roy hill iron ore pty ltd | june 2009








roy hill 1 iron ore mining project

stage 1 public environmental review conceptual closure and rehabilitation management plan

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1 Introduction

1.1 Project overview

The Roy Hill 1 Project has a total operating life of approximately 20 years; however the operation will be divided into two stages. The scope of the two stages is described below:

- Stage 1: construction of all infrastructure to meet the full 20 year life of mine, plus mining and processing ore from the Stage 1 Mining Area. Dewatering to provide 'dry' mining conditions in the Stage 1 area and advanced dewatering from future mining areas in Stage 2 in the southeast of the project area will supply the majority of water for operations. Additional water from opportunistic capture of rainfall will also be used to make up any shortfall. This will mean that all water requirements for Stage 1 would be sourced entirely from within the Project area and an external water supply would not be required. Saline water produced from dewatering will be disposed in an evaporation pond.
- Stage 2: mining and processing ore from the Stage 2 Mining Area and an external water supply.

1.2 Purpose of this document

The purpose of this document is to set out RHIO's commitments for establishment of a Mine Closure and Rehabilitation Management Strategy for the Project following cessation of mining and processing activities.

1.2.1 Objectives

An important aspect of mine closure is the identification of the appropriate post-closure land use. Historically the land on which the Project is situated has been used for pastoral activities. It is likely that following mine closure and rehabilitation the land will be returned to pastoral use and responsibility for the management of the land vested with the Pastoral Lands Board. To achieve mine closure and lease relinquishment the management plan needs to establish some agreed, measurable and achievable closure criteria with the responsible authorities.

To meet the requirements of the potential post-closure land uses, the objectives of the Conceptual Mine Closure and Rehabilitation Management Plan (CCRMP) are to:

1. Create a safe, stable and non-polluting landform that supports self sustaining native vegetation comprised of local provenance species and minimises erosion.
2. Maintain surface water inflow into the Fortescue Marsh (the Marsh) and minimise impacts of interrupted surface flows on downstream ecosystems;
3. Recreate a self sustaining and functioning ecosystem comparable as far as possible to the pre-mining environment;
4. Salvage and appropriately dispose of all redundant infrastructure at the conclusion of mining and mineral processing. Items with beneficial uses post-operations may be left in situ following negotiations with post-closure land users and regulators (roads, rail loop etc);
5. Disturbed areas to be left in a safe, stable, non-polluting and orderly state;
6. Monitor progressive rehabilitation activities and develop a post-closure monitoring program to ensure closure criteria are met; and
7. During operations, establish a stakeholder consultation forum to discuss closure planning processes and post-closure land use issues.

1.2.2 Relevant legislation and guidelines

In preparation of the CCRMP, the following legislation and industry guidance materials have been referred to:

- *Environmental Protection Act,* 1986 (WA);
- *Environmental Protection Regulations,* 1987 (WA);

- *Mining Act,* 1978 (WA);
- *Mining Regulations,* 1981(WA);
- Environmental Protection Authority (EPA). *Guidance for the Assessment of Environmental Factors – Rehabilitation of Terrestrial Ecosystems.* June 2006;
- Department of Industry and Resources (DoIR). *Mining Environmental Management Guidelines – Mining Proposals in WA.* February 2006;
- Department of Industry, Tourism and Resources (DITR). *Leading Practice Sustainable Development Program for the Mining Industry – Mine Closure and Completion.* October 2006; and
- Department of Industry, Tourism and Resources (DITR). *Leading Practice Sustainable Development Program for the Mining Industry – Mine Rehabilitation.* October 2006.

1.2.3 Responsibilities and reporting

The responsibility for the implementation of the Conceptual Mine Closure and Rehabilitation Management Plan rests with the management of RHIO. Internal reporting requirements are to be outlined by the management team and delegated to the relevant staff.

Closure and rehabilitation activities and processes are to be reported on an annual basis to the Department of Minerals and Petroleum (DMP), formerly called the Department of Industry and Resources (DoIR). The Annual Environmental Report (AER) process for mining tenements provides a suitable avenue of reporting to DMP. Additionally, results of rehabilitation trials will be used to update the details of the Mine Closure and Rehabilitation Plan during regular review periods.

1.2.4 Consultation

As the project commences and the closure planning process continues, stakeholder consultation and participation will be required. Consultation will enable stakeholders including government departments, non-government organisations, local communities, surrounding landowners, company management and employees an opportunity to provide input into the closure planning process.

1.2.5 Definitions

A list of terms used within this report and their definitions is presented in Table 1.1.

Table 1-1: Terms and definitions.

TERM	DEFINITION
Acid Mine Drainage (AMD)	Oxidation of sulphidic minerals, (ie pyrite) in mine wastes resulting in acidic drainage being generated.
Analogue	Unmined ecosystem against which a mined and rehabilitated ecosystem can be compared.
Backfilling	Refilling a excavation or mining void.
Berm	A horizontal shelf or ledge built into an embankment slope to disrupt the continuity of a slope and improve stability, or to control the flow of stormwater runoff.
Bund	A retaining structure constructed of earth and/or rock material.
Closure	A whole of mine life process which typically culminates in tenement relinquishment. It includes decommissioning and rehabilitation.
Completion or Closure Criteria	An agreed standard or level of performance which demonstrate successful closure of the operation.
Contaminated Site	A site at which hazardous substances occur at concentrations above background levels and where assessment shows it poses, or is likely to pose, an immediate or long-term hazard to human health or the environment.
Decommissioning	The process that begins near, or at, the cessation of mineral production and ends with removal of all unwanted infrastructure and services.
Ecosystem	A biological system whose members benefit from each other's participation via symbiotic relationships.
Encapsulation	Total enclosure of a waste in another material that isolates the waste material from outside conditions (typically infiltrating water and oxygen).
Final Void	The remnant open pit left at mine closure.
Footprint	The surface area disturbed by mining operations and associated supporting infrastructure.
Functional Ecosystem	An ecosystem that is stable (not subject to high rates of erosion), effective at retaining water and nutrients and is self sustaining.
Interested party	A person, group or organisation with an interest in the process of, or outcome of, mine closure.
Local provenance	Plants whose native origin is close to the location where they are to be used during revegetation activities.
Overtopping	Water or tailings residue breaching the top of the containment structure.
Post-mining land use	Term used to describe a land use which occurs after the cessation of mining operations.
Provision	A financial accrual based on a cost estimate of the closure activities.
Rehabilitation	The return of disturbed land to a stable, productive and self sustaining condition, after taking into account beneficial uses of the site and surrounding land.
Relinquishment	Formal approval by the regulating authorities indicating that the completion criteria for the operation have been met to the satisfaction of the authority.
Remediation	To clean-up or mitigate contaminated soil or water.
Stakeholder	A person, group or organisation with the potential to affect or be affected by the process of, or outcome of, mine closure.
Store/release cover	Cover system suited to seasonal, moisture deficient climates that stores rainfall infiltration during the wet season and subsequently releases it through evapotranspiration during the dry season.
Supernatant	Water that bleeds off the top of deposited tailings residue slurry.
Tenement	Some form of legal instrument providing access to land for the purposes of mining.
Waste Rock	Uneconomic rock extracted from the ground during a mining operation to gain access to the ore body.

Source: DITR (2006a and 2006b).

1.3 Implementation

Closure planning needs to be considered in all aspects of the project development. As the project advances the closure plan will progress from conceptual through to a detailed “Life of Mine” closure plan incorporating more information and specific details for the closure and rehabilitation of all aspects of the operation.

A proposed schedule for the development and implementation of the Project closure plan is detailed in Table 1-2 below.

Table 1-2: Potential implementation schedule for the Roy Hill 1 Iron Ore closure and rehabilitation plan.

ITEM	DESCRIPTION	COMMENCEMENT	TIMEFRAME
1	Conceptual Mine Closure and Rehabilitation Plan.	During project planning and approval process.	12 to 18 Months.
2	Preliminary “Life of Mine” Closure Plan.	Within five years of Operation.	Five years.
3	Triennial review of “Life of Mine” Closure Plan.	Every three years.	Three Months.
4	RHIO Identify date of closure.	Minimum three years prior to closure. Currently estimated life of the operation is in excess of 20 years.	N/A.
5	Detailed Mine Closure and Rehabilitation Plan – Cost estimates within 10%.	Detailed planning process to commence following setting of closure date by RHIO.	Ongoing once closure decision reached.
6	Stakeholder Consultation in Closure Planning process.	Ongoing throughout the life of the operation.	One month during triennial review period.
7	Demolition and salvage of infrastructure.	Within three months of operations ceasing.	Six months.
8	Rehabilitation earthworks and revegetation of disturbed areas.	Following demolition and salvage.	Six months.
9	Post-closure monitoring of rehabilitation, groundwater, surface water etc.	Following closure and rehabilitation.	Five years.
10	Lease relinquishment and bond return.	Upon the satisfactory completion of agreed closure criteria.	As assessed by DoIR.

1.4 Risk and financial management

1.4.1 Risk management

A risk based approach is required to assess the most appropriate methods to achieve the closure criteria for the project. A detailed risk assessment will ensure a consistent approach to the identification and management of issues associated with the closure of the operation. The assessment needs to consider environmental, social, economic and regulatory risks (DITR, 2006). The management options selected for inclusion in the closure plan need to reduce the unacceptable risks to a level that is deemed tolerable. RHIO proposes to undertake a detailed risk assessment process prior to the development of the Preliminary Mine Closure and Rehabilitation Plan during the first five years of operation.

The mine closure and rehabilitation risk assessment will need to be reviewed and revised during the triennial closure plan review.

1.4.2 Financial assurance

The costs associated with the closure and rehabilitation of Australia mining operations have to be accounted for under the *Australia Accounting Standards Board 137: Provisions, Contingent Liabilities and Contingent Assets* standard. The costs are recorded as a liability on the company's balance sheet and are required to reflect the costs associated with the level of disturbance at the time of reporting (DITR, 2006).

RHIO will investigate and detail the closure cost provisioning process for the project during the preparation of the Preliminary Mine Closure and Rehabilitation Plan. Accurate assessment of the costs of mine closure and the associated risks are required to ensure sufficient funds are available for the effective implementation of the closure plan at the cessation of mining operations.

1.5 Project disturbance

The proposed development of Stage 1 of the Project will disturb 7,200 hectares (ha) of vegetation over the initial ten years of the operation. The proposed Stage 2 of the Project will result in further disturbance of native vegetation. The disturbance will be a mixture of permanent alterations to the landscape and temporary land uses. The disturbance areas have been categorised as either for mining operations, mineral processing infrastructure or ancillary project infrastructure and are discussed below.

1.5.1 Mining operation

Open pits

The project involves mining of iron ore from a series of relatively shallow open pits. The planned mining pits will have a cumulative disturbance of approximately 6,150 ha. The disturbance will be progressive over the life of the operation and pits will only remain open whilst in operation. As overburden material is removed from a new pit it will be used as backfill for a previously mined out pit.

Waste rock dump

Overburden removed from the initial starter pit (years one and two) and Kulbee Creek diversion excavation will be placed in a waste rock dump (WRD) located close to the northern tenement boundary. The waste dump will require a capacity of 200 million tonnes (Mt) of material. Given a bulk density of the waste of 2.5 tonnes per bank cubic metre (t/bcm) and a swell factor of 20% the initial waste rock dump will require a volume of 9.3 million cubic metres (Mm^3). Based on a waste rock dump height ceiling of 40 metres, the initial waste rock dump will require a footprint of approximately 270ha (allowing for a final slope angle of 17 degrees (º) using traditional linear slopes with benches every vertical 20 metres) (Coffey 2008).

The stability of the waste rock dump may be improved through employment of a design incorporating concave slopes for the outer embankments. Concave sloping can achieve an overall slope of less than 17º and provide increased protection against erosion and improve long term stability. Options for the use of concave sloping will be considered prior to undertaking rehabilitation of the WRD.

1.5.2 Haul roads and heavy vehicle park up areas

Construction of haul roads is required for the hauling of waste rock and ore from the mining pits to either in pit disposal areas or processing facility. A significant area will be cleared of vegetation for roads and associated drainage.

The haul roads and associated park up areas will be constructed, where practical, within areas planned for future mining. This will reduce the total disturbance footprint of the operation.

1.6 Mineral processing infrastructure

1.6.1 Ore handling infrastructure (primary crushing, conveyors)

The construction of infrastructure to transport large quantities of ore from the open pit mining operations to the ore processing facilities will result in the disturbance of a significant area of land. The Preliminary Engineering Studies have identified that primary crushing facilities will be located at several locations within the active mining areas. The primary crushers will feed ore onto overland conveyors that will transport the material to the processing facilities.

A network of conveyors 70 kilometres (km) long will be required resulting in approximately 140ha of disturbance.

1.6.2 Processing plant, administration, maintenance facilities

A processing and administration facility is proposed to be located in the northwest of the mining lease area. The footprint of the combined processing, administration and maintenance facilities is approximately 120ha. This area is expected to remain disturbed for the life of the project.

1.6.3 Waste fines storage facility

The proposed de-sanding process will produce a waste fines residue in slurry form (approximately 50% solids). For the initial two to three years of operations the slurry will be pumped to a waste fines storage facility (WFSF) located to the south of the processing facility. For the remainder of the project the slurry will be co-disposed with waste rock as backfill in the mined out pit voids.

In addition to the disturbance from the waste fines storage facility itself, further disturbance will be required for additional infrastructure including access roads, pipelines, pump stations, powerlines, water holding ponds and equipment lay down areas. An option exists to recover the deposited waste fines and dispose of the material as pit backfill. This will permanently remove the WFSF and the supporting infrastructure can be salvaged and the area rehabilitated.

If co-disposal is not a feasible option for disposal of the waste fines a permanent WFSF will be required to be constructed. The permanent structure will be engineered and operated following industry best practice and guidelines published by national and state authorities. The structure will be rehabilitated to complement the surrounding landscape. Under this scenario Stage 2 of the project will require a second WFSF to be constructed.

1.6.4 Rail loop and loading facility

The Project proposes to construct a rail loop and loading facility located adjacent the processing plant to facilitate the transport of iron ore for export. The rail loop will result in disturbance to vegetation and may have impacts on the surface hydrology of the area.

The rail loop will connect to a shared infrastructure corridor or independent rail operation. The infrastructure corridor and independent rail option will be subject to a separate environmental impact assessment. Any future infrastructure associated with the Project will be captured by the Mine Closure and Rehabilitation Management Plan during regular review periods.

1.6.5 Water supply borefield

Water balance calculations for the Project define a substantial shortfall in water of a suitable quality to meet the processing requirements. To satisfy this demand a water supply borefield will be required. The location of the water supply borefield is proposed to be within the project area south of the Stage 1 mining pits, wholly within the north-east boundary of the tenement. Infrastructure associated with the water supply borefield may include:

- access roads;
- powerlines;
- pipelines;
- pump stations;
- holding ponds, and
- equipment lay down areas.

These impacts will be dependent on the number of bores, distance from processing facility and quantity of water to be abstracted.

1.7 Ancillary project infrastructure

1.7.1 Accommodation camps and associated infrastructure

The conceptual project layout proposes the construction of one accommodation camp and ancillary infrastructure. The camp is intended to be the permanent accommodation camp housing the fly in-fly out (FIFO) workforce of 750 people during the construction and operation of the mine and processing facility. It is proposed to have a footprint of approximately 45ha, and is to be located to the east of the mining operations.

1.7.2 Access roads

A number of roads will be required within the Project area to control access to various aspects of the project including mining areas, ore transport corridors (conveyors etc), WFSF, water supply bore field, and rail load out facility. These roads will result in disturbance to vegetation, habitats and surface water drainage. However these access roads will control vehicular traffic and reduce the incidence of off-road driving and associated environmental impacts.

1.7.3 Realignment of the Marble Bar Road

Currently the Newman-Marble Bar Road is located directly over the area to mined during the first ten years of scheduled mining at the Project. RHIO propose that a 20km diversion of a section of the Newman-Marble Bar Road be constructed to the east of the Project area. The road is to be sealed and remain as a permanent realignment.

1.7.4 Aerodrome

The Project will require an aerodrome of sufficient size to cater for the demands of the proposed FIFO workforce. The airstrip will be sealed so that it can be used during all weather conditions. A terminal building, luggage handling facilities, refuelling equipment and associated infrastructure will also be required. The proposed disturbance for the aerodrome is approximately 130ha.

1.7.5 Surface water diversion drainage channels

The proposed mining areas and processing facilities are situated on the foot slopes of the Chichester Ranges. During wet season rainfall events, stormwater flows across the Project area and into the Marsh catchment area. A number of stormwater diversion drains and containment structures will be required to control stormwater from upstream of the Project area and prevent flooding of active mining areas.

1.7.6 Dewatering evaporation pond

During mine dewatering activities hypersaline water will be abstracted from groundwater aquifers beneath the project area commencing in mining year three. The hypersaline water will not be suitable for use in the processing of iron ore and there is no alternative beneficial use for the water in the region. An estimated quantity 122,540ML of saline water is expected to be dewatered during the 20 year mine life. During stage 1 of the Project (years one to ten) the dewatering operations will result in 22.5GL of saline water requiring disposal. Evaporation of the saline water will produce 1.5Mt of salt.

The hypersaline water requires disposal, with the proposed base case method being to evaporate the water in a series of lined cells constructed within a large pond structure. This will produce solidified salt precipitate requiring disposal. Harvested salt shall be placed in engineered encapsulation cells located within the backfilled pit(s). The cells will be located above the water table and constructed of suitable materials to minimise contact with ground water and in-flow of surface water (Lycopodium 2009).

Two options have been identified for the location of the evaporation pond. The exact location will be determined during detailed engineering design. The maximum area of clearing required for the evaporation pond is included in the total area of disturbance for the Project.

Alternatives to burial of harvested salt include disposing of the salt offsite or identifying a beneficial use of the salt material. The alternative options require further investigation and evaluation which will be undertaken by the proponent.

1.7.7 Power generation and transmission

The Project will consume electricity and will require four million kilowatt hours to be generated for onsite use during the Project. Options for the supply of energy are being considered and they include onsite generation or transmission from a third party energy supplier. If the third party energy supply option is favoured a small onsite back up energy supply will be required. Disturbance associated with power generation and transmission will be restricted to the:

- footprint of onsite generation facility (dependent upon capacity);
- natural gas pipeline corridor (if required); and
- transmission and internal distribution power line corridors.

2 Conceptual closure options

This section will describe the conceptual options for the closure of the Project. The information is based on the conceptual project layout and preliminary engineering study completed by RHIO. The options are subject to change given the period of time between the development of this conceptual plan and the anticipated closure of the operation in excess of 20 years. During this period it is envisaged that there will be changes to the closure standards applicable to the project along with advances in mining and earthmoving technologies and techniques used in rehabilitation. The regular review of the closure plan during the life of the operation will provide the opportunity to update the closure options to reflect any relevant changes.

Table 2-1 describes the closure objectives, closure criteria and the task required to meet the objectives for various components of the project.

Table 2-1: Conceptual closure objectives, criteria and tasks.

PROJECT COMPONENT	CLOSURE OBJECTIVE	CLOSURE CRITERIA	CLOSURE TASKS
Mining pits and waste rock dumps			
Backfilled Mining Voids.	Create a safe and stable landform that sustains vegetation and minimises erosion. Reintroduce surface water flow across rehabilitated surface. Recreate a self sustaining and functioning ecosystem comparable to the pre-mining environment where possible. Implement post-closure monitoring program to ensure closure criteria compliance.	Contour landscape consistent to surrounding environment and allow free drainage of stormwater. Return topsoil and cleared vegetation material to create soil structure. Self-sustaining vegetation community established.	<u>Prior to Construction:</u> Accurately survey natural landscape and original drainage lines. Incorporate closure objectives into mine planning and design. Strip all vegetation and topsoil for use during rehabilitation. <u>During Operations:</u> Following establishment of initial mining pit and associated waste rock dump, overburden is to be used for progressive backfilling of mined–out pits. Schedule progressive clearing and rehabilitation activities to allow direct application of fresh topsoil to backfilled areas. <u>Post-closure:</u> Surface to be re-contoured to facilitate free-draining of stormwater to prevent ponding. If required, apply additional local provenance vegetation seed (where available) to rehabilitated areas and lightly scarify the surface. Monitor rehabilitated areas for land system function, surface water quality and impacts on the downstream environment.
Waste Rock Dump.	Create a safe and stable landform that sustains vegetation and minimises erosion. Minimise downstream impacts through interruption to surface drainage. Implement post-closure monitoring program to ensure closure criteria compliance.	Minimise total area required for overburden storage through backfilling of mined out pits. Storage facility to compliment natural environment through detailed design. External embankments to have an average slope of less than 20º with a five metre wide back sloping berm every 20 vertical metres. Use topsoil and cleared vegetation material to establish soils structure. Self sustaining vegetation community established. Diverted surface drainage to be redistributed to minimise impacts to downstream ecosystems.	<u>Prior to Construction:</u> Accurately survey natural landscape and original drainage lines. Incorporate the closure objectives into the detailed design, engineering and construction of the facility. Investigate the suitability of a concave slope design for waste rock storage facility. Strip all vegetation and topsoil for use during rehabilitation. <u>During Operations:</u> Progressively rehabilitate lower embankment slopes as storage facility develops. Fresh or stockpiled topsoil and cleared vegetation material to be applied the rehabilitated areas. Deep rip along the contours to minimise erosion.

PROJECT COMPONENT	CLOSURE OBJECTIVE	CLOSURE CRITERIA	CLOSURE TASKS
			<u>Post-closure:</u> Top surface to be contoured and perimeter bund established to prevent stormwater overtopping the structure. If required apply additional local provenance vegetation seed (where available) to rehabilitated areas and lightly scarify the surface. Surface diversion drainage structures to be maintained. Monitor rehabilitated areas for land system function, surface water quality and impacts on the downstream environment.
Material handling and processing facilities			
Primary and Secondary Crushing, Screening and Processing Plant and associated maintenance facilities.	Post-mining and mineral processing all redundant infrastructure to be salvaged and disposed of appropriately. Items with beneficial uses post-operation may be left in situ following negotiations with post-closure land users (roads, rail loop etc). Disturbed areas to be left in a safe, stable, non-polluting and orderly state.	No infrastructure items without a beneficial post-closure use to remain in situ.	<u>Post-closure:</u> Reusable or saleable equipment to be salvaged (crushing plants, screens, conveyors etc). Hydrocarbon contaminated material to be excavated and remediate or disposed off site. Bury one metre below the surface scrap material (not saleable or recyclable) and does not pose an environmental risk. Excavate or leave in-situ (if a minimum of one metre below the surface) footings and buried infrastructure (pipelines, cable etc). Rip (less than one metre) compacted surfaces prior to topsoil application to allow storm water infiltration. Surface to be re-contoured to facilitate free draining of stormwater to prevent ponding. Fresh or stockpiled topsoil and cleared vegetation material to be applied to the rehabilitated areas. If required, apply additional local provenance vegetation seed (where available) to rehabilitated areas and lightly scarify the surface. Monitor rehabilitated areas for land system function, surface water quality and impacts on the downstream environment.

PROJECT COMPONENT	CLOSURE OBJECTIVE	CLOSURE CRITERIA	CLOSURE TASKS
Waste Fines Storage Facility.	Create a safe and stable landform that supports vegetation and minimises erosion. Minimise impacts of interrupted surface flows on downstream ecosystems. Post-mining and mineral processing all redundant infrastructure to be salvaged and disposed of appropriately. Items with post-operational beneficial uses may be left in situ following negotiations with post-closure land users (roads, rail loop etc). Disturbed areas to be left in a safe, stable, non-polluting and orderly state. Monitor progressive rehabilitation activities and develop a post-closure monitoring program to ensure closure criteria are met. Closure of Waste Fines Storage Facility to meet the requirements detailed in the industry guidance materials provide by DoIR "*Mining Environmental Management Guidelines - Safe Design And Operating Standards For Tailings Storage"* and the Commonwealth Department of Industry, Tourism and Resources (DITR) "*Leading practice Sustainable Development program for the Mining Industry – Tailings Management"*.	No infrastructure items without a beneficial post-closure use to remain in situ. Minimise total area required for waste fines storage through co-disposal of waste fines with overburden in mined out pits. Storage facility to compliment natural environment through detailed design and suitable site selection. External embankments to have an average slope of less than 20º with a five metre wide back sloping berm every ten vertical metres. Use topsoil and cleared vegetation material to establish soil structure on residue material and embankments. Self sustaining vegetation community established. Diverted surface drainage to be redistributed to minimise impacts to downstream ecosystems.	<u>Prior to Construction:</u> Incorporate the closure objectives into the detailed design, engineering and construction of the facility. Waste fines storage facility to be located to minimise significant interruptions to surface drainage. Investigate the suitability of a concave slope design for the waste fines storage facility embankment slopes. The option of co-disposing waste fines with overburden material in mined-out pits to be investigated. Accurately survey natural landscape and original drainage lines. <u>During Operations:</u> Progressively rehabilitate lower embankment slopes as storage facility develops. Fresh or stockpiled topsoil and cleared vegetation material to be applied the rehabilitated areas. Deep rip along the contours to minimise erosion. Engineered spillway to be constructed to allow safe overtopping of storm water following intense rainfall events. <u>Post-closure:</u> Reusable or saleable equipment to be salvaged (crushing plants, screens, conveyors etc). Bury one metre below the surface scrap material (not saleable or recyclable) and does not pose an environmental risk. Excavate or leave in-situ (if a minimum of one metre below the surface) footings and buried infrastructure (pipelines, cable etc). Rip (less than one metre) compacted surfaces prior to topsoil application to allow storm water infiltration. Surface to be re-contoured to facilitate free draining of stormwater to prevent ponding. Fresh or stockpiled topsoil and cleared vegetation material to be applied the rehabilitated areas. If required, apply additional local provenance vegetation seed (where available) to rehabilitated areas and lightly scarify the surface.

PROJECT COMPONENT	CLOSURE OBJECTIVE	CLOSURE CRITERIA	CLOSURE TASKS
			Monitor rehabilitated areas for land system function, surface water quality and impacts on the downstream environment.
Train Loading facility (stockpile and infrastructure).	Post-mining and mineral processing all redundant infrastructure to be salvaged and disposed of appropriately. Items with beneficial uses post-operations may be left in situ following negotiations with post-closure land users (roads, rail loop etc). Disturbed areas to be left in a safe, stable, non-polluting and orderly state.	No infrastructure items without a beneficial post-closure use to remain in situ.	<u>Post-closure:</u> Sell any remaining stockpiled ore or return the material to the mined out pits. Reusable or saleable equipment to be salvaged (rail line, sleepers, reclaimer etc). Hydrocarbon contaminated material to be excavated and remediate or dispose off site. Bury one metre below the surface scrap material (not saleable or recyclable) and does not pose an environmental risk. Excavate or leave in-situ (if a minimum of one metre below the surface) footings and buried infrastructure (pipelines, cable etc). Rip (less than one metre) compacted surfaces prior to topsoil application to allow storm water infiltration. Surface to be re-contoured to facilitate free draining of stormwater to prevent ponding. Fresh or stockpiled topsoil and cleared vegetation material to be applied the rehabilitated areas. If required, apply additional local provenance vegetation seed (where available) to rehabilitated areas and lightly scarify the surface. Monitor rehabilitated areas for land system function, surface water quality and impacts on the downstream environment.
Rail Loop	Post mining and mineral processing all redundant infrastructure to be salvaged and disposed of appropriately. Items with beneficial uses post-operations may be left in situ following negotiations with post-closure land users (roads, rail loop etc). Disturbed areas to be left in a safe, stable, non-polluting and orderly state. During operations establish a stakeholder consultation forum to discuss closure planning processes and post-closure land use issues.	No infrastructure items without a beneficial post-closure use to remain in situ.	<u>During Operations:</u> Prior to closure consult with relevant stakeholders to determine if rail loop, or part thereof, could be used by future land users or mineral projects. <u>Post-closure:</u> Reusable or saleable equipment to be salvaged (rail line, sleepers, points systems etc). Bury scrap material (not saleable or recyclable) that does not pose an environmental risk 1m below the surface. Excavate or leave in-situ (if a minimum of one metre below the surface) footings and buried infrastructure (pipelines, cable etc).

PROJECT COMPONENT	CLOSURE OBJECTIVE	CLOSURE CRITERIA	CLOSURE TASKS
			Hydrocarbon contaminated material to be excavated and remediate or dispose off site. Deep rip compacted surfaces prior to topsoil application to allow storm water infiltration. Surface to be re-contoured to facilitate free draining of stormwater to prevent ponding; Fresh or stockpiled topsoil and cleared vegetation material to be applied the rehabilitated areas; If required, apply additional local provenance vegetation seed (where available) to rehabilitated areas and lightly scarify the surface; and Monitor rehabilitated areas for land system function, surface water quality and impacts on the downstream environment.
Supporting infrastructure			
Accommodation Camp, Recreation and Administration Facilities.	Post-mining and mineral processing all redundant infrastructure to be salvaged and disposed of appropriately. Items with beneficial uses post-operations may be left in situ following negotiations with post-closure land users (roads, rail loop etc). Disturbed areas to be left in a safe, stable, non-polluting and orderly state. During operation establish a stakeholder consultation forum to discuss closure planning processes and post-closure land use issues.	No infrastructure items without a beneficial post-closure use to remain in situ.	<u>During Operation:</u> Prior to closure consult with relevant stakeholders to determine if rail loop, or part thereof, could be used by future land users or mineral projects. <u>Post-closure:</u> Reusable or saleable equipment to be salvaged (accommodation units, electrical equipment etc). Bury one metre below the surface scrap material (not saleable or recyclable) and does not pose an environmental risk. Excavate or leave in-situ (if a minimum of one metre below the surface) footings and buried infrastructure (pipelines, cable etc). Hydrocarbon contaminated material to be excavated and remediate or dispose off site. Rip (less than one metre) compacted surfaces prior to topsoil application to allow storm water infiltration. Surface to be re-contoured to facilitate free draining of stormwater to prevent ponding. Fresh or stockpiled topsoil and cleared vegetation material to be applied the rehabilitated areas. If required, apply additional local provenance vegetation seed (where available) to rehabilitated areas and lightly scarify the surface.

PROJECT COMPONENT	CLOSURE OBJECTIVE	CLOSURE CRITERIA	CLOSURE TASKS
			Monitor rehabilitated areas for land system function, surface water quality and impacts on the downstream environment.
Aerodrome.	Post-mining and mineral processing all redundant infrastructure to be salvaged and disposed of appropriately. Items with beneficial uses post-operations may be left in situ following negotiations with post-closure land users (roads, rail loop etc). Disturbed areas to be left in a safe, stable, non-polluting and orderly state. During operations establish a stakeholder consultation forum to discuss closure planning processes and post-closure land use issues.	No infrastructure items without a beneficial post-closure use to remain in situ.	<u>During Operation:</u> Prior to closure consult with relevant stakeholders to determine if rail loop or part thereof, could be used by future land users or mineral projects. Transfer ownership and responsibilities to new managing authority. <u>Post-closure:</u> Reusable or saleable equipment to be salvaged (buildings, electrical equipment etc). Bury scrap material (not saleable or recyclable) that does not pose an environmental risk 1m below the surface. Excavate or leave in-situ (if a minimum of one metre below the surface) footings and buried infrastructure (pipelines, cable etc). Hydrocarbon contaminated material to be excavated and remediate or dispose off site. Deep rip compacted surfaces prior to topsoil application to allow storm water infiltration. Surface to be re-contoured to facilitate free draining of stormwater to prevent ponding. Fresh or stockpiled topsoil and cleared vegetation material to be applied the rehabilitated areas. If required, apply additional local provenance vegetation seed (where available) to rehabilitated areas and lightly scarify the surface. Monitor rehabilitated areas for land system function, surface water quality and impacts on the downstream environment.
Saline Water Evaporation Pond.	Post-mining and mineral processing all redundant infrastructure to be salvaged and disposed of appropriately. Disturbed areas to be left in a safe, stable, non-polluting and orderly state.	No infrastructure items without a beneficial post-closure use to remain in situ.	<u>Post-closure:</u> Drain and dispose (offsite) any remaining saline water from the evaporation cells. Saline residue to be excavated and buried in within engineered encapsulation cell within mine backfill area. Pond liner to be removed and buried with saline material. Pit to be backfilled with stockpiled waste overburden (incorporating a capillary break) and rehabilitated consistent with other mining pits.

PROJECT COMPONENT	CLOSURE OBJECTIVE	CLOSURE CRITERIA	CLOSURE TASKS
			Reusable or saleable equipment to be salvaged (pumps, pipelines etc). Bury one metre below the surface scrap material (not saleable or recyclable) and does not pose an environmental risk. Excavate or leave in-situ (if a minimum of one metre below the surface) footings and buried infrastructure (pipelines, cable etc). Rip (less than one metre) compacted surfaces prior to topsoil application to allow storm water infiltration. Surface to be re-contoured to facilitate free draining of stormwater to prevent ponding. Fresh or stockpiled topsoil and cleared vegetation material to be applied the rehabilitated areas. If required, apply additional local provenance vegetation seed (where available) to rehabilitated areas and lightly scarify the surface. Monitor rehabilitated areas for land system function, surface water quality and impacts on the downstream environment.
Water monitoring bores, water supply bores, dewatering bores and associated infrastructure.	Post-mining and mineral processing all redundant infrastructure to be salvaged and disposed of appropriately. Items with beneficial uses post-operations may be left in situ following negotiations with post-closure land users (bores suitable for stock water, tanks etc). Disturbed areas to be left in a safe, stable, non-polluting and orderly state.	No infrastructure items without a beneficial post-closure use to remain in situ.	<u>During Operations:</u> Identify bores required for post-closure monitoring purposes. <u>Post-closure:</u> Monitoring bores required for post-closure monitoring to remain in situ. Water supply and monitoring bores not required for post-closure monitoring are to be decommissioned with the casings cut off below the ground surface and holes plugged. All pipelines and infrastructure on the surface are to be salvaged and disposed. Buried pipelines below a depth of one metre to be cut off below the surface, capped and left in situ. Access tracks are to be ripped, contoured and seeded with endemic species. Monitor rehabilitated areas for land system function, surface water quality and impacts on the downstream environment.

PROJECT COMPONENT	CLOSURE OBJECTIVE	CLOSURE CRITERIA	CLOSURE TASKS
Wastewater Treatment Facilities.	Post-mining and mineral processing all redundant infrastructure to be salvaged and disposed of appropriately. Items with beneficial uses post-operations may be left in situ following negotiations with post-closure land users (roads, rail loop etc). Disturbed areas to be left in a safe, stable, non-polluting and orderly state.	No infrastructure items without a beneficial post-closure use to remain in situ.	Post-closure: Drain and appropriately dispose of any remaining untreated effluent. Reusable or saleable equipment (pumps, electrical equipment etc) to be salvaged. Bury one metre below the surface scrap material (not saleable or recyclable) and does not pose an environmental risk. Excavate or leave in-situ (if a minimum of one metre below the surface) footings and buried infrastructure (pipelines, cable etc). Rip (less than one metre) compacted surfaces prior to topsoil application to allow storm water infiltration. Surface to be re-contoured to facilitate free draining of stormwater to prevent ponding. Fresh or stockpiled topsoil and cleared vegetation material to be applied the rehabilitated areas. If required, apply additional local provenance vegetation seed (where available) to rehabilitated areas and lightly scarify the surface. Monitor rehabilitated areas for land system function, surface water quality and impacts on the downstream environment.
Power Supply Infrastructure (Generation Plant and transmission Lines).	Post-mining and mineral processing all redundant infrastructure to be salvaged and disposed of appropriately. Items with beneficial uses post-operations may be left in situ following negotiations with post-closure land users (roads, rail loop etc). Disturbed areas to be left in a safe, stable, non-polluting and orderly state.	No infrastructure items without a beneficial post-closure use to remain in situ.	Post-closure: Reusable or saleable equipment (generation equipment, transformers etc) to be salvaged. Bury one metre below the surface scrap material (not saleable or recyclable) and does not pose an environmental risk. Excavate or leave in-situ (if a minimum of 1m below the surface) footings and buried infrastructure (pipelines, cable etc). Hydrocarbon contaminated material to be excavated and remediate or dispose off site. Rip (less than one metre) compacted surfaces prior to topsoil application to allow storm water infiltration. Surface to be re-contoured to facilitate free draining of stormwater to prevent ponding. Fresh or stockpiled topsoil and cleared vegetation material to be applied the rehabilitated areas.

PROJECT COMPONENT	CLOSURE OBJECTIVE	CLOSURE CRITERIA	CLOSURE TASKS
			If required, apply additional local provenance vegetation seed (where available) to rehabilitated areas and lightly scarify the surface. Monitor rehabilitated areas for land system function, surface water quality and impacts on the downstream environment.
Dangerous Goods Storage Facilities (bulk hydrocarbon storage, explosives, processing chemicals).	Post-mining and mineral processing all redundant infrastructure to be salvaged and disposed of appropriately. Items with beneficial uses post-operations may be left in situ following negotiations with post-closure land users (roads, rail loop etc). Disturbed areas to be left in a safe, stable, non-polluting and orderly state.	No infrastructure items without a beneficial post-closure use to remain in situ. Comply with the requirements of the *Contaminated Sites Act 2003.*	<u>Post-closure:</u> Empty remaining contents of storage vessels and dispose of appropriately. Remove transportable vessels from the site. Demolished and salvage scrap metals from permanent facilities. Undertake contamination investigation and sampling program around dangerous good storage areas. Excavate and dispose of contaminated material at an appropriate facility. Bury one metre below the surface scrap material (not saleable or recyclable) and does not pose an environmental risk. Excavate or leave in-situ (if a minimum of one metre below the surface) footings and buried infrastructure (pipelines, cable etc). Rip (less than one metre) compacted surfaces prior to topsoil application to allow storm water infiltration. Surface to be re-contoured to facilitate free draining of stormwater to prevent ponding. Fresh or stockpiled topsoil and cleared vegetation material to be applied the rehabilitated areas. If required, apply additional local provenance vegetation seed (where available) to rehabilitated areas and lightly scarify the surface. Monitor rehabilitated areas for land system function, surface water quality and impacts on the downstream environment.
Access and Haul Roads	Post-mining and mineral processing all redundant infrastructure to be salvaged and disposed of appropriately. Items with beneficial uses post-operations may be left in situ following negotiations with post-closure land users (roads, rail loop etc).	No infrastructure items without a beneficial post-closure use to remain in situ.	<u>During Operations:</u> Prior to Closure undertake stakeholder consultation to determine which access roads may be suitable for use post-closure. Ownership and responsibility to be transferred to the new managing authority.

PROJECT COMPONENT	CLOSURE OBJECTIVE	CLOSURE CRITERIA	CLOSURE TASKS
	Disturbed areas to be left in a safe, stable, non-polluting and orderly state. During operations establish a stakeholder consultation forum to discuss closure planning processes and post-closure land use issues.		Post-closure: Rehabilitate haul roads and access tracks not required post-closure. Backfill road side drains and remove culverts. Deep rip compacted surfaces prior to topsoil application to allow storm water infiltration. Surface to be re-contoured to facilitate free draining of stormwater to prevent ponding. Fresh or stockpiled topsoil and cleared vegetation material to be applied the rehabilitated areas. Monitor rehabilitated areas for land system function, surface water quality and impacts on the downstream environment.
Diversion Drains and Containment Ponds	Maintain surface water inflow into the Marsh and minimise impacts of interrupted surface flows on downstream ecosystems. Recreate a self sustaining and functioning ecosystem comparable to the pre-mining environment where possible. Disturbed areas to be left in a safe, stable, non-polluting and orderly state. Monitor progressive rehabilitation activities and develop a post-closure monitoring program to ensure closure criteria are met.	Re distribute surface water over rehabilitated project areas. Maintain pre-mining surface water inflow into the Marsh.	Post-closure: Demolish redundant diversion drains and containment structures. Deep rip compacted surfaces prior to topsoil application to allow storm water infiltration. Surface to be re-contoured to facilitate free draining of stormwater to prevent ponding. Fresh or stockpiled topsoil and cleared vegetation material to be applied the rehabilitated areas. If required, apply additional local provenance vegetation seed (where available) to rehabilitated areas and lightly scarify the surface. Monitor rehabilitated areas for land system function, surface water quality and impacts on the downstream environment.

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3 Mine closure completion

A number of completion criteria need to be achieved in order to relinquish the mining lease tenements. The closure criteria for the Project will be agreed following negotiations between RHIO and the project stakeholders, including government regulatory agencies, during the project approval process. The triennial closure plan review process will allow for regular review and updating of the closure criteria based on available information at the time of the review. Updated closure criteria may be required to incorporate the findings of monitoring programs established during progressive rehabilitation activities or changes made to the operation between review periods.

Table 3-1 describes draft closure criteria to satisfy the closure objectives of the Project.

Table 3-1: Conceptual closure criteria.

CLOSURE OBJECTIVE	DRAFT COMPLETION CRITERIA
1. Create a safe and stable landform that supports vegetation and minimises erosion.	All embankment slopes of engineered landforms (residue and waste rock storage facilities) to be at a slope angle no greater than 20º. All mined out pit voids to be backfilled to the pre-mining surface level, contoured to allow free draining and revegetated with endemic species. The residue storage facility to be designed and operated in accordance with the relevant DMP guidance and industry best practice.
2. Maintain surface water inflow into the Marsh and minimise impacts of interrupted surface flows on downstream ecosystems.	Natural drainage lines to be reinstated where practicable over the rehabilitated areas. Pit voids to be backfilled and free draining to prevent water ponding post-closure. Rehabilitated areas to be contoured to allow surface water to flow and minimise downstream impacts.
3. Re-create a self sustaining and functioning ecosystem comparable to the pre-mining environment where possible.	Flora and fauna species diversity and abundance and ecosystem function within rehabilitated areas to be comparable to surrounding environment at the time.
4. Post-mining and mineral processing all redundant infrastructure to be salvaged and disposed of appropriately. Items with beneficial uses post-operations may be left in situ following negotiations with post-closure land users (roads, rail loop etc).	Prior to closure identify items of plant and equipment suitable for salvage and reuse or recycling. Negotiate with post-closure land users ongoing care, maintenance and responsibility for any infrastructure to be left in situ.
5. Disturbed areas to be left in a safe, stable, non-polluting and orderly state.	All redundant infrastructure to be removed from site for salvage or disposal. Inert material to be buried below a depth of one metre; Buried infrastructure (pipelines, cables etc) to be made safe prior to closure. Areas of contamination to be remediated prior to closure.
6. Monitor progressive rehabilitation activities and develop a post-closure monitoring program to ensure closure criteria are met.	Establish monitoring locations for flora, fauna, ecosystem function analysis, surface water and groundwater. Identify suitable control points in surrounding environment as a comparison to rehabilitated areas. Monitor progressive rehabilitation projects during the life of the project and use the results to improve rehabilitation techniques.
7. During operations establish a stakeholder consultation forum to discuss closure planning processes and post-closure land use issues.	Implement the *Stakeholder Consultation* program to ensure all relevant stakeholders have an opportunity to provide input in the mine closure planning process. Establish a formal process for engaging and responding to stakeholder concerns and issues.

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4 Rehabilitation strategy

Rehabilitation and revegetation of disturbed areas is a significant component of achieving a number of the conceptual mine closure objective. Successful revegetation can be achieved through implementing an appropriate rehabilitation and revegetation strategy.

4.1 Vegetation clearing

The following is proposed in relation to clearing of vegetation during the life of the mine:

- areas that require clearing are to be surveyed and demarcated prior to clearing operations commencing;
- the topsoil is to be removed and reused directly (preferred option) or stockpiled (if required) for reuse during rehabilitation activities, as it contains valuable organic matter, nutrients, and seeds; and
- during rehabilitation, stripped vegetation will be spread across the topsoil to assist with soil stabilisation and erosion control. Over time, the vegetation will decompose and release nutrients, seeds and organic matter into the soil.

A vegetation disturbance and clearing procedure will be developed by RHIO to detail the project requirements for the clearing and reuse of vegetation resources.

4.2 Topsoil recovery and handling

Topsoil is required to be recovered during clearing/pre-strip operations. The topsoil contains valuable organic matter, vegetation seeds and soil micro-organisms which are important in establishing new vegetation during rehabilitation. Prior to commencing the recovery of topsoil, it will need to be characterised. Sampling and analysis of the topsoil will assist in identifying the depth of topsoil to recover and most suitable reuse option for the material (DITR, 2006).

Once the topsoil suitable for reuse has been identified, it is to be salvaged using a combination of front end loaders or wide tracked dozers to push up the material. The topsoil salvage operations should be scheduled as far as possible to coincide with progressive rehabilitation projects so that the topsoil can be immediately reused. This will maximise the viability of the topsoil seed bank and soil microbes.

If the topsoil is to be stockpiled between recovery and reuse, suitable storage locations will need prior identification. The stockpiles will need to be constructed in a manner that minimises deterioration of seed, nutrients and soil microbes. This can be achieved by not recovering topsoil following rainfall and through constructing stockpiles no taller than three metres in height. After six to 12 months of stockpiling, degradation of the topsoil may occur, so for best results stockpiled topsoil needs to be used within 12 months of recovery (DITR, 2006).

During topsoil salvaging and stockpiling operations, dust suppression may be required. To preserve the quality of the topsoil, only fresh water will be used. Additionally topsoil salvaging and spreading operations will be avoided following significant rainfall events to avoid damaging soil structure and viability.

4.3 Rehabilitation earthworks

The rehabilitation of the Project area will require significant earthworks to construct the post-mining landscape and to rehabilitate the newly created mining landforms (waste rock dump, residue storage facility, backfilled pits). The post-mining landform design and construction is critical to achieving the conceptual closure plan criteria. The process of backfilling mined out pits progressively will assist with creating a post-mining landscape that resembles the pre-mining environment as close as is practical.

The design, engineering and construction of the large mining structures (waste rock dump and waste fines storage facilities) will need to incorporate the post-closure objectives. This will allow the large structures to be incorporated into the natural landscape and minimise the impact to visual amenity. During the detailed design and engineering study for the Project, the proponent will investigate the appropriateness of incorporating concave slopes into the design of the mining landforms.

The use of concave slopes as opposed to traditional linear slopes is expected to improve the ability of the landforms to mimic the natural environment, as a number of the “mesa” like structures found to the north of the project areas have distinct concave slopes. Additionally, exposed rock outcrops are a feature of the Pilbara and could be incorporated into the post-closure landform design. Research into concave slopes has indicated that concave slopes can improve the stability of structure and reduce erosion (Landloch Pty Ltd, 2005).

4.4 Surface water drainage

The post-mining landscape will be contoured to control stormwater runoff and minimise erosion. All constructed slopes within the Project area will have an average slope angle of less than 20° to reduce stormwater velocity. The surface of slopes will be ripped along the contours to increase infiltration of stormwater and reduce erosion.

Where natural stormwater drainage lines are to be reinstated, areas susceptible to excessive erosion will require armouring with coarse rock material. Additionally, direct planting of stabilising vegetation may be required to assist with retaining the banks for the drainage line during heavy flows.

Pit voids are to be backfilled to above the pre-mining watertable to reduce the risk of water ponding and creating water bodies. A detailed surface water management strategy will be included in the Project Integrated Water Management Plan (MWH, 2008).

4.5 Vegetation establishment

Implementing the CCRMP will provide an opportunity to establish revegetation trials through the progressive nature of the proposed closure plan. Trialling different revegetation techniques during the initial rehabilitation projects will identify the most suitable technique for the various areas that are required to be rehabilitated (slopes, backfilled pits etc).

Monitoring the rehabilitation trials will identify if the additional seeding of topsoil is required to encourage revegetation. Results of the monitoring can be used to improve the topsoil recovery and handling procedures to maximise the content and viability of the seed bank content.

Following completion of flora surveys and vegetation mapping by Ecologia Environment Pty Ltd (in autumn 2009), a detailed species list for the Project area can be compiled. The flora data will provide information on the vegetation species that will be most suitable for use in rehabilitation projects.

A seed collection program will be established to target the suitable rehabilitation species. Seeds collected for rehabilitation purposes must be stored in appropriate facilities to prevent deterioration or damage from pests or fungi. A detailed catalogue will be required to record species, quantity, source, collection date, and similar. Prior to seeding, some species may benefit from various treatments such as heat treatment, scarification and exposure to smoke or smoke water to promote germination (DITR, 2006b).

4.6 Feral species control

Invasion by feral flora and fauna species may influence the success of the rehabilitation projects. Weeds and non-native plants will compete with native plants for valuable water and nutrients. Grazing animals, such as pastoral stock, feral donkeys and kangaroos, may damage vegetation as it tries to establish.

Weeds are to be controlled through ongoing monitoring and management. Options include germination testing of seed prior to use to ensure minimal weed species are introduced to the rehabilitation areas (for seeds purchased through third party suppliers). If weeds become established an eradication program using chemical herbicides or manual removal will be implemented to control or eliminate the weed populations.

If monitoring of the rehabilitated areas identifies over grazing as an issue of concern then management actions will be required to limit their impact within the area (in cooperation with relevant pastoralists). Fencing may also be required to prevent access and removing sources of water may deter grazing animals from entering rehabilitated areas.

4.7 Encouraging native fauna

Fauna species can be encouraged to colonise rehabilitated areas through the provision of suitable habitat (DITR, 2006b). Spreading previously cleared vegetation over the rehabilitated areas will provide habitat for a range of insects, reptiles and small animals. Reptiles will inhabit rocky outcrops and bird perches will encourage raptors and other large birds into the area. Re-colonisation of the recreated environment is an important aspect in achieving a self sustaining ecosystem criterion.

4.8 Maintenance and rework

Maintaining the rehabilitated areas until mining lease relinquishment is important to the overall success of the closure plan. Monitoring of the Project area will identify any issues requiring maintenance or remedial works. These issues may include:

- excessive erosion of drainage lines;
- excessive erosion of contour ripping; and
- failure of vegetation to establish and become self sustaining.

Where issues are identified, suitable remedial works will be scheduled and undertaken.

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5 Geographic information system

An important component of the Conceptual Closure and Rehabilitation Management Plan will be documenting and maintaining records of activities within the project. A geographic information system (GIS) provides a suitable mechanism for recording and displaying data. Data relating the Project land tenure, approval boundaries, planned disturbance, actual disturbance and rehabilitation activities all needs to be recorded and incorporated into internal and external reporting. The advantage of a GIS over traditional data recording spreadsheets and databases is that it allows the data to be displayed and analysed visually as spatial information is stored with the data. Thus, accurate maps and diagrams can be created using the GIS data.

The activity data are critical to estimating the closure liability of the operation along with applicable bonds payable under the *Mining Act, (1978)* administered by DoIR. The performance bonds do not represent the full costs associated with mine closure and are not recoverable until rehabilitation is complete to the satisfaction of the regulators. A GIS database will be able to link data from the mine planning process and survey data of actual project activities to provide a single point of reference for all mine closure and rehabilitation data.

5.1 Classifying disturbance in GIS

For ease of use, all land disturbances within the Project area will be described using the description provided in the *DoIR Bond Policy* (DoIR, 2008). This classification will enable bond liabilities to be easily calculated and reconciled in line with annual environmental reporting (AER) requirements (DoIR, 1996). The current DoIR mining disturbance descriptions and relevant bond rates are outlined in Table 5-1. Any disturbance types not described in the relevant guideline will be discussed with DoIR and appropriate performance bonds applied.

Table 5-1: Minimum bond rates.

RATES		
RATE	DESCRIPTION	RATE/HA MINIMUM
1*	Tailings Storage Facilities, including in-pit disposal, Heap/Vat leach, Evaporation dams, Turkey Nest Dams, Waste dumps, ROM pads, low grade oxide stockpiles, plant sites, workshops and process water dams.	A$20,000
2	Camp Sites, Strip Mining (backfilled mining voids), hypersaline pipelines (>15,000 TDS), causeways, haul roads, sewage ponds and landfill.	A$5,000
3	Roads and access tracks, “Fresh” water pipelines, lay down areas, borrow pits and airstrips.	A$3,000

******High risk facilities and landforms (sulphides present, highly erodible or >25m high) may attract a higher rate and will be determined on a case by case basis).*

^*Higher risk exploration programs will be bonded at A$2,000/ha, eg exploration programs in environmentally sensitive areas.*

Source: DoIR, 2008

5.2 Classification of rehabilitation works in GIS

The *DoIR Bond Policy* provides for the reduction of bond rates and eventual retirement of the performance bonds following the completion of applicable criteria (DoIR, 2008). Within the GIS, closure and rehabilitation activities undertaken during the life of the project should be recorded and classified following the criteria provided by DoIR. Using these criteria will enable accurate calculation of the areas rehabilitated and the applicable bond reduction available to the proponent. The *DoIR Bond Policy* outlines the bond reduction rates and criteria required as shown in Table 5-2 (DoIR, 2008).

Table 5-2: Bond reduction rates and criteria.

STAGE	ACTION	COMPLETION CRITERIA MET	REDUCTION RATES (AFTER 01/07/2008)
1	Primary Earthworks - reshaping - drainage	Structure stable. Erosion controlled. Water run-off managed effectively.	50% total.
2	Finishing Earthworks - topsoil spread - deep ripping	Appropriate topsoil cover. Adequate, contour ripping. Demonstrated stability and erosion control.	30% total.
3	Re-vegetation - seeding - planting	Vegetation established but not demonstrated to be self-sustaining. Weed control program commenced. Grazing control commenced.	20% total.
4	Relinquishment - all actions complete	All criteria met.	Bond Retired.

(Source: DoIR, 2008).

5.3 Other GIS uses

The closure and rehabilitation GIS database will be used for other functions including:

- tracking the location and volumes of topsoil, vegetation and other rehabilitation material stockpiles;
- storing and displaying rehabilitation monitoring data;
- storing and reporting ground and surface water monitoring data;
- tracking progress of progressive closure activities; and
- displaying the locations of environmental incidents (eg hydrocarbon spills, saline water contamination sites).

Sufficient resourcing and training of relevant staff is required to ensure any geographic information system can be suitably maintained.

6 Conclusions

The Roy Hill 1 Iron Ore Project is anticipated to be in operation for a period in excess of 20 years. At this early stage of the Project development it is impossible to identify all possible project disturbances and closure issues that may eventuate during the life of the operation. The Conceptual Mine Closure and Rehabilitation Management Plan provides the framework for establishing mine closure criteria and the development of a detailed Mine Closure and Rehabilitation Plan. The detailed Mine Closure and Rehabilitation Plan will require significant input from community and government stakeholders and require regular review and updates. The plan is designed to evolve from conceptual to comprehensive as the project progresses and changes during the mine life.

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