Carmichael coal mine and rail project (quarries)
Preliminary 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

Final Draft

Report B13054RP4 | Prepared for Adani Mining Pty Ltd | 26 July 2013

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1 Introduction

Adani Mining Pty Ltd (Adani) is developing the Carmichael Coal Mine and Rail Project (the Project) in the Galilee Basin, approximately 160 km north-west of the town of Clermont, Central Queensland. Adani proposes to develop a number of quarries that will provide material to support the construction of the Project:

- Moray;
- North Creek;
- Disney;
- Borrow 7; and
- South Back Creek;

The quarries will supply 34 million tonnes of quarry products. The Project includes the following components:

- The Project (Mine): a greenfield coal mine over Exploration Permit for Coal (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 (off-site) infrastructure including a workers accommodation village and associated facilities, a permanent airport site, an industrial area and water supply infrastructure.
- The Project (Rail): a new rail line connecting the mine to the existing Goonyella and Newlands rail lines to provide for the export of coal via the Port of Hay Point (Dudgeon Point expansion) and the Port of Abbot Point. The Project (Rail) consists of:
    - Rail (west): a 120 kilometre (km) dual gauge line from the mine to Diamond Creek.
    - Rail (east): a 69 km narrow gauge portion running east from Diamond Creek connecting to the Goonyella rail line south of Moranbah.

The quarries will also provide material to upgrade local infrastructure and roads as agreed with Isaac Regional Council (IRC) and possibly provide material fill to other future Adani projects in the area.

1.1 Quarry overview

The location of the Project and the quarries included in this preliminary closure and rehabilitation strategy are shown in Figure 1.1. The following sections provide a summary overview of each the quarries included in this preliminary closure and rehabilitation strategy.

1.1.1 Moray

The proposed Moray Quarry (Moray Quarry) is 145 km north of Clermont in the Isaac Regional Council (IRC) area. The site is bounded by Bulliwallah Road to the east and Moray Carmichael Road to the south-east located on Lot 662 PH1491. The lots are zoned Rural under the *Belyando Shire Planning Scheme 2009* and are primarily used for agricultural activities.

The Moray Quarry will be an expansion of an existing quarry.

1.1.2 North Creek Quarry

The proposed North Creek Quarry (North Creek Quarry) is 135 km north of Clermont in the IRC area. The site is adjacent to the eastern side of Bulliwallah Road, which connects to Moray Carmichael Road in the south and the Gregory Development Road in the north adjacent to the eastern side of Bulliwallah Road located on lot Lot 2 SP119925. The lot is zoned Rural under the *Belyando Shire Planning Scheme 2009*. The property is primarily used for agricultural activities.

Historically the North Creek Quarry has been used for quarrying operations.

1.1.3 Disney

The proposed Disney Quarry (Disney Quarry) is located 144 km north of Clermont in the IRC area. The site is located adjacent to the Gregory Development Road located on Lot 4 SP116046. The lot is zoned Rural under the *Belyando Shire Planning Scheme 2009* and are primarily used for agricultural activities.

The Disney Quarry is a combination of expansion to an existing extraction area in the north of the lot and developing a green field extraction area in the south.

1.1.4 Borrow 7

The proposed Borrow 7 Quarry (Borrow 7 Quarry) is located approximately 120 km north-west of Clermont in the IRC area. The site is approximately 5 km west of the Gregory Development Road and accessed through an existing internal property track that connects to Twin Hills Road and the Gregory Development Road located on Lot 3235 PH752. The lot is zoned Rural under the *Belyando Shire Planning Scheme 2009* and is primarily used for agricultural activities.

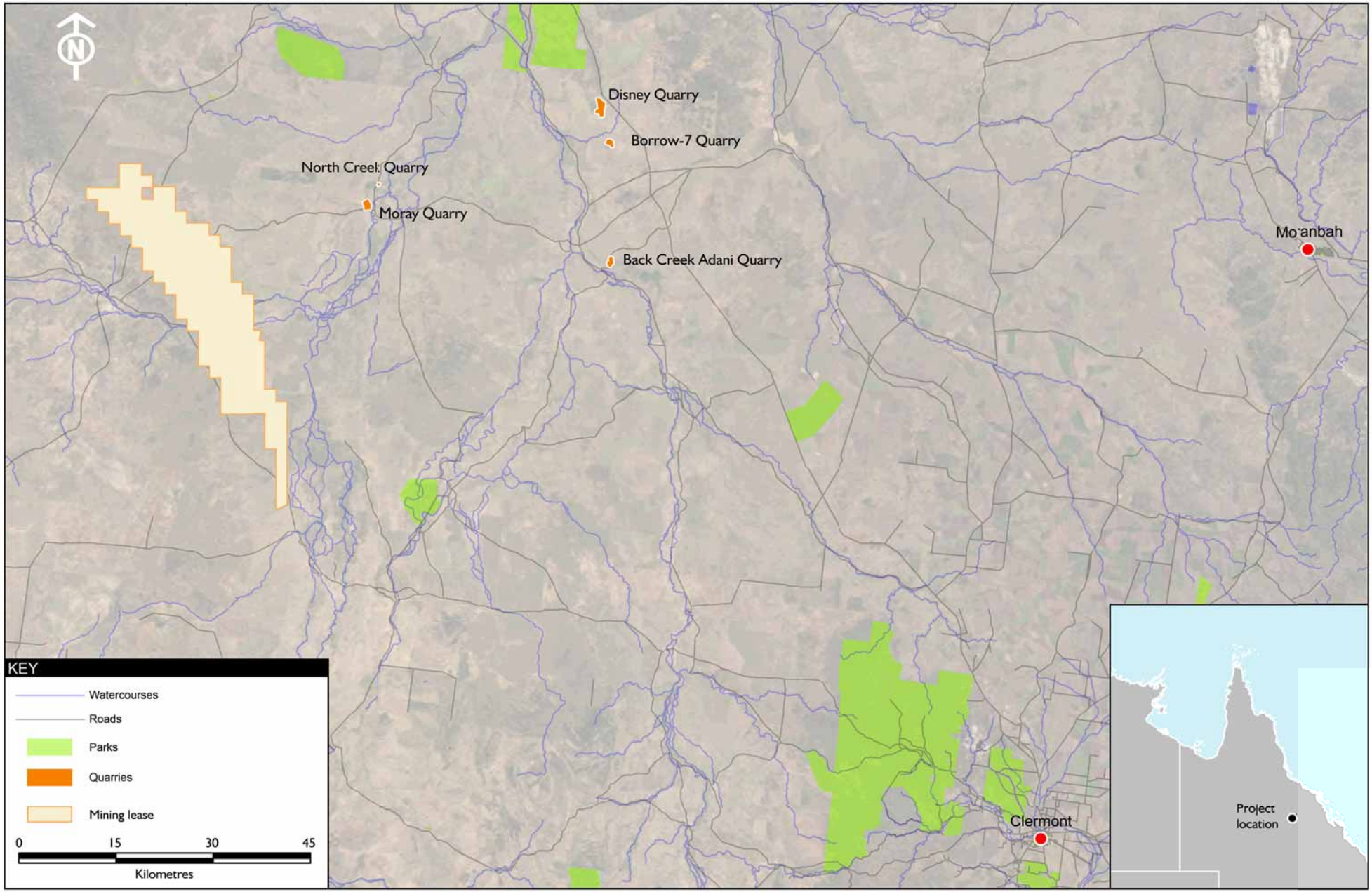
The Borrow 7 Quarry is a green field site.

1.1.5 South Back Creek

The proposed South Back Creek Quarry (South Back Creek Quarry) is approximately 102 km north-west of Clermont in the IRC area. The site is approximately 10 km west of the Gregory Development Road, and will be existing roads. The quarry is located on Lot 656 SP138788. The lot is zoned Rural under the *Belyando Shire Planning Scheme 2009* and is primarily used for agricultural activities.

1.2 Legislative and other obligations

This preliminary closure and rehabilitation strategy has been developed based on relevant legislative requirements, noting that such legislative requirements may be different at the time of closure and rehabilitation. Relevant legislative and other obligation and their potential impact on closure and rehabilitation is summarised in Appendix A.



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Quarry and mine locations

Rehabilitation management plan (quarry)

Figure 1.1

1.3 Preliminary closure and rehabilitation strategy structure

This preliminary closure and rehabilitation strategy incorporates rehabilitation objectives, an overall management strategy and general rehabilitation methods for the quarries shown in (Figure 1.1). The preliminary closure and rehabilitation strategy is structured as follows:

- Chapter 2 describes delegation and review for the implementation and delivery of this preliminary closure and rehabilitation strategy.
- Chapter 3 presents a summary of the proposed rehabilitation schedule. The individual quarry schedules are described in greater detail in Appendix A and Appendix C.
- Chapter 4 describes the preferred rehabilitation strategy for each quarry domain. The domains are common to all quarries. The chapter also describes how the preferred closure strategy differs from the pre-activity good quality agricultural land assessment (GQAL) assessment.
- Chapter 5 describes general rehabilitation activates that are common to all quarries.
- Chapter 6 describes completion criteria for how to measure whether the rehabilitation strategies have been successful.
- Chapter 7 describes monitoring hat is required to measure the completion criteria described in Chapter 6 as well as intervention/maintenance.

2 Delegation and review

2.1 Roles and responsibilities

Table 2.1 Role and responsibilities

Role	Responsibility
Quarry Manager or representative	Ensure that adequate resources are available within Adani and ensure that contractors meet all compliance requirements.
	Implement the preliminary closure and rehabilitation strategy.
	Facilitate rehabilitation planning review.
Environment Manager or representative	Implement the preliminary closure and rehabilitation strategy.
	Review, update and further develop the preliminary 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 preliminary closure and rehabilitation strategy.
	Report non-conformances to Quarry Manager or representative and ensure corrective actions are closed out.
	Advise Quarry 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 Quarry Manager or representative.
Employees	Be familiar with the contents of this preliminary closure and rehabilitation strategy.
	Ensure works are completed in accordance with the preliminary closure and rehabilitation strategy.
	Report all incidents or non-compliance with the preliminary closure and rehabilitation strategy to the Quarry Manager immediately.
Contractors	Be familiar with this preliminary closure and rehabilitation strategy.
	Ensure works are completed in accordance with the preliminary closure and rehabilitation strategy.
	Report all incidents or non-compliance with the preliminary closure and rehabilitation strategy to the Quarry Manager immediately.

2.2 Review

The preliminary closure and rehabilitation strategy will be reviewed annually throughout the life of the quarries. As the operational plan changes or rehabilitation activities are completed, the preliminary closure and rehabilitation strategy will be updated to reflect these changes. One year prior to the confirmed closure date, the final quarries preliminary closure and rehabilitation strategy will be developed to properly address the post-quarry landscape for the sites.

3 Rehabilitation schedule

A conceptual quarry rehabilitation schedule is provided in Appendix A, developed from the proposed staged extraction and site layout. The proposed staged extraction and schematic site layout for each quarry is provided in Appendix C.

Table 3.1 provides a summary of the schedules for each quarry presented as Appendix A.

Table 3.1 Summary of rehabilitation schedule

Quarry	Disturbance area (ha)	Year quarrying starts	Year progressive rehabilitation starts	Year progressive rehabilitation ends	Total area rehabilitated (ha)
Moray	70.08	2014	2016	2018	70.08
North Creek	7.24	2014	2017	2018	7.24
Disney	99.27	2014	2018	2019	99.27
Borrow 7	36.17	2025	2025	end of mine life	36.17
South Back Creek	55.5	2014	TBA	2020	55.5

Notes: 1.Appendix A and Appendix C provides more detailed information for each quarry.

3.1 Unplanned closure

Closure of the quarries 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 quarry 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 Purpose and objectives

The objectives of rehabilitation are to:

- return the landscape outside of the quarry workings to a natural topography by removing stockpiles;
- ensure that rehabilitated areas are returned to a stable and functional state;
- ensure that the proposed land uses are functional and appropriate to the surroundings;
- limit the potential for soil erosion and sedimentation;
- ensure that soil material is stored and utilised in an appropriate manner; and
- ensure that the long-term stability of the site is provided through a sustainable vegetative cover.

This preliminary closure and rehabilitation strategy describes processes and methods to meet the above objectives.

The preliminary closure and rehabilitation strategy will evolve over time as activities progress and additional technical studies and investigations are completed. Future reviews of the preliminary closure and rehabilitation strategy may need to include expansion of the quarries dependent on demand from the Project or IRC.

This preliminary closure and rehabilitation strategy covers rehabilitation of all operational activities and associated infrastructure being undertaken as part of the quarries. Construction activities requiring rehabilitation at the quarries will be managed via the *Construction Operations Plan (Quarries)* with guidance from this preliminary closure and rehabilitation strategy.

4.2 Post-quarry land use strategy

Land uses in the area of the quarries are dominated by agriculture. The final land uses for quarries will aim to replicate the existing surrounding land uses.

In rehabilitated areas outside of the quarry workings a final land use of cultivation will be impeded by fractured rock within or at the surface of the soil profile. Abundant near-surface or surface pieces of fractured rock will limit the ability of the site to be practically and economically rehabilitated to agricultural production other than grazing.

The post-quarry land use strategy is to return land to Class C Good Quality Agricultural Land (GQAL). That is land suitable for improved or native pasture with limited or no cultivation. The exception to this may be the rehabilitated quarry workings which are likely to be Class D GQAL. That is, not suitable for agriculture due to extreme limitations such as slope angle, topsoil thickness, rock fragments or plant available water capacity.

4.3 Preliminary conceptual final landforms

4.3.1 Quarries

Rehabilitation is an essential component of quarry planning and development. Rehabilitation will be staged to limit the area of disturbed land open at any time.

Extraction areas will be rehabilitated. The following general rehabilitation strategy will be applied:

- all temporary infrastructure and facilities will be removed;
- disturbed land will be reinstated to a stable form similar to the surrounding contour of the land;
- there will be no void left as land will be re-profiled to the gully contour;
- permanent erosion and sediment controls will be designed to provide long-term stability;
- topsoil will be reinstated over the contoured profile;
- topsoil will be seeded with native grasses or sterile crops during initial reinstatement works to assist in stabilising the area and reducing the potential for weed outbreaks;
- allow natural regeneration of vegetation where viable, if not successful assisted regeneration using local species and sourced stock will be used;
- fertilisers and soil supplements will be used only as necessary, assessment and application procedures will be documented in the topsoil management plan;
- temporary access roads will be closed and rehabilitated to a condition compatible with the surrounding land; and
- weed control and ongoing monitoring will be implemented to ensure successful regeneration.

i Batter treatment

A cross-section showing three batter treatments is presented as Figure 4.1 for:

- Completely weathered rock – maximum slope angle of 27°, maximum bench height 8 m, max slope length of 30 m, batter preparation by blasting the final quarry face, finished with 0.5 m of topsoil from stockpiles;
- Highly to moderately weathered rock – maximum slope angle of 45°, maximum bench height 15 m, max slope length of 30 m, batter preparation by blasting the final quarry face, finished with 0.5 m of topsoil from stockpiles; and
- Fresh rock – maximum slope angle of 80 °(overall maximum slope angle 55°), maximum bench height 15 m, slope face scaled to dislodge loose rock, lip of the working face rounded with a hydraulic pick.

ii Bench treatment

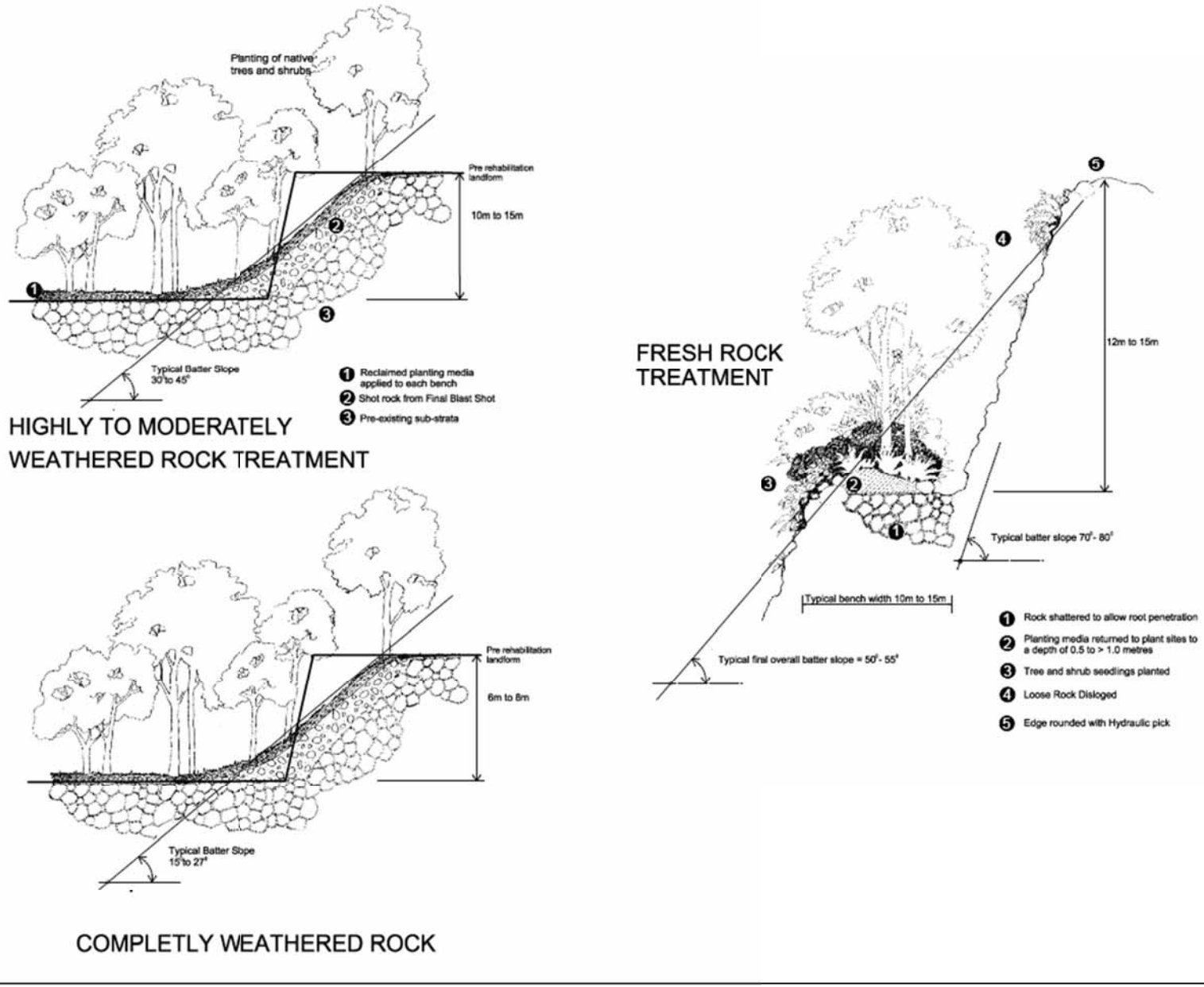
The topography of the final landform will consist of stepped benches formed in an amphitheatre configuration, each bench will be revegetated. A cross-section showing the bench treatment is presented as Figure 4.2.

Benches will be approximately 15 m wide and will be covered with 0.5 – 1 m of topsoil. The bench will include a bench drain graded towards an inter-bench drop drain. Topsoil will be prevented from eroding off the bench at the crest of the batter slope by the construction of an earthen barrier.

iii Surface water management

Inter-bench drop drains built from rip-rap will be constructed at no more than 10 m intervals. Refer to Figure 4.2 (long-section). The purpose of the inter-bench drop drains is to move surface water from the top to the bottom of the landscape and minimise the potential for erosion of the batters and benches.

The batter slope will be swaled so that small areas drain to each inter-bench drop drain.



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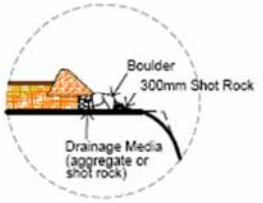
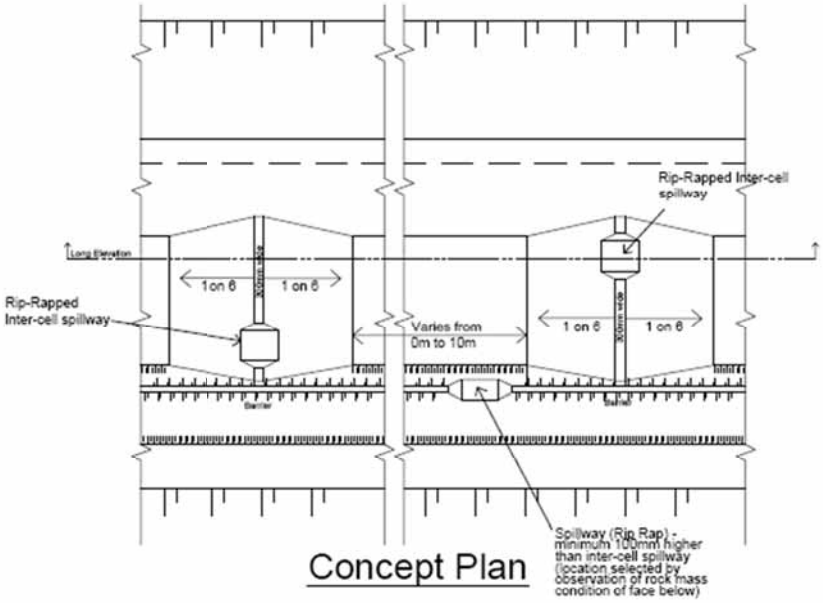
General batter slope treatments

Rehabilitation management plan (quarry)

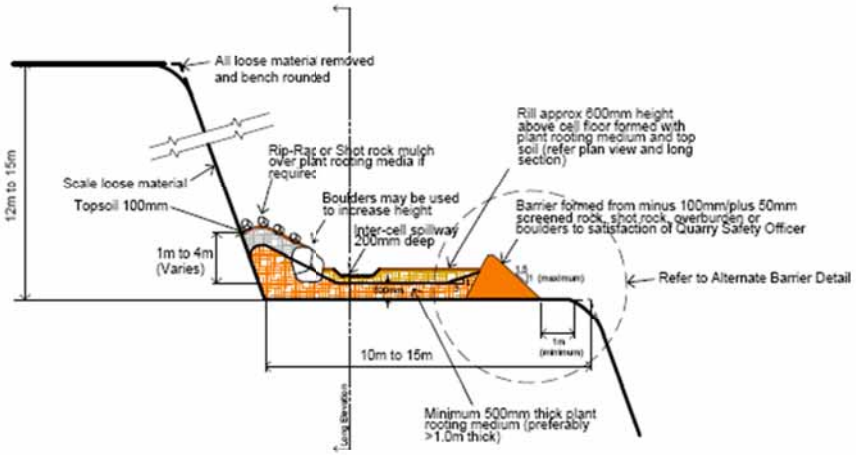
Figure 4.1



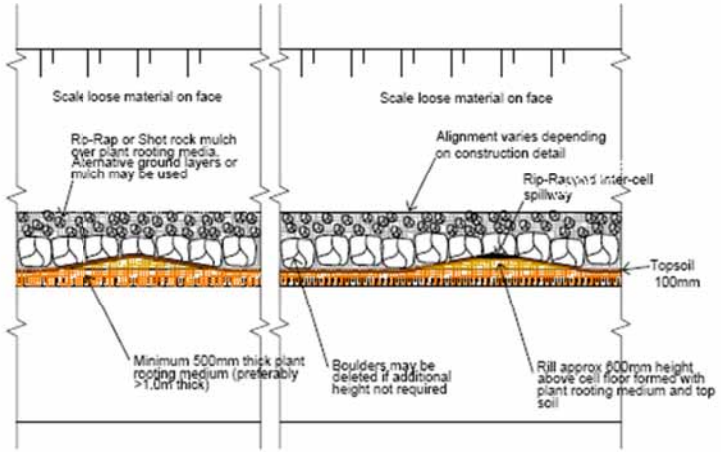
Alternate Barrier Detail



Concept Plan



Concept Cross Elevation



Concept Long Elevation

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General bench treatments

Rehabilitation management plan (quarry)

Figure 4.2

iv Revegetation

Revegetation will be carried out in consultation with the leaseholder and with the relevant government department or agency to ensure the measures proposed are acceptable and have a high likelihood of success.

Preference will be given to using endemic species to the quarries for revegetation. Vegetation clearing for grazing has been extensive on most of the quarry sites; however a pre-quarry vegetation survey identified a number of tree and grass species that will be useful in rehabilitation. Appendix D lists endemic tree and grass species by quarry location.

4.3.2 Infrastructure and buildings

Infrastructure at the quarries may include a combination of crushing and screening plants, offices, a weighbridge area and maintenance areas.

Prior to final decommissioning of infrastructure and buildings; alternative uses, resale and/or recycling will be investigated. A survey for hazardous materials will occur prior to any material being disturbed or removed from site.

All material that is able to be economically recycled will be removed from site. Material to be recycled includes waste metal and electrical goods. Where this is not possible, such as with concrete footings, they will be excavated to at least 1 m below the surface. Waste concrete may be used for fill within the quarry workings.

When infrastructure or buildings have been designated for decommissioning, the site will undergo a rigorous pre-demolition check. All sumps will be dewatered and de-silted. All associated equipment will be isolated, de-oiled, degassed and depressurised in an environmentally responsible manner.

Contaminated soil assessments will be conducted as required (Section 4.4). 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.

4.3.3 Site services

There are no site services that require rehabilitation at closure:

- site power will be provided by generator, which will be removed from site at closure;
- phone will be via satellite communication; and
- water will be sourced on site from rainwater or bore water, there will be no buried pipes.

4.3.4 Roadways, car parks and hardstands

The infrastructure area will include product stockpile areas, interconnecting roads and light vehicle car parks. Roadways, car parks and hardstands that are designated for decommissioning and are no longer useful for grazing or conservation land uses will be rehabilitated as early as possible.

Sealed areas will initially require removal of the bituminous seal which will be tested for contaminants. Contaminated bitumen will be removed from site with the remaining being used for fill in the quarry workings. The gravel layer will then be removed using a scraper or front end loader in order to minimise the removal of soil (ie topsoil/subsoil). The mixture of gravel and soil will be separated or reused for fill in the quarry workings. Where possible rehabilitated areas will be re-profiled so that they are consistent with the surrounding landscape.

The roadways, car parks and hardstands will be deep ripped to alleviate compaction, topsoiled, seeded and watered.

4.3.5 Re-fuelling area and lubricant storage area

The quarries will have an on-site bunded re-fuelling area. Contaminated soil assessments will be conducted as required (Section 4.4). Any waste, 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.

4.3.6 Retention dams, diversions and surface water features

Drainage will be influenced by a series of contour banks and retention dams which will be installed for sediment control and capture of water for dust suppression. The retention dams and contour drains will be retained for grazing.

The retention dams may receive surface run-off from the rehabilitated quarry drop drains.

4.4 Management of contaminated land

Areas of the quarry and associated facilities are likely to be deemed contaminated under the *Environmental Protection* (EP) *Act 1994*. The CLR and Environmental 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 closure.

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 closure. 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.

5 General rehabilitation activities

5.1 Decommissioning

Site specific decommissioning plans will be developed for each quarry closer to closure. The plans will deal specifically with each sites equipment inventory and the potential for scrap and salvage.

Each quarries decommissioning pans will also specifically detail how:

- operations will be completed including equipment isolation;
- to dispose of chemicals stored on site (if there are any); and
- the site will be handed over to a demolition contractor.

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 the quarries. Topsoil management during the construction and operation of the quarries will include activities such as vegetation clearing, topsoil stripping, subsoil stripping, stockpiling, re-profiling, ripping to remove compaction 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;
- if required, a procedure for testing stockpiled topsoil and subsoil for its physical and chemical properties;
- if required, a procedure for amelioration/improvement of topsoil and subsoil based on results of physical and chemical testing;
- topsoil stripping quantities formulated from pre-activity soil survey information; and
- stripping and stockpile management.

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, controls for erosion by runoff will be through the construction of sediment ponds and through progressive rehabilitation. Sediment control will follow the ESCP.

5.2.3 Surface water management

Information on surface water conditions and proposed surface water management at the site are provided in detail, in Volume 4 Appendices B and K5 of the Supplementary EIS.

Currently surface water run-off at the site will be captured in retention dams. Surface water conditions and surface water management measures undertaken on site 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 closure and rehabilitation design. It is therefore recommended that additional information regarding surface water management is included in future iterations of this preliminary closure and rehabilitation strategy.

With respect to closure, the potential for surface water run-off to become contaminated by suspended solids will need to be taken into account.

5.2.4 Groundwater management

The standing water level ranges from approximately 12 m below ground level (m bgl) to greater than 27 m bgl. Site specific groundwater levels have not yet been undertaken as Adani is currently investigating water supply options which may include groundwater or harvesting stormwater and groundwater seepage.

The quarry workings are not expected to intercept groundwater and will remain dry post-rehabilitation. There is some potential for interception of the water table at Borrow 7. Further investigation is required to determine if interception will occur. If further investigation confirms that groundwater will be intercepted at Borrow 7 then this preliminary closure and rehabilitation strategy will be updated to reflect a new rehabilitation strategy.

If groundwater is used in the quarries then a groundwater monitoring program will be developed and will be described in the groundwater monitoring and management plan (GWMP). The GWMP will be updated on a regular basis. The GMMP will present rehabilitation objectives for groundwater and describe an ongoing monitoring program to ensure compliance.

5.2.5 Revegetation

A revegetation management plan will be developed for the quarries. Plant and grass species will be preferentially chosen from the lists provided in Appendix D. The specific species mix for each quarry 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, natural regrowth 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 and feral animal control

A weed and feral animal management plan will be developed for the quarries.

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 off-site 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 done;
- a weed and pest control program will be developed and implemented if required.

Feral animal control will be assessed regularly and acted upon on a need-to basis.

6 Completion criteria

Completion criteria for quarries are presented as Table 6.1. The completion criteria have been presented aligning to the phase of closure relevant to the quarries. 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.

A post-activity land use strategy for the quarries is described in Section 4.2.

6.1 Interpretation of completion criteria table (Table 6.1)

All reporting is to be completed as an annual rehabilitation monitoring report unless otherwise specified in Table 6.1. 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 preliminary closure and rehabilitation strategy incorporating criteria from the environmental authority.

Table 6.1 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 6.1 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.

Table 6.1 Summary of completion criteria

Phase	Objective	Completion criteria	Indicator that completion criteria is being met
Decommissioning.	All quarry 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.
	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.	Completely weathered rock – maximum slope angle of 27°, maximum bench height 8 m, max slope length of 30 m, batter preparation by blasting the final quarry face, finished with 0.5 m of topsoil from stockpiles; Highly to moderately weathered rock – maximum slope angle of 45°, maximum bench height 15 m, max slope length of 30 m, batter preparation by blasting the final quarry face, finished with 0.5 m of topsoil from stockpiles; and Fresh rock – maximum slope angle of 80 °(overall maximum slope angle 55°), maximum bench height 15 m, slope face scaled to dislodge loose rock, lip of the working face rounded with a hydraulic pick.	As built design reports. No evidence of slumping of slopes. Certification of slopes and quarry workings by an appropriately qualified person. Geotechnical stability of and geotechnical investigations demonstrate that stability 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 quarry workings.
	The contour banks and inter-bench drop drains 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 banks and drains meet approved design criteria. All regulated structures meet design criteria. All non-permanent structures are decommissioned in accordance with regulating	Certification by an appropriately qualified person.

Table 6.1 Summary of completion criteria

Phase	Objective	Completion criteria	Indicator that completion criteria is being met
		authority requirements.	
	Topsoil replacement consistent with pre-activity quarry 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 contamination.	Surface and groundwater quality is as predicted and stable.	Certification by an appropriately qualified person that the specified controls and cover is in place (as-built report)
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.

Table 6.1 Summary of completion criteria

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, herbs 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; Erosion type and severity; Deposited materials; Surface resistance to disturbance; Slake test; Compaction; and Surface roughness.	Final landform closure report.
	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 quarry land use are sustaining an equal rate than that calculated for relevant reference site.

Table 6.1 Summary of completion criteria

Phase	Objective	Completion criteria	Indicator that completion criteria is being met
		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-activity 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 preliminary closure and rehabilitation strategy describes conceptual monitoring and maintenance activities that will be undertaken post-rehabilitation.

The post-rehabilitation phase commences upon completion of the preliminary closure and rehabilitation 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 closure 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 preliminary closure and rehabilitation strategy develops in the future.

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

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

All monitoring will conclude 12 months after quarry activity ends.

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 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 quarries. Monitoring will conclude 12 months after quarry activity ends.

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

Monitoring will conclude 12 months after quarry activity ends.

7.3 Dust monitoring and analysis

Dust monitoring and analyses will be conducted to assess the quality of post-rehabilitation 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 will only occur during rehabilitation earthworks.

7.4 Rehabilitation monitoring

Land function stability analysis will be undertaken for the following indicators:

- soil cover;
- erosion type and severity;
- deposited materials;

- surface resistance to disturbance;
- slake test;
- compaction;
- surface roughness; and
- safe carry capacity for cattle

Monitoring will be concluded 12 months after quarry activity ends.

The procedure for completing landform function analysis will be documented in the rehabilitation monitoring management plan.

7.5 Weed and feral animal control

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

7.6 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

Legislative and other requirements

A critical factor in defining the scope and context of closure and rehabilitation is to identify and evaluate the legal and other obligations that affect closure and rehabilitation. Legal requirements for closure and 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 B.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.

Appendix B

Closure and rehabilitation schedule

Table B.1 Moray: closure and rehabilitation schedule

Area	Area of disturbance (ha)	Year of extraction	Year of rehabilitation
1	9.25	2016 -2017	2018
2	9.88	2016 - 2017	2018
3	10.08	2015 -2016	2017
4	10.47	2015 - 2016	2017
5	8.17	2014 -2015	2016
6	7.82	2014 -2015	2016
7	7.37	2014 -2015	2016
8	7.04	2014 -2015	2016
Total	**70.08**	**-**	

Notes: 1.Refer to Appendix C for staged extraction and schematic site layout plan

Table B.2 North Creek: closure and rehabilitation schedule

Area	Area of disturbance (ha)	Year of extraction	Year of rehabilitation
1	7.24	2014 - 2017	2017-18
Total	**7.24**	**-**	

Notes: 1.Refer to Appendix C for staged extraction and schematic site layout plan

Table B.3 Disney: closure and rehabilitation schedule

Area	Area of disturbance/rehabilitation (ha)	Year of extraction	Year of rehabilitation
1	63.64	2014 – 2018	2018
2	25.12	2016 - 2018	2018
3	10.51	2018 - 2019	2019
Total	**99.27**	**-**	

Notes: 1.Refer to Appendix C for staged extraction and schematic site layout plan

Table B.4 Borrow 7: closure and rehabilitation schedule

Area	Area of disturbance (ha)	Year of extraction	Year of rehabilitation
1	36.17	2014 to Life of Mine	End of Life of Mine
Total	**36.17**	**-**	

Notes: 1.Refer to Appendix C for staged extraction and schematic site layout plan

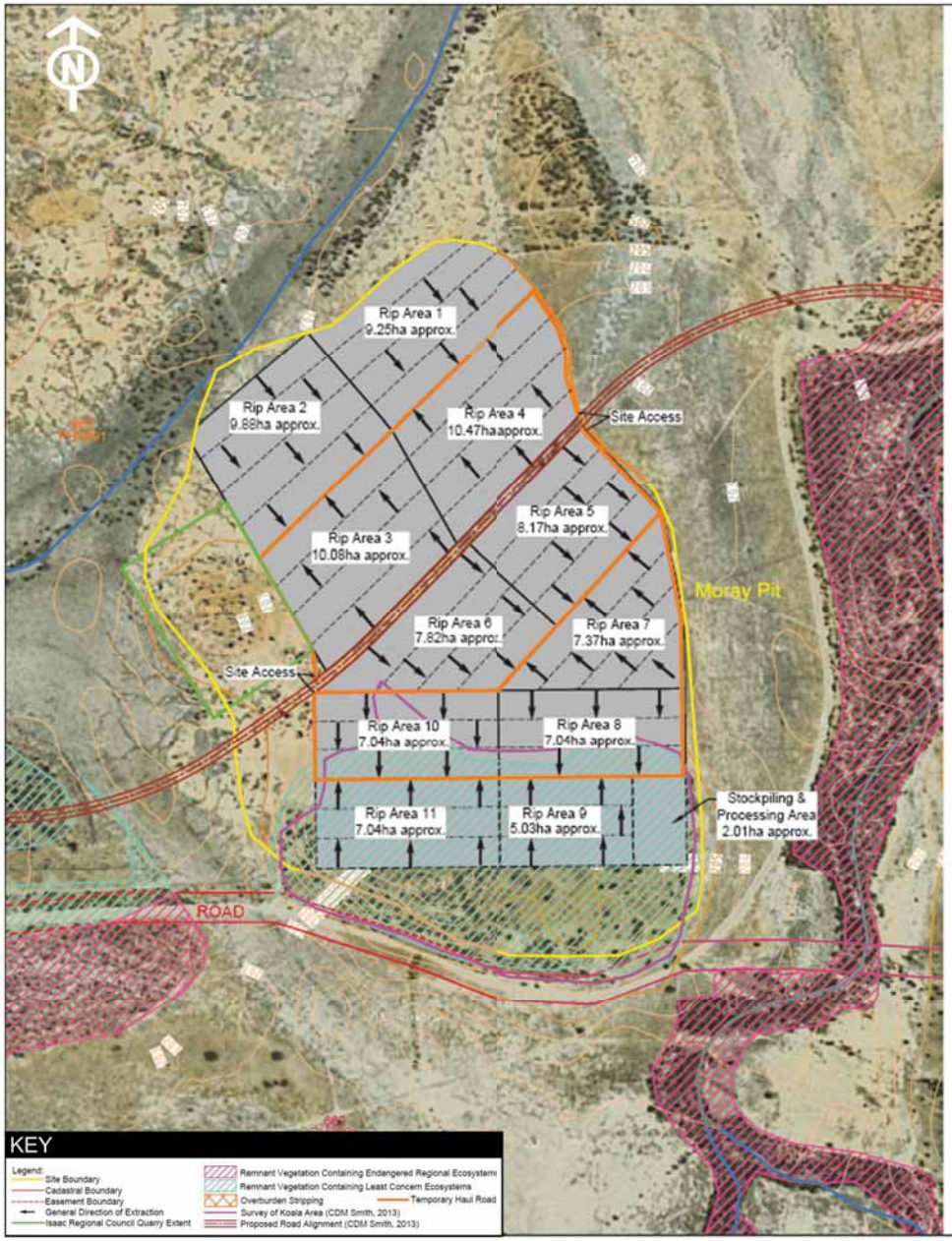
Table B.5 South Bank Creek: closure and rehabilitation schedule

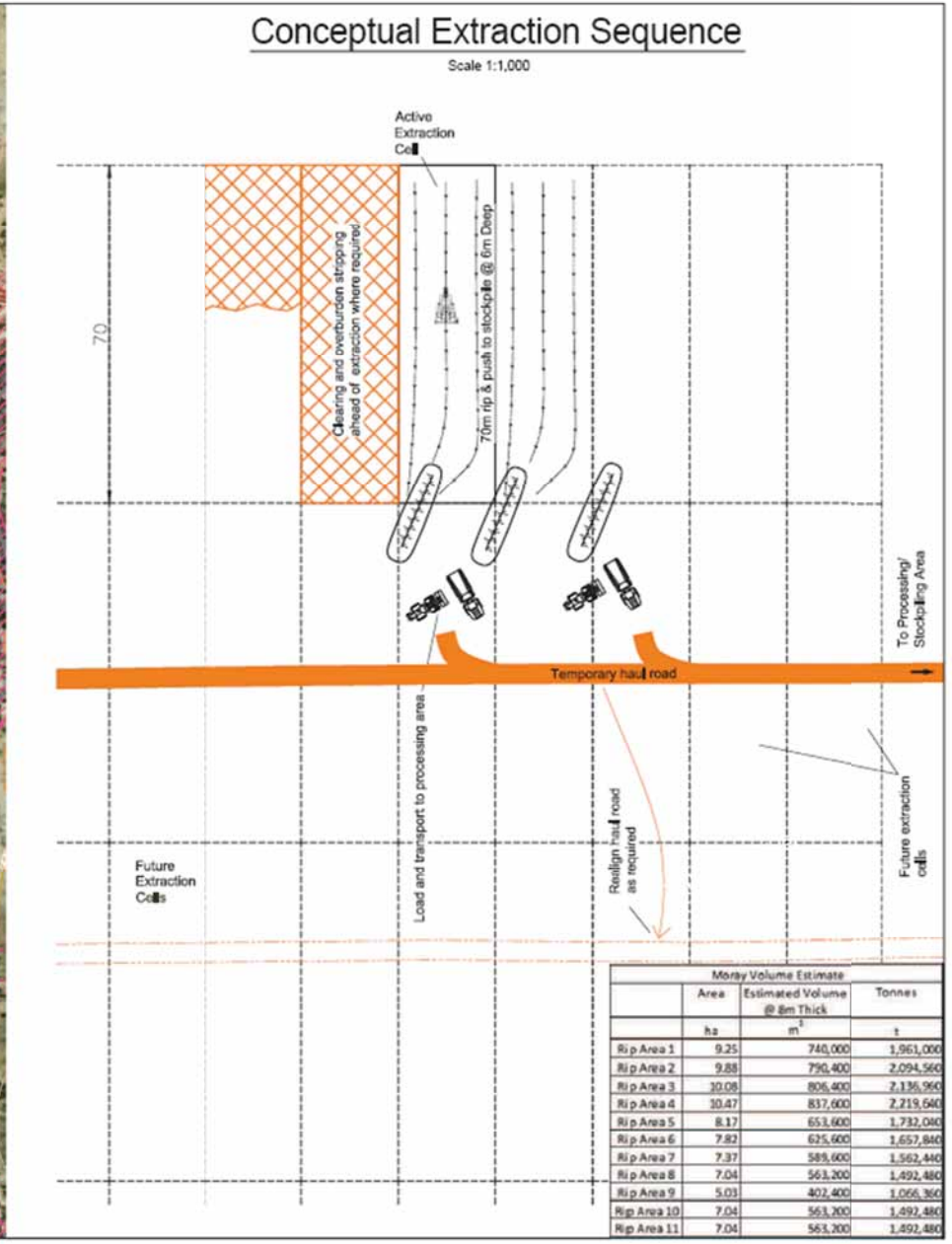
Area	Area of disturbance (ha)	Year of extraction	Year of rehabilitation
1	27.8	2014 - 2020	2020
Total	**27.8**	**-**	

Notes: 1.Refer to Appendix C for staged extraction and schematic site layout plan

Appendix C

Staged extraction and schematic site layout





Moray Volume Estimate			
	Area	Estimated Volume @ 8m Thick	Tonnes
	ha	m^3	t
Rip Area 1	9.25	740,000	1,961,000
Rip Area 2	9.88	790,400	2,094,560
Rip Area 3	10.08	806,400	2,136,960
Rip Area 4	10.47	837,600	2,219,640
Rip Area 5	8.17	653,600	1,732,040
Rip Area 6	7.82	625,600	1,657,840
Rip Area 7	7.37	589,600	1,562,440
Rip Area 8	7.04	563,200	1,492,480
Rip Area 9	5.03	402,400	1,066,360
Rip Area 10	7.04	563,200	1,492,480
Rip Area 11	7.04	563,200	1,492,480

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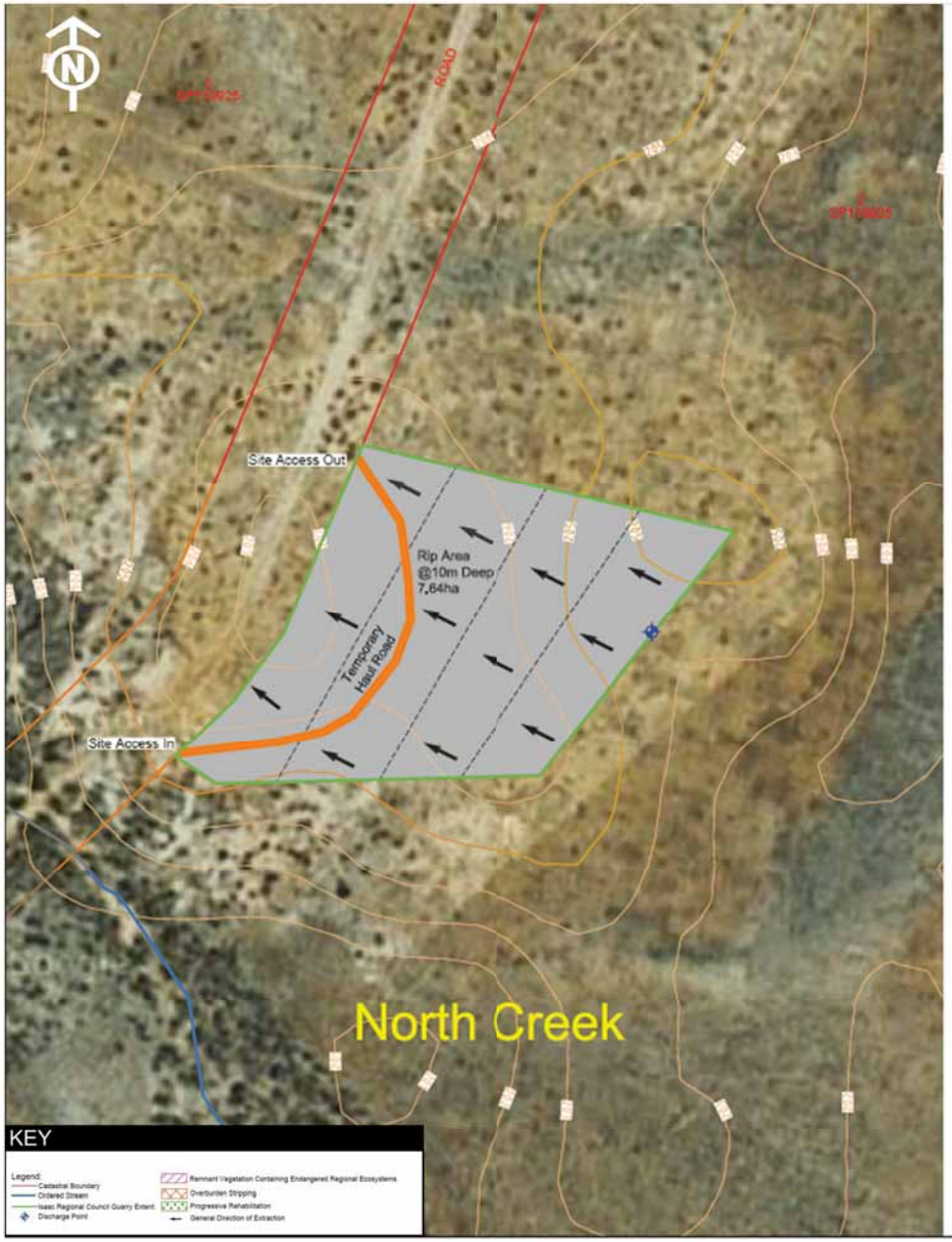
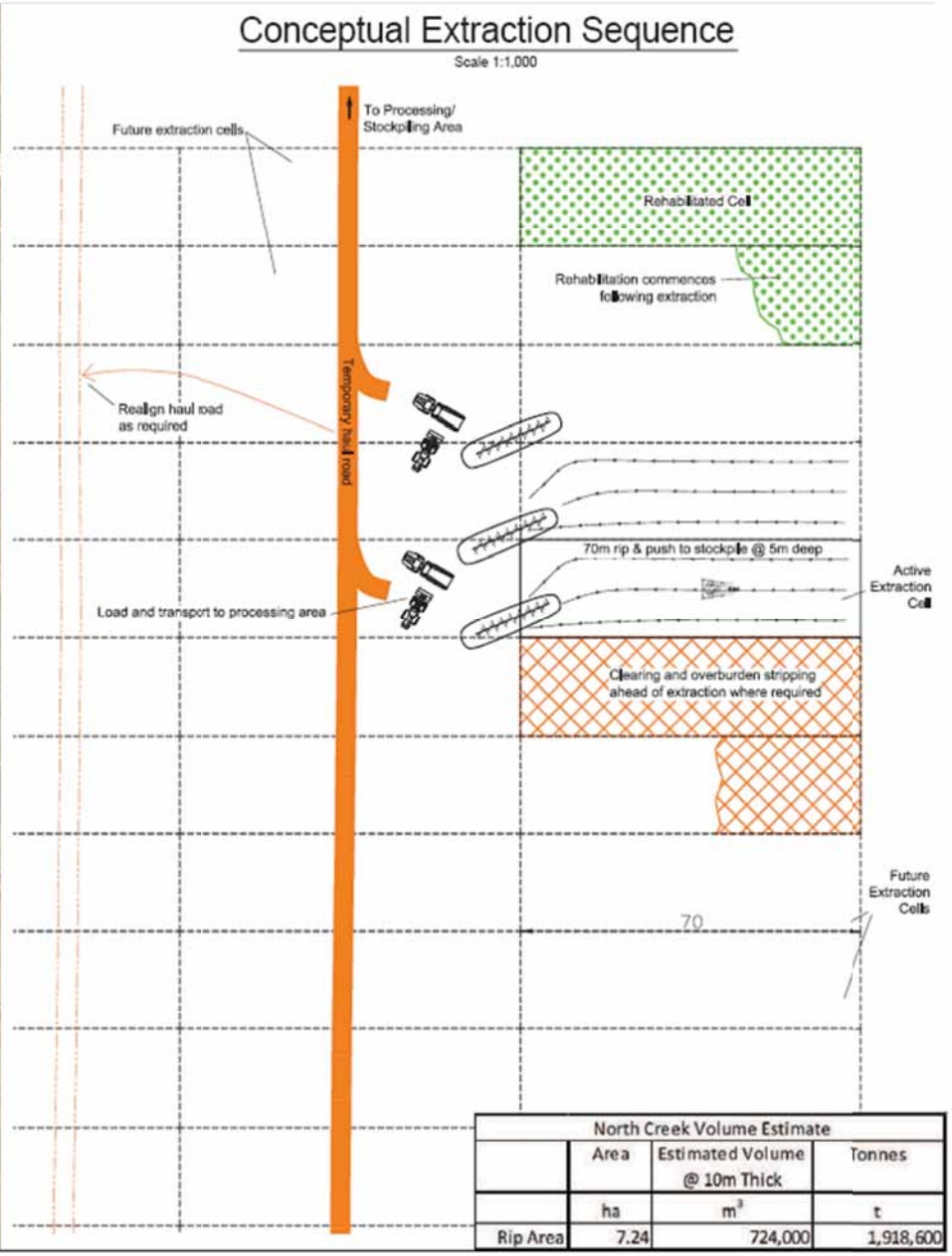
Moray Stage 1: Extraction and schematic site layout

Rehabilitation management plan (quarry)

Figure C.1





North Creek Volume Estimate			
	Area	Estimated Volume @ 10m Thick	Tonnes
	ha	m^3	t
Rip Area	7.24	724,000	1,918,600

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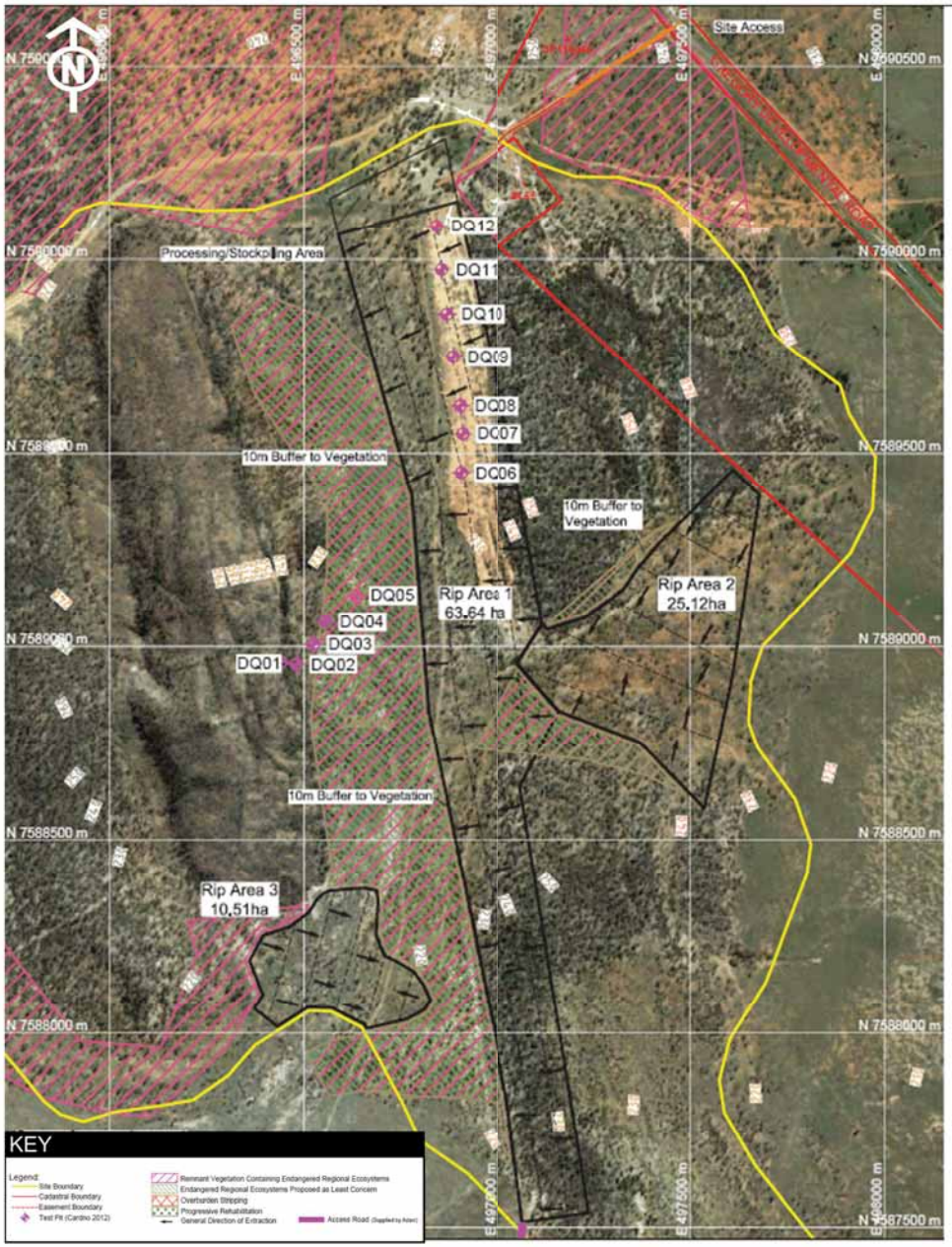
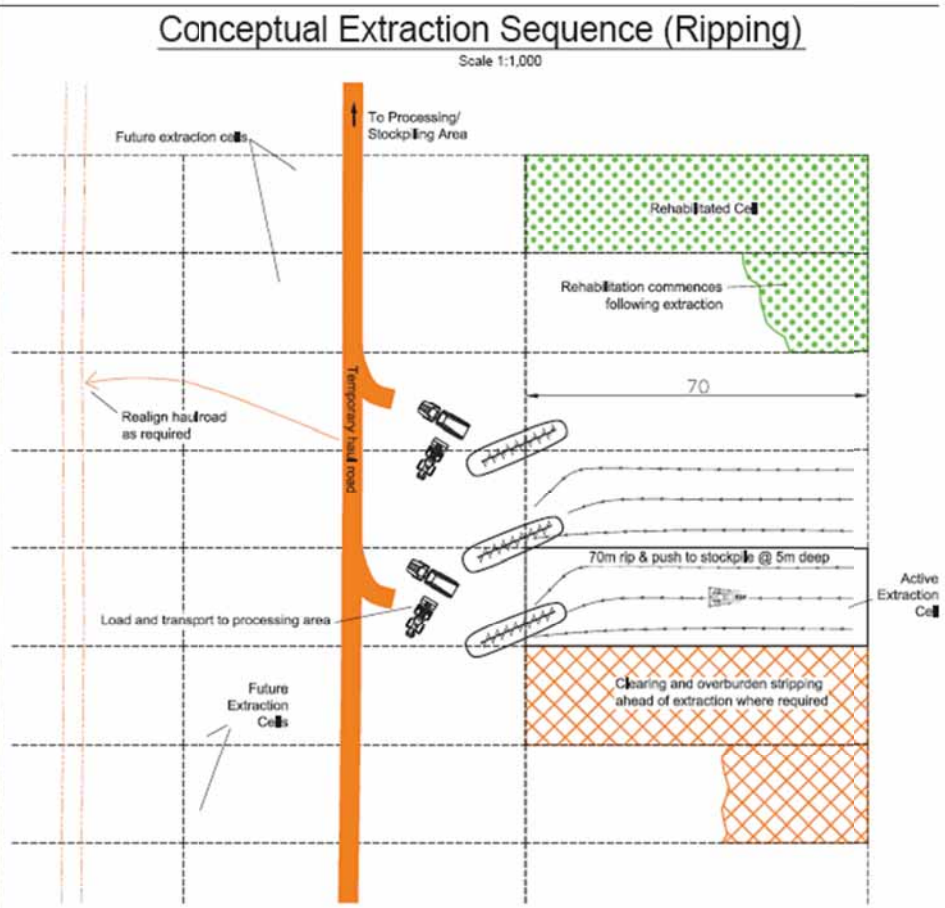
North Creek: Extraction and schematic site layout

Rehabilitation management plan (quarry)

Figure C.2





NOTE: Extraction Areas will require conventional drill and blast techniques

Disney Volume Estimate			
	Area	Estimated Volume @ 5m Thick	Tonnes
	ha	m^3	t
Rip Area 1	63.64	3,182,000	8,432,300
Rip Area 2	25.12	1,256,000	3,328,400
Rip Area 3	10.51	525,500	1,392,575

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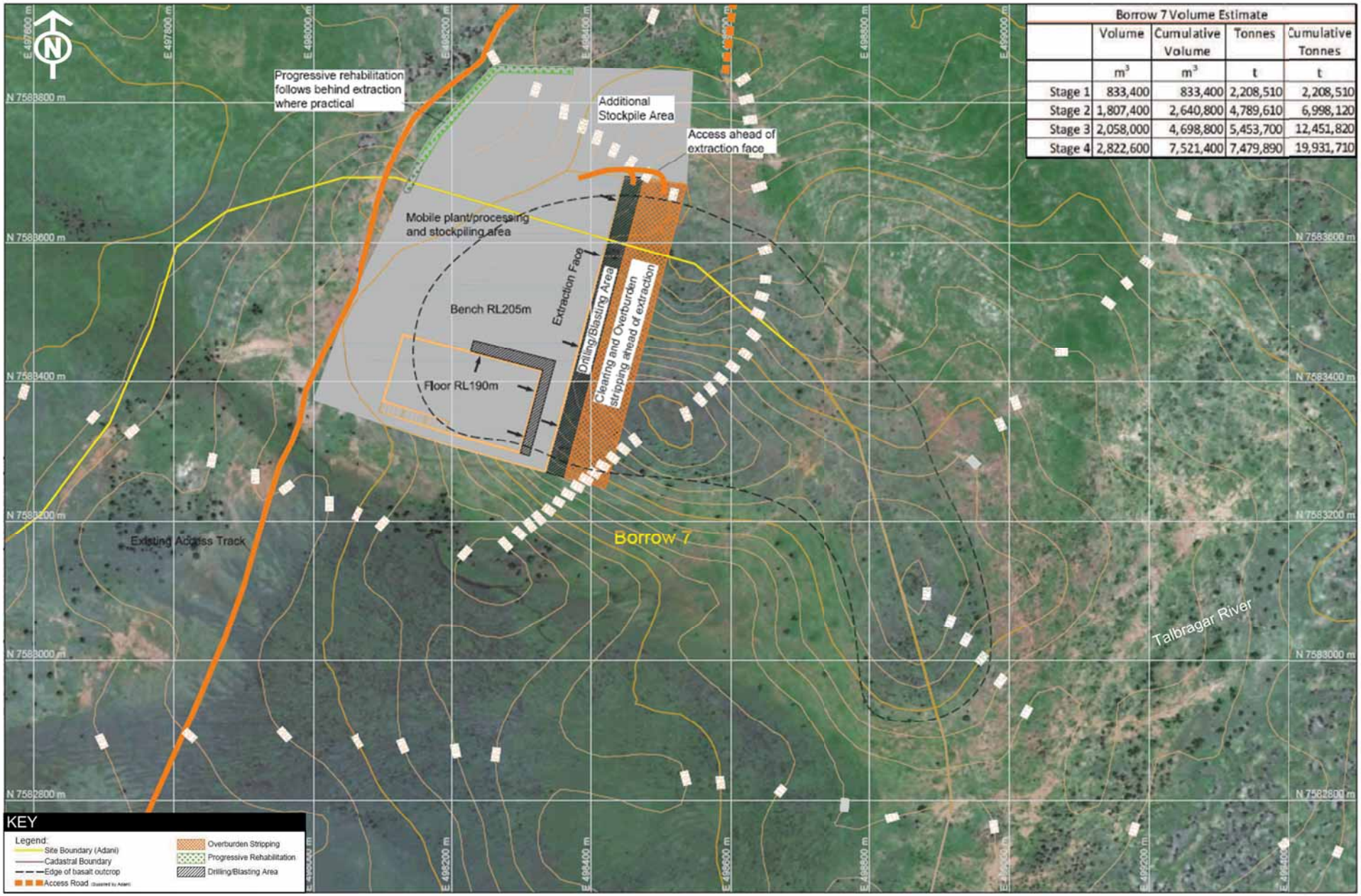
Disney: Extraction and schematic site layout

Rehabilitation management plan (quarry)

Figure C.3



Borrow 7 Volume Estimate				
	Volume	Cumulative Volume	Tonnes	Cumulative Tonnes
	m^3	m^3	t	t
Stage 1	833,400	833,400	2,208,510	2,208,510
Stage 2	1,807,400	2,640,800	4,789,610	6,998,120
Stage 3	2,058,000	4,698,800	5,453,700	12,451,820
Stage 4	2,822,600	7,521,400	7,479,890	19,931,710

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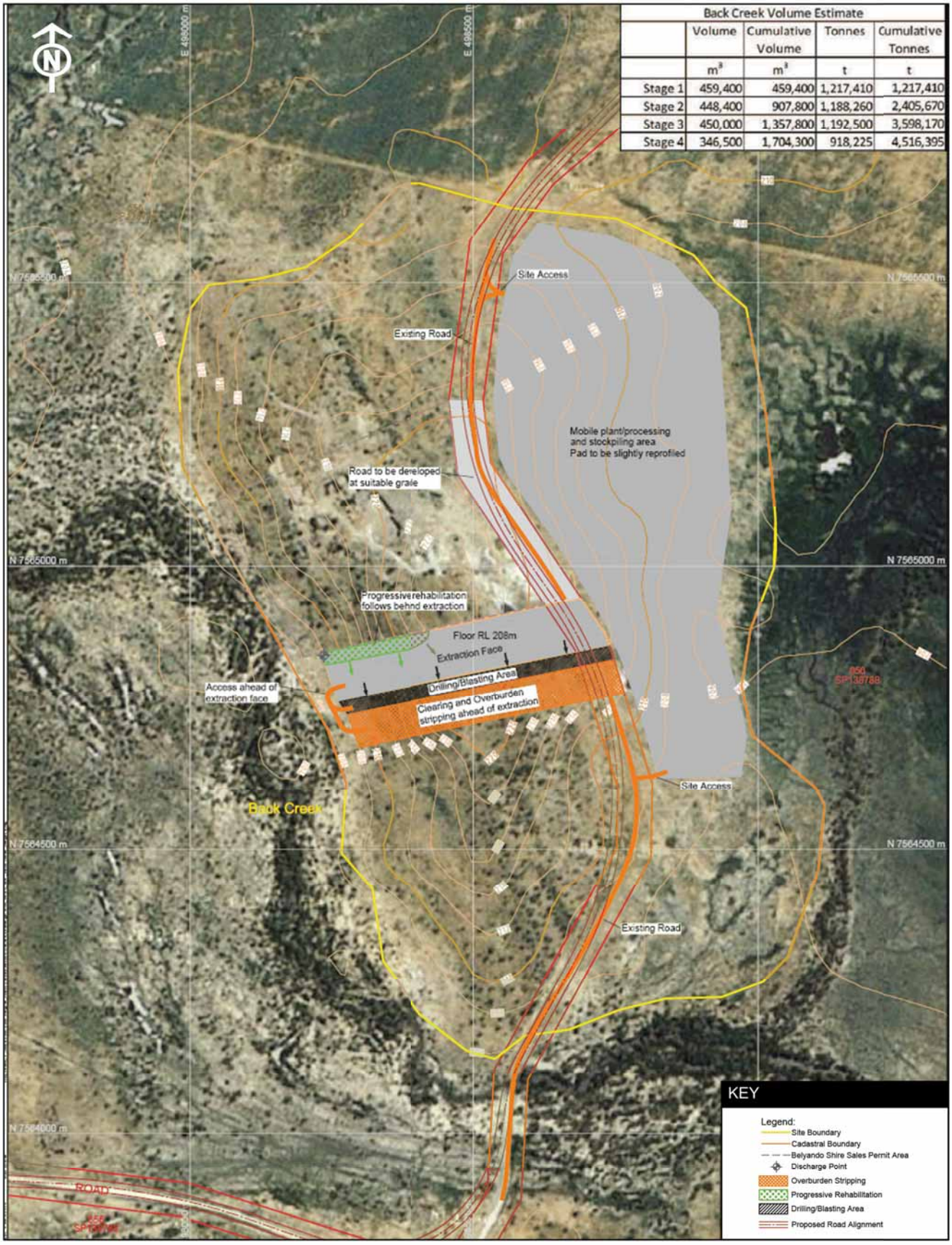
Borrow 7: Extraction and schematic site layout

Rehabilitation management plan (quarry)

Figure C.4



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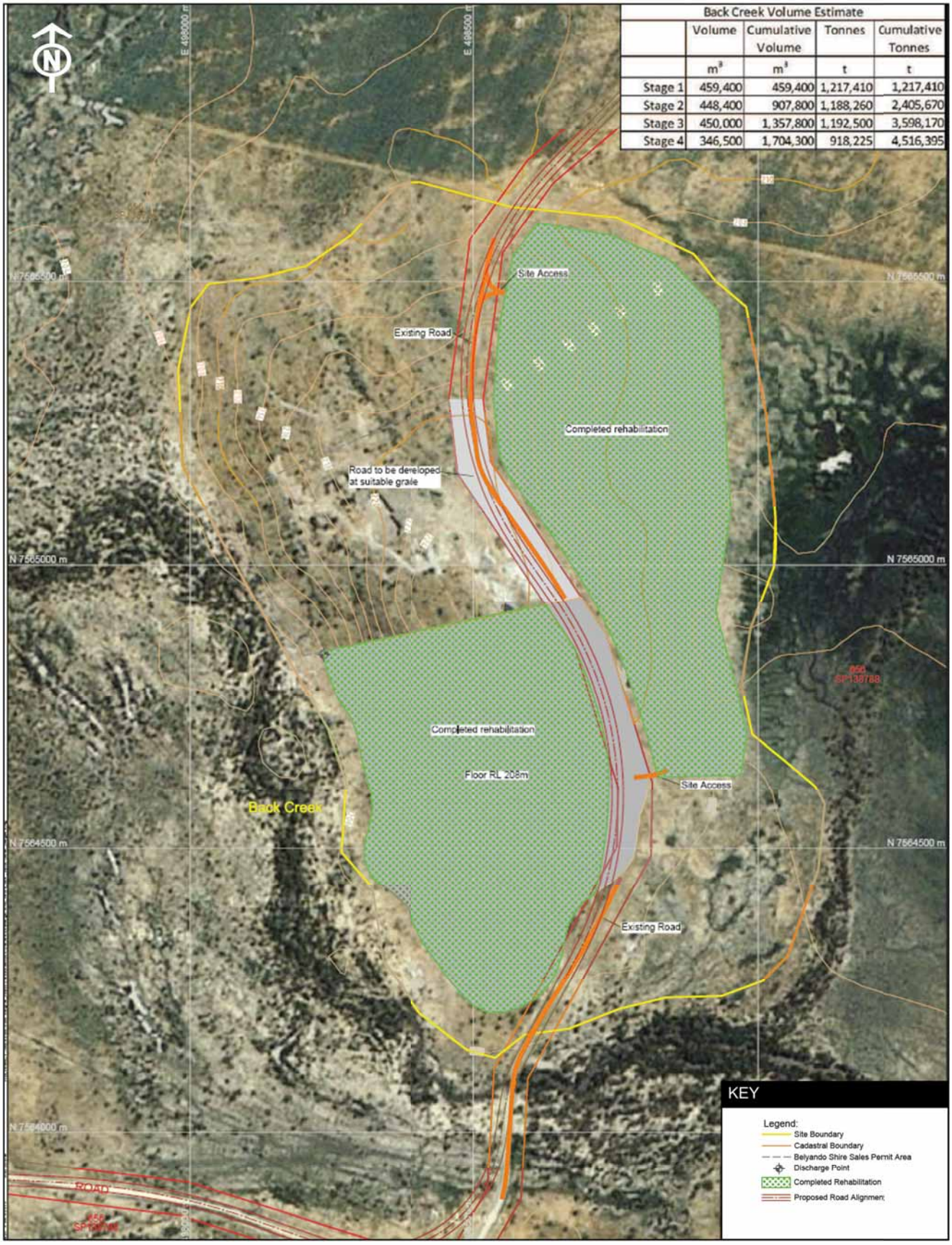
South Back Creek: Extraction and schematic site layout

Rehabilitation management plan (quarry)

Figure C.5



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South Back Creek: Extraction and schematic site layout

Rehabilitation management plan (quarry)

Figure C.5a

Appendix D

Plant and grass species for revegetation

Table D.1 Moray: species list

Scientific name	Common name
Acacia cambagei	Gidgee
Astrebla squarrosa	Bull Mitchell
Atalaya hemiglauca	Whitewood
Bothriochloa bladhii	Forest Blue-grass
Carissa ovata	Currant Bush
Chloris gayana	Rhodes Grass
Enneapogon nigricans	Black Heads
Flindersia dissosperma	Scrub Leopardwood
Pennisetum ciliare	Buffel Grass
Corymbia clarksoniana	Clarkson's Bloodwood
Corymbia dallachiana	Ghost Gum
Aristida latifolia	Feathertop Wiregrass
Acacia salicina	Sally Wattle
Eucalyptus brownii	Reid River Box
Lysiphyllum carronii	Red Bauhinia

Notes: 1.Species survey at site prior to quarry development

Table D.2 Disney: species list

Scientific name	Common name
Acacia decora	Showy Wattle
Alphitonia excelsa	Red Ash
Aristida latifolia	Feathertop Wiregrass
Breynia oblongifolia	Coffee Bush
Cassia brewsteri	Leichhardt Bean
Chrysocephalum apiculatum	Yellow Buttons
Citrus glauca	Desert Lime
Corymbia clarksoniana	Clarkson’s Bloodwood
Corymbia clarksoniana	Long Fruited Bloodwood
Corymbia dallachiana	Ghost Gum
Corymbia erythrophloia	Variable-barked Bloodwood
Dodonaea filifolia	Hop Bush
Erythroxylum australe	Dogwood
Eucalyptus brownii	Reid River Box
Eucalyptus crebra	Narrow-leaved Ironbark
Grewia retusifolia	Dogs Balls
Heteropogon contortus	Black Spear-grass
Hovea longipes	Hovea
Melaleuca nervosa	Paperbark
Melinis repens	Red Natal Grass
Panicum decompositum	Native Millet

Table D.2 Disney: species list

Scientific name	Common name
Pennisetum ciliare	Buffel Grass
Petalostigma pubescens	Quinine Bush
Pogonolobus reticulatus	Pogonolobus
Sida cordifolia	Flannel Weed
Terminalia oblongata	Yellowwood
Triodia mitchellii	Buck Spinifex

Notes: 1.Species survey at site prior to quarry development

Table D.3 North Creek: species list

Scientific name	Common name
Acacia excelsa	Ironwood
Carissa ovata	Currant Bush
Eucalyptus coolabah	Coolabah
Acacia excelsa	Ironwood
Owenia acidula	Emu Bush
Erythroxylum australe	Dogwood

Notes: 1.Species survey at site prior to quarry development

Table D.4 South Back Creek: species list

Scientific name	Common name
Eucalyptus crebra	Narrow-leaved Ironbark
Corymbia dallachiana	Ghost Gum
Flindersia dissosperma	Scrub Leopardwood
Acacia excelsa	Ironwood
Ventilago viminalis	Vine Tree
Arundinella nepalensis	Reed Grass
Heteropogon contortus	Black Spear Grass

Notes: 1.Species survey at site prior to quarry development

Table D.5 Borrow 7: species list

Scientific name	Common name
Corymbia dallachiana	Ghost Gum
Acacia excelsa	Ironwood
Flindersia dissosperma	Scrub Leopardwood
Acacia harpophylla	Brigalow
Lysiphyllum carronii	Native Bauhinia
Grevillea striata	Beefwood
Petalostigma pubescens	Quinine Bush
Atalaya hemiglauca	Whitewood
Carissa ovata	Currant Bush
Capparis lasiantha	Wait-a-While
Archidendropsis basaltica	Dead Finish
Eremophila deserti	Turkey Bush
Grewia latifolia	Dogs Balls
Eremophila mitchellii	False Sandalwood
Owenia acidula	Emu Bush
Eragrostis sororia	Love Grass
Heteropogon contortus	Black Spear Grass
Themeda triandra	Kangaroo Grass
Aristida latifolia	Feathertop Wiregrass
Lysiphyllum carronii	Red Bauhinia

Notes: 1.Species survey at site prior to quarry development

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