land dealings relating to changes in land tenure.
Flora and Fauna	Nature Conservation Act 1992	To provide framework for the protection of state listed threatened species and communities.	Rehabilitation strategies may need to include any state listed threatened species or communities that occur in the area.
Due Diligence	State Development and Public Works Organisation Act 1971	To provide state planning and organisational legislation that aids in the delivery of ecologically sustainable development.	Commitments during the EIS phase may impact on the rehabilitation of the site.
Flora and Fauna	Vegetation Management Act 1999	Regulates clearing of vegetation to ensure appropriate management and conservation.	Development to comply with state and regional vegetation management plans and policies and also comply with vegetation management practices on leased and freehold land.
Due Diligence	Minerals Council of Australia (MCA) (2000) Code for Environmental Management	Now superseded by Enduring Value – the Australian Minerals Industry Framework for Sustainable Development.	Highlights a range of closure Scenarios that should be considered during plannings. Scenarios include: Planned Closure: This occurs when mining and processing ceases due to economic or operational requirements, or if the resource is exhausted. In this situation a decommissioning and closure plan will be prepared and submitted to the regulatory authorities for approval prior to closure. Unplanned Closure: This occurs

Table A.1 Summary of Legalisation and best practice and potential Project obligation

Issue	legislation	Objective	Obligation
			when processing ceases due to financial constraints or non-conformances with regulatory requirements. In this situation a decommissioning plan will be prepared immediately. Care and Maintenance: This can occur if the economics of the project area are unfavourable or if there is some impediment to extracting the resource. In this situation a 'caretaker' manages the site until conditions become favourable again. A decommissioning plan will be prepared which takes into account the recommencement. The plan will be implemented when a decision has been made to close the operation.
Land Use	Strategic framework for Mine Closure – Australian and New Zealand Minerals Council of Australia	States mine life criteria and rehabilitation guidelines	May be relevant to rehabilitation requirements.

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