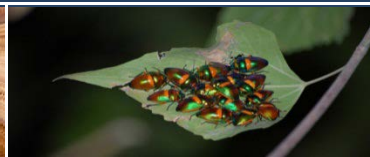




Appendix J Rehabilitation & Mine Closure Plan



Sherwin Iron (NT) Pty Ltd
Sherwin Creek Iron Ore Project
Environmental Impact Statement



2013





Draft Rehabilitation and Mine Closure Plan: Sherwin Creek Iron Ore Project

Prepared for: Sherwin Iron (NT) Pty Ltd

Prepared by: EcOz Environmental Services



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Executive Summary

Sherwin Iron (NT) Pty Ltd (Sherwin) is proposing to develop an iron ore mine in the Roper River region of the Northern Territory. The project is titled the Sherwin Creek Iron Ore Project.

This Draft Rehabilitation and Mine Closure Plan (RMCP) is a preliminary document and has been developed to ensure that the rehabilitation and closure program is integrated into the mine plan and considered as part of the mining operation, rather than as a separate phase at the end of mine life.

Sherwin have identified that physical and financial resources will be provided to assist rehabilitation and closure, and the planning and studying of these activities from the beginning of operations. The RMCP will be subject to adaptive management through annual review and updating.

It is intended that as much rehabilitation as possible will be undertaken progressively during the life of the mine. This will allow rehabilitation methods to be tested, refined and adapted to suit a successful method for final rehabilitation. Where operationally practicable, rehabilitation will be performed as soon as possible after disturbance.

As far as possible, the landforms will be designed to be compliant with the post-mining land use agreed to by the relevant stakeholders, to this end consultation with relevant stakeholders will be undertaken during the first year of operation. It is important that the reinstated landforms are capable of supporting a functioning ecosystem. In general terms, a 'functional' ecosystem is considered to be one that is:

- Stable (not subject to high rates of erosion)
- Effective in retaining water and nutrients
- Self-sustaining
- Safe
- Free of weeds.

At the completion of rehabilitation establishment operations, monitoring will assess early rehabilitation success, reveal the need for any remedial actions (i.e. maintenance) and determine whether rehabilitation is likely to meet long-term objectives and mine closure criteria.

Completion criteria are necessary to provide the basis on which successful rehabilitation and mine closure, and achievements of closure objectives are determined. The criteria will be developed before the end of the second year of operation and will be subject to on going review and refinement throughout the project to respond to information from monitoring and research trials, and any other information or change, as appropriate. Once developed, the completion criteria will include performance indicators to assess if rehabilitation trends are following the desired performance. This will enable tracking of the progressive rehabilitation of the site.

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1 Introduction

Sherwin Iron (NT) Pty Ltd (Sherwin) is seeking approval to mine the direct shipping ore (DSO) portion of the Sherwin Creek Iron Ore Project. Planning for rehabilitation will be undertaken in the early stages of project development and developed in the context of the overall site closure objectives. Progressive rehabilitation will be carried out and will begin before the end of the second year of operation. Sherwin also commits to development of a comprehensive Mine Closure Plan with updated rehabilitation commitments two years before expected mine closure. This will enable capture of the lessons of early rehabilitation and the best mine management practice at that time.

Although this plan is a preliminary approach and compiled prior to the approval and development of the project, it is focussed on:

- Ensuring that the rehabilitation and closure program is integrated into the mine plan and considered as part of the mining operation, rather than as a separate phase at the end of mine life
- Understanding the issues that will require management to ensure effective closure planning
- Ensuring that the currently available information be prepared and presented, so that it can be utilised in the planning phases
- Identifying the types of information that will need to be gathered during the early stages of the project that will feed into the rehabilitation and closure plans.

It is intended that as much rehabilitation as possible will be undertaken progressively during the life of the mine. This will allow rehabilitation methods to be tested, refined and adapted to suit a successful method for final rehabilitation.

1.1 Project overview

The Sherwin Creek Iron Ore Project area within MLA29584 (Figure 1) is located approximately 540 km south-south-east of Darwin and is within EL24101. It is accessed via the Stuart Highway south to Mataranka and then approximately 150kms east along the Roper Highway towards Roper Bar and the Gulf of Carpentaria. EL24101 is located entirely within the Urapunga (SD53-10) 1:250 000 map sheet.

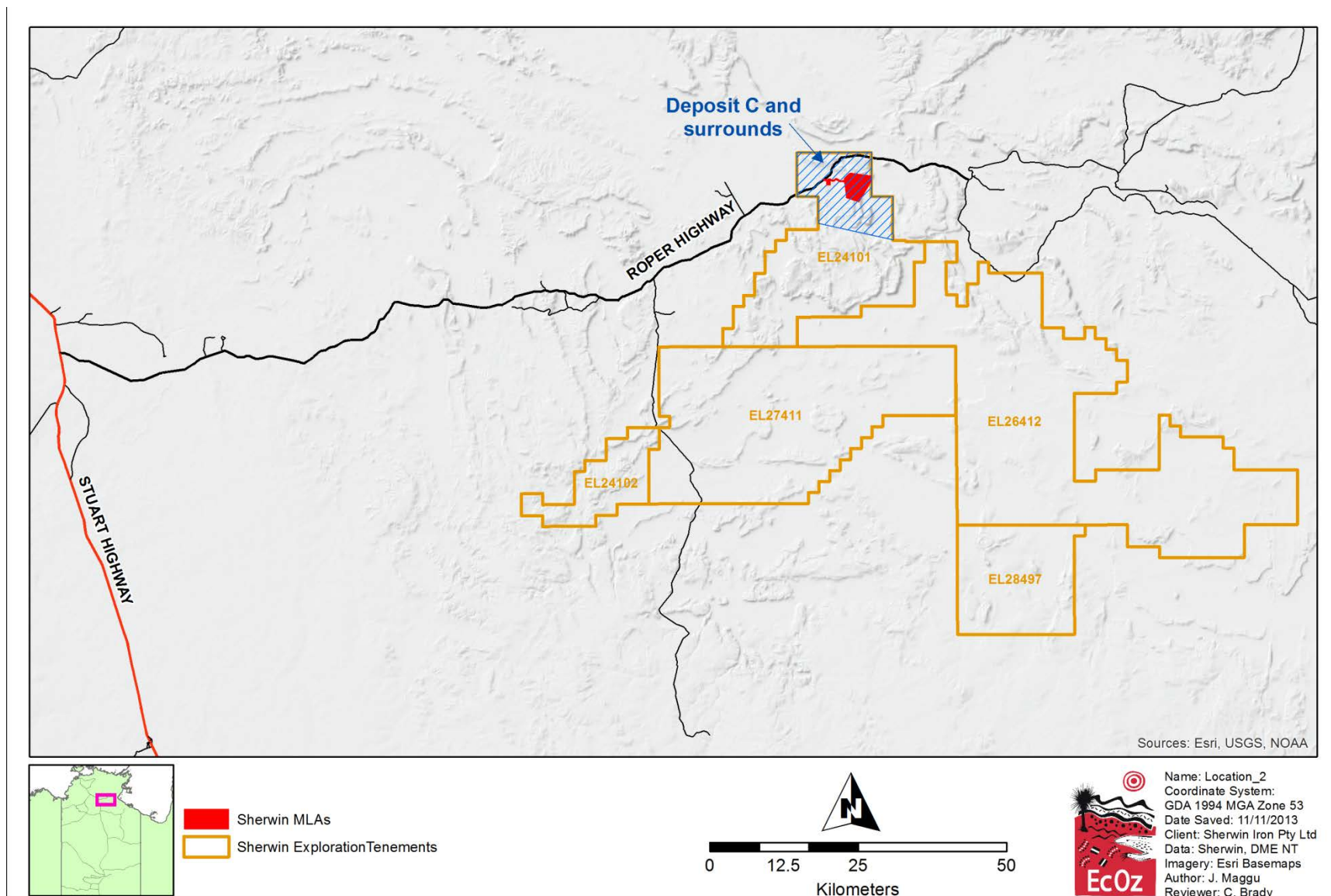


Figure 1. Location of Sherwin Creek Iron Ore project

The project will involve the development of:

- Open pits to mine DSO at Deposit C (within ML29584)
- Infrastructure (workshops, office, laydown, magazine, drainage, others)
- An area for DSO stockpile at the mine (ROM)
- Low grade stockpile area and waste dump area at the mine site
- Haul road between pit and stockpiles
- Service roads within the project
- Accommodation village
- Water management and water storage infrastructure
- Haul road construction between Deposit C and the Roper Highway
- Stockpile at the Port of Darwin.

The proposed layout of the mining lease area of the project is presented in Figure 2. This initial Draft Rehabilitation and Mine Closure Plan (RMCP) is submitted as an appendix to the project EIS and the information summarised in this project overview is analysed in detail elsewhere. Once the RMCP becomes a stand-alone document for use throughout the life of the project, it will include an increased level of information, so that new employees and stakeholders gain a full understanding of the project history, components and environmental and social policies and compliances.

The DSO is located at shallow depths resulting in a mining pit design that will evolve as the mining activities progress along the deposit. The deposit is expected to be mined in sections so that as much as practicable the top soils and rock wastes can be returned to the depleted pits and progressive rehabilitation can occur. Generally disturbed areas will be rehabilitated as follows:

- **Top soils** – will be carefully removed and stored as these materials will provide optimum revegetation conditions by being natural seed and nutrient banks minimising the need for direct revegetation. Where ever possible top soil will be removed and immediately place on an area prepared for rehabilitation.
- **Open Pits** - where pit design is amenable, conventional truck and shovel open cut mining methods and surface mining machines are expected to be used allowing open pits to be progressively backfilled with waste rock during mining. Landforms will be constructed utilising overburden of varying characteristics to maximise the success of rehabilitation. These areas will be contoured to blend with the surrounding environment and covered with top soil allowing direct seed revegetation with native species.
- **Subgrade ore stockpile** - will be battered off to a stable landform at 20° and deep-rippled on contour to minimise erosion of the waste dump face and will be vegetated.
- **Infrastructure Areas** – any infrastructure not required or not wanted to remain on site after mining ceases will be removed. Any affected and/or contaminated areas will be remediated, revegetated with native species and where possible blended to the surrounding natural landscape.

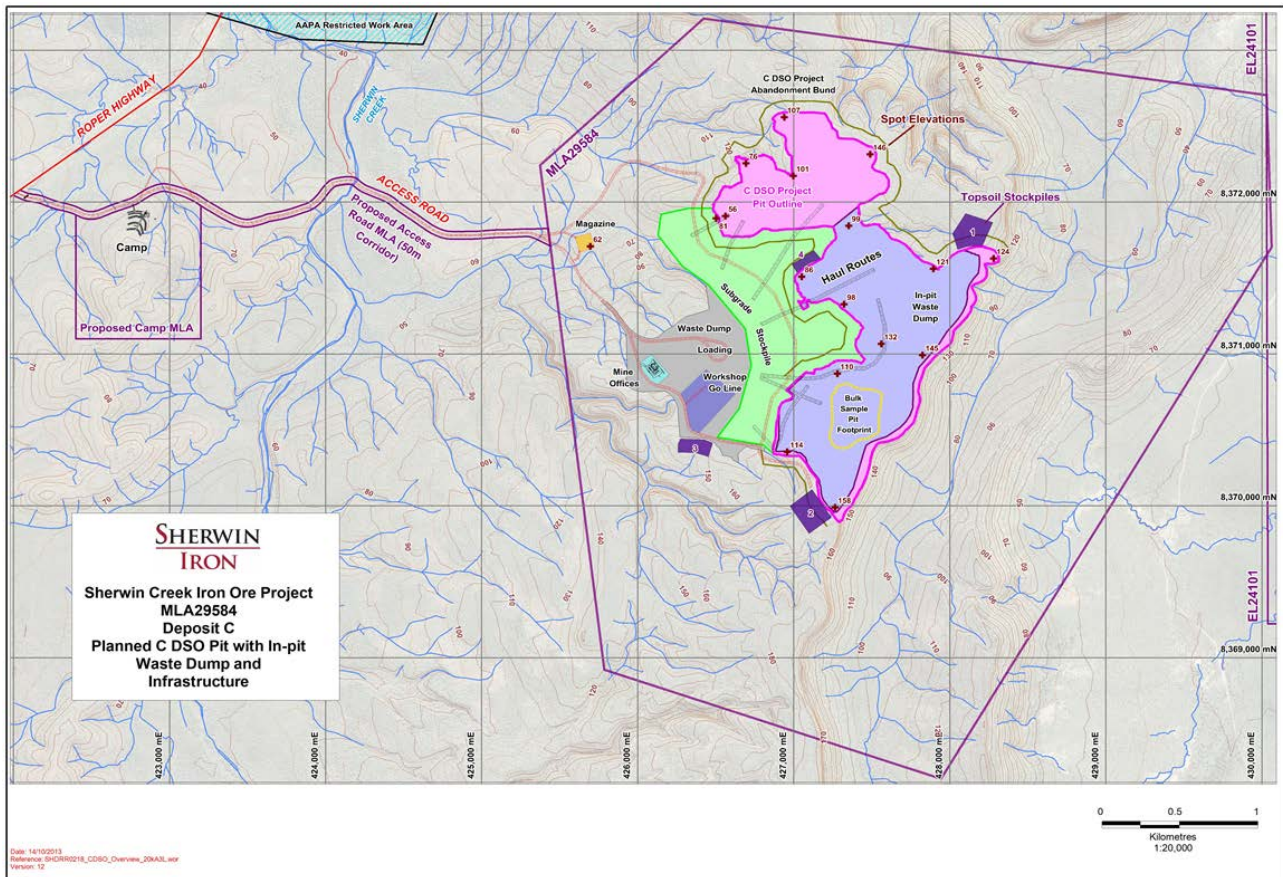


Figure 2. Layout of the Mining Area Disturbance areas – Deposit C

1.2 Regulatory requirements

A conceptual Mine Closure Plan is a requirement of the project EIS, as identified in the EIS Guidelines, to demonstrate an understanding of the issues that require management at closure and that all the relevant issues have been identified and appropriately managed.

The *Mining Management Act 2001*, administered by the NT Department of Mines and Energy (DME), is the main statute under which mining operations are regulated in the Northern Territory. Under the *Mining Management Act*, a Mining Management Plan (MMP) is to be submitted with an application for an authorisation and must include details on all aspects of the projects operations, including a plan and costing of closure activities.

The *Mining Management Act 2001* also requires that operators of mining interests submit 100% of the security calculated for rehabilitation and closure. This prerequisite is the highest level of security required by any jurisdiction in Australia and provides the regulators and stakeholders with confidence that the site can be successfully closed, irrespective of the financial or other condition of the operator.

1.3 Company obligations and commitments

Sherwin have identified that physical and financial resources will be provided to assist rehabilitation and closure, and the planning and studying of these activities from the beginning of operations.

Along with the project MMP, the RMCP will be subject to adaptive management through annual review and updating. This will include a review of assumptions and cost estimates to address any changes in circumstances such as changes in mining schedules, legal requirements, new technologies and local

environmental and community expectations. These reviews will be performed by appropriately experienced and competent persons, including external experts.

Sherwin commit to undertake consultation with relevant stakeholders to develop closure criteria during the first year of operation. Sherwin intend to develop, monitor and react to a life-of-project Social Impact Assessment, which will allow for the on-going engagement of stakeholders with respect to their rehabilitation and closure expectations.

Sherwin commit to progressive rehabilitation with some rehabilitation occurring within two years of the commencement of operations. During the first year of operation Sherwin also commit to an analysis of previous rehabilitation of other similar sites to inform their rehabilitation strategy.

1.3.1 Goals

In accordance with the document *Leading Practice Sustainable Development in Mining – Mine Rehabilitation* (DITR 2006), the key message and goals associated with this Rehabilitation and Closure Planning document include:

- The development of a rehabilitation plan during the planning phase which will evolve as results from research and on-site trials become available
- Ensuring early characterisation of the materials to be rehabilitated to identify potential issues in time for them to be resolved
- The understanding of the environmental factors which have the potential to constrain rehabilitation success
- The setting of realistic rehabilitation objectives.

2 Rehabilitation Plan

2.1 Rehabilitation strategy

Where operationally practicable, rehabilitation will be performed as soon as possible after disturbance, and this progressive rehabilitation will help inform and refine ongoing selected rehabilitation processes and closure plans. Sherwin commit to beginning rehabilitation before the end of the second year of operation. To ensure this strategy can be achieved, financial provision for rehabilitation and closure will be reviewed annually, as will ongoing consultation with stakeholders about post-mining land use objectives. Additionally, Sherwin will monitor the success of rehabilitation. Early investigations and observations will be used to improve rehabilitation planning. Ongoing research and investigation will be carried out and applied to the annual review of the RMCP.

Initial rehabilitation will involve the use of topsoil and the natural seed bank. The rehabilitation will be monitored to determine if this method results in an appropriate species mix and ground cover. If required experiments with additional seeding and planting of tube stock will be undertaken.

2.2 Rehabilitation objectives

The main objectives of the Sherwin rehabilitation program are to:

- Plan the placement of soil and waste materials in a strategic manner to facilitate progressive rehabilitation and to minimise material handling costs
- Conduct studies that will enable effective techniques to be implemented when carrying out rehabilitation
- Carry out rehabilitation works that will, at the completion of the mining project, result in a stable, self-sustaining vegetated landscape having minimal impact on the surrounding environment. The analogue areas will provide key natural parameters to achieve these objectives
- Create a landform with a land use capability similar to that prior to disturbance, unless other appropriate land uses are pre-determined and agreed upon
- Carry out construction and rehabilitation works that will, at the completion of the mining project, result in stable landforms with drainage systems having minimal impact on the surrounding environment
- Create a landform in line with the desires of stakeholders
- Develop a clear set of indicators that will demonstrate successful rehabilitation.

The rehabilitation strategy will remain flexible and will be amended as new rehabilitation techniques and environmental investigations progress.

2.3 Rehabilitation planning

Conventional truck and shovel open cut mining methods are expected to be used during the first phase of the proposed mining operations. Accordingly, the initial stages of the project will require there to be some soil, overburden and waste material storages.

Initial planning will focus on the prevention of any contamination leaving the mine footprint to the wider environment and progressive rehabilitation of the pit to minimise any effects on the surrounding environment. Principally, these will encompass;

- Contamination identification, containment and remediation to prevent mining development effects on the surface and ground waters

- Adequate design and construction of mine waste landforms that are geotechnically, physically and geochemically stable
- Altered landforms are contoured and where feasible immediately rehabilitated.

Suitable key processes are;

- Implementation of environmental monitoring and reporting programs focusing on preventing wider site disturbances so as to achieve closure outcomes in the shortest possible periods of time
- Implementation of risk management processes to identify and develop processes to address potential problems in a timely, cost-effective and efficient manner
- Implementation of long term monitoring and maintenance to reduce residual risks through design, remodelling, landform reshaping and remediation
- Implement processes for stakeholder involvement so rehabilitation and closure practice and commitments:
 - o Meet their perceptions of a suitable end land use of the project area
 - o Incorporate their requirements
 - o Keep informed of the achievements of ongoing mine rehabilitation processes towards closure.

2.3.1 Scheduling

Aside of the commitments made elsewhere, early in the mine life and once resource extraction has commenced, Sherwin plans to:

- Stockpile and segregate topsoil and subsoil
- Form back-filled pits so as to reduce the overall impact area and minimise potential short and long-term management issues associated with the creation of pit voids and above ground waste dumps
- Begin rehabilitation trials as soon as practicable and before the end of the second year of operation.

Research will be undertaken concurrently with mining operations to ensure the best possible understanding of site specific requirements that will lead to successful rehabilitation.

Additionally, Sherwin will:

- Develop of a more detailed RMCP within two years of the commencement of mining. This plan will be submitted for review and approval by the consent authority
- Subject this RMCP to continual adaptive management to ensure the latest thinking and best rehabilitation and mine management practice is being considered and incorporated
- Within a period of not less than four years prior to the completion of mining and intended mine closure, the RMCP will be updated to incorporate previous years' rehabilitation and outcomes. This plan will be again be submitted for review and approval by the consent authority.

2.3.2 Rehabilitation zones

Sherwin is proposing to mine in a sequential manner and to progressively rehabilitate mined out and other disturbed areas. For this purpose, the site can be separated into identifiable zones for rehabilitation:

- Infill of the first available mined out pit
- Subgrade ore stockpile
- Other mining and waste areas as required and available including exploration drill holes, pads, provisional sumps
- Project infrastructure including ROM pad and plant area, and heavy vehicle internal roads
- Project infrastructure including haul road within the tenements
- Project infrastructure such as water management and storage areas, sensitive management areas, internal light vehicle roads and accommodation facility.

This RMCP will continually be reviewed and updated. Thus the current focuses are on areas which will be the first rehabilitated. Practices employed in these activities will help inform and improve future rehabilitation plans and methodologies. General principles applied to rehabilitation of other areas are provided, with the understanding that this may change due to the increased knowledge from initial rehabilitation undertaken.

2.3.3 Rehabilitation methods

During the first year of operation Sherwin will undertake an analysis of previous rehabilitation of other similar sites to inform their rehabilitation strategy. General rehabilitation of mine disturbed sites will be based on the following general principles:

- All areas significantly disturbed by mining activities will be rehabilitated to a stable landform with a self-sustaining vegetation cover
- Constructed landforms will be sited so they do not interfere with any potential future pit areas or access to new ore bodies
- Local seeds and propagules contained within topsoil will be utilised for revegetation programs
- Rehabilitation works will commence before the end of the second year of operation
- Land will generally be regarded as successfully rehabilitated when nominated targets (to be established within two years of commencement of mining) for land use (including vegetation cover and composition), landform stability, and land contamination have been met
- All topsoil and soil forming materials will be managed in a manner that enables retention of soil biological, chemical and physical properties
- Rehabilitation trials will be performed during the early operational period to refine the rehabilitation design
- Site-specific issues will be identified to enable adoption of the most appropriate rehabilitation methods to ensure they are both achievable and current best-practice.

Backfilled Pits

Mine pits will be progressively rehabilitated in the following manner:

- A bund wall will be constructed around the completed mining area.
- Any reactive materials returned to the pits shall be properly encapsulated by methodologies as proposed for the PAF materials
- Overburden susceptible to erosion will be appropriately encapsulated within the pits (see Figure 3)
- Back-filled pits shall be properly contoured and blended with the surrounding environment
- Surface outlines are implemented with proper drainage systems so as to prevent erosion of cover soils
- Topsoil will be spread over the final landform and the surface ripped
- Cleared vegetation will be placed over the landform to provide habitat for fauna
- Initial revegetation of the landform will rely on seed stored in the topsoil. An assessment of the success of revegetation will be made following the wet season. If required, additional seed will be spread over the landform. Plantings of raised seedlings may also be undertaken if required.

Haul Road Rehabilitation

At the cessation of the project Sherwin will consult with the NT Government on their preferences for decommissioning. The standard road rehabilitation techniques outlined below will be applied if the relevant stakeholders do not wish to take ownership of any of the roads.

Should a haul road no longer be required, Sherwin will rehabilitate the haul road area as follows;

- Removal of all infrastructure including culverts, bridges, signage and any other civil construction, ensuring that the remaining land surface is safe and stable
- To aid in success of rehabilitation, access to the road will be blocked to ensure no unofficial ongoing use of the road by the general public
- Establishment of a land surface which is able to support vegetation growth and not prone to erosion or sedimentation issues in perpetuity, particularly near waterways and in areas subject to flood risk
- Ensure re-instatement of vegetation native to the area and consistent with the surrounding environment, through deep ripping to the contour and natural seeding
- Identification of areas with potential for weed introduction or spread and appropriate mitigation strategies undertaken, e.g. ongoing monitoring and control programs
- Ensure that drainage is not interrupted to minimise downstream impacts on vegetation, this may include leaving some culverts in place beyond the life of the haul road, to ensure that flow is not impeded.

2.3.4 Revegetation

Rehabilitation areas will be compatible with the surrounding landscape. It is expected that the majority of revegetation will occur in the lead up to the wet season. Revegetation will begin with the spreading of topsoil on the revegetation area, to provide an endemic seed bank and soil microbes. Where possible and appropriate, topsoil will be located from a new mining or disturbance area to a revegetation area as soon as possible, to promote and retain the biological value of the soil.

The amount of topsoil available is dependent upon the pit area to rehabilitation area ratio and therefore strategies such as spreading it to a thinner depth or placing it in strips will be investigated. Another strategy is to scarify the rehabilitation area across slope so as to 'key in' the topsoil and reduce the likelihood of it being lost through erosion.

The initial goal of rehabilitation and revegetation is to provide stability to the created landform. The design of the landform is expected to achieve this short term goal. Follow up actions such as direct seeding or the planting of seedlings may be required, so as to achieve a suitable species mix.

A site relevant methodology to study the success of rehabilitation will be developed and utilised within two years of the commencement of rehabilitation.

Progress, success and the endpoint of rehabilitation will be assessed by an industry best practice monitoring program, which will indicate landscape functionality and resilience.

It is expected that the initial rehabilitation trials will take place during Year 2, and will continue allowing for several years of study and refinement prior to larger scale rehabilitation.

The mine sites and much of the surrounding area currently has few weeds. A Weed and Pest Management Plan is submitted as part of the EIS process along with this document. Monitoring for weeds and control of new infestations is a high priority and will remain so throughout the project.

The occurrence of feral animals in and around the site is low and active management during operations and rehabilitation will reduce any potential impacts to rehabilitated areas from feral animals.

Fire will be excluded from rehabilitation areas for several years, until it is determined that the vegetation is sufficiently established to be resilient to fire. The rehabilitation areas will be protected by firebreaks to assist this.

2.3.5 Materials characterisation

Waste material has been classified according to its physical properties (Campbell & Associates 2011; Outback Ecology 2011). Overburden has been classified in three distinct management units:

- Overburden Management Unit Three (OMU3) consists of Clay, Colluvium and Mudstone materials. These materials will be used as growth medium/topsoil layer
- Overburden Management Unit Two (OMU2) consists of Ferruginous siltstone/sandstone, Ironstone, Porcellanite, Sandstone and Siltstone. These materials will form the main structural material for landform construction and will also be blended with OMU3 to reduce the erosion potential of OMU3
- Overburden Management Unit One (OMU1) consists of the Quartz Sandstone lithology, which is particularly susceptible to erosion, hard-setting and structural decline. These materials will be buried within the final landform.

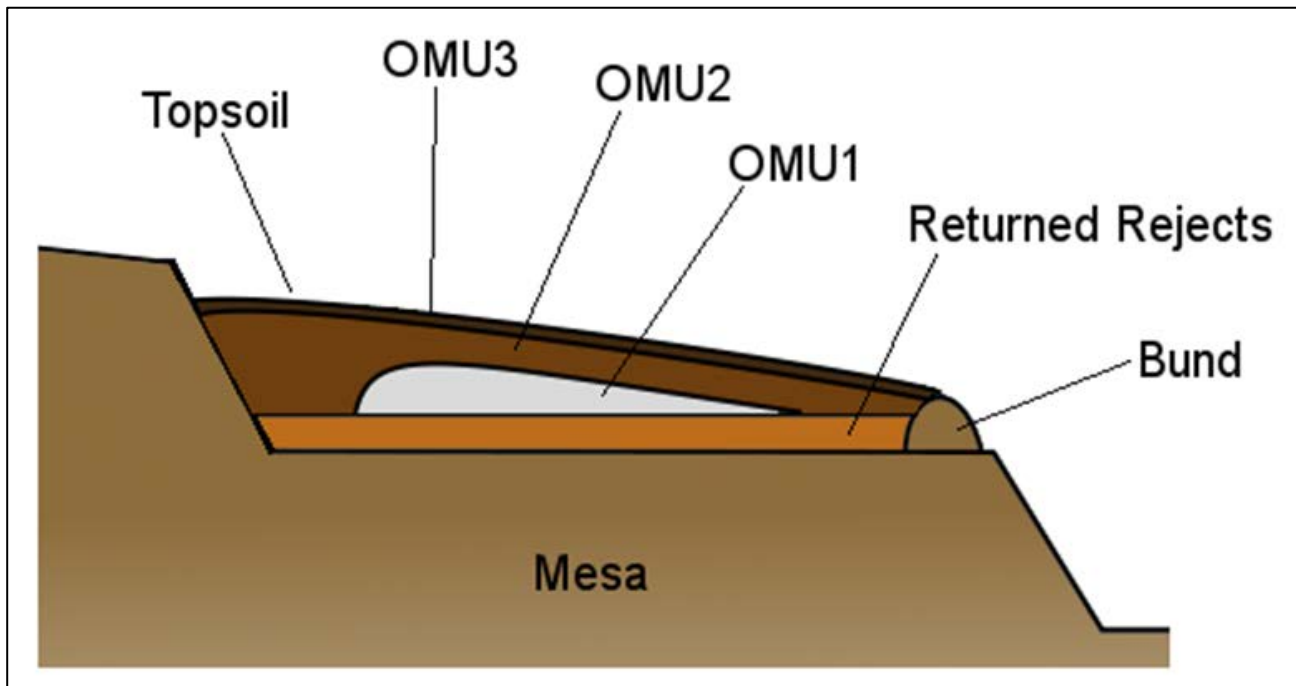


Figure 3. In-pit waste landform conceptual schematic

The entire deposit lies well above the regional and local groundwater table. In general, the mine waste is considered to be non-acid forming. Very minor occurrences of potentially acid forming (PAF) material were discovered and will be further studied.

2.3.6 Erosion and sedimentation

The prevention of erosion and sedimentation is critical to the success of the long term stability of any disturbed or rehabilitated area. An Erosion and Sediment Control Plan (ESCP) has been developed for the project (appendix E). The principles and guidance presented within these documents will be adopted in an updated RMCP. The ESCP will focus on the prevention of sediment leaving the site via the implementation of sediment ponds and other geotechnical measures adopted in the construction of the pit bunds, waste rock dumps, and other mine infrastructure.

2.3.7 Physical constraints

The nature of iron ore mining involves the rock being physically removed from its place of origin. This creates physical constraints on rehabilitation options. Topsoil is also scarce in some of the areas, especially where the ore outcrops on the surface. These constraints have been identified as being manageable as they are constraints presented to many other projects, and responses to these constraints are well established. Other potential physical constraints will be identified and researched during the early stages of the project.

2.4 Progressive rehabilitation

Progressive rehabilitation during the life of the mine helps to reduce the overall liability for rehabilitation works particularly after decommissioning of the site when there is no direct income to offset costs. Progressive rehabilitation will be implemented throughout the mine life. Progressive rehabilitation provides an opportunity for testing rehabilitation practices and for the on-going development and improvement of rehabilitation methods. In addition, the visual amenity of the site will also be improved. Progressive rehabilitation of waste landforms, backfilled pits, and all other disturbed areas will be done as soon as practicable to the appropriate standard and recommended guidelines

During mining, research and site trials will enable the rehabilitation program to be modified to reflect site-specific parameters. At closure, the final landforms will be created and the progressive rehabilitation program extended to include the remaining areas of disturbance. During mining, research and site trials will enable the rehabilitation program to be modified to reflect site-specific parameters.

2.4.1 Topsoil management

Depending on its constituents, topsoil can serve a number of important functions, such as (DITR 2006);

- The supply of seed and other propagules
- Contribution of beneficial micro-organisms
- Supply of natural nutrients
- Rapid development of groundcover
- Amelioration of adverse constituents in the underlying mine waste.

Topsoil and its seed bank viability are difficult to manage in the wet dry tropics. For this reason the use of topsoil from one location to rehabilitate another location is the best way to ensure nutrient viability of the soil, its organisms and seed bank. Therefore, where possible, the timing of topsoil removal would be coordinated with rehabilitation operations to ensure minimal handling and storage.

It is expected that the amount of topsoil available will be limited and therefore strategies such as spreading it to a thinner depth or placing it in strips will be investigated. Another strategy would be to scarify the rehabilitation area across slope so as to 'key in' the topsoil and reduce the likelihood of it being lost through erosion.

2.4.2 Developing a functional ecosystem

In general terms, a 'functional' ecosystem is considered to be one that is:

- Stable (not subject to high rates of erosion)
- Effective in retaining water and nutrients
- Self-sustaining
- Safe
- Free of weeds.

These goals are achievable and an appropriate monitoring regime will be installed to ensure that these goals can be and are being met.

Specific ecological indices which may be used to determine success of rehabilitation include:

- Development of completion criteria, through consultation with stakeholders
- Establishment of plant species compatible with the surrounding areas
- Resilience to likely disturbance
- The absence of erosion.

2.4.3 Monitoring and maintenance

Monitoring is essential to determine whether the rehabilitation program is achieving its goals. During rehabilitation establishment, relevant information will be documented in detail. This serves the dual purposes of enabling analysis of rehabilitation success and the information can also be used as an auditable checklist to confirm to regulators and stakeholders that agreed commitments have been met.

At the completion of rehabilitation establishment operations, monitoring can assess early rehabilitation success, reveal the need for any remedial actions (i.e. maintenance) and determine whether rehabilitation is likely to meet long-term objectives and mine closure criteria.

An annual monitoring and assessment report will enable:

- a. Classification and quantification of rehabilitation status;
- b. Comment on progress with rehabilitation, forecast trajectories and succession trends and highlight any alterations which need to feedback into management interventions;
- c. Enhanced appreciation of the complexity, requirements and criteria delimiting successful rehabilitation for the local context; and
- d. Determination of an endpoint to intervention post-mining (i.e. completion criteria).

Sherwin appreciates that a successful rehabilitation monitoring program needs to incorporate a strong overarching management cycle. Scientific assessment, evaluation of ecosystem development and continuous improvement are important components of this cycle. In particular, Sherwin sees a need to strengthen how monitoring may inform management practices.

2.5 Contingency management

In the event that monitoring shows that rehabilitation is not on a trajectory to meet the success or completion criteria, Sherwin will modify the rehabilitation program. Specifically, where monitoring has identified development of acid effluents, erosion, weed invasion, or failure of revegetation (to any material degree) maintenance activities will be implemented to ensure rehabilitation progresses efficaciously and swiftly. This might include the propagation of different plant species, modification of erosion and sedimentation control structures, and/or the implementation of supportive management such as irrigation.

In the worst case scenario the Northern Territory Government will have received a 100% security bond to ensure rehabilitation can continue, as discussed below.

2.6 Unexpected or temporary closure

The requirement for provision in the event of unexpected closure will be addressed annually as part of the submission of the Mining Management Plan (MMP)

The MMP will contain a summary of the current disturbed areas and the progressive rehabilitation status. Closure costs are re-calculated annually and are included in the MMP, providing a detailed allocation for decommissioning and rehabilitation costs, including a contingency. Closure costs provide the basis for the security bond. The Northern Territory requires a 100% security bond.

In the event of unexpected closure,

- An environmental audit of the site will be conducted immediately and provided to DME
- Mine access and security and will be reviewed
- Storage of chemicals and hydrocarbons will be reviewed and removal if necessary
- A programme to address incomplete rehabilitation and revegetation works will be developed

- Any contaminated material will be relocated from hardstand areas to a suitable holding facility, and any PAF material will be placed within an open pit and suitably encapsulated within an appropriate landform
- The stability of landforms, water quality and revegetation will be monitored.

The security bond will fund activities so that the site can be rehabilitated in accordance with the closure plan.

3 Mine Closure Plan

3.1 Scope

The RMCP identifies project design components that assist with the closure planning of the site, rehabilitation measures, monitoring and reporting of rehabilitation activities and the need for closure activities.

3.2 Closure objectives

As a general guide, government's broad closure objectives require that a mine site is physically safe to humans and animals, geotechnically and geochemically stable and non-polluting, and capable of sustaining an agreed post-mining land use. Any residual liabilities relating to the agreed land use must be identified and agreed to by the key stakeholders. At the project approval stage, it is acceptable for the closure objectives to be more broadly identified and further refined in the stakeholder consultation process (WAEPA/DMP 2011), provided that they are based on the best available data at the time and specific enough to guide closure development strategies.

The area to be disturbed is within a large and intact landscape. The current uses for the area are limited to pastoralism, subsistence-type enjoyment and hunting/ gathering activities. The actual areas of impact have previously been largely inaccessible by vehicle.

It is not expected that the current level or type of use for the area will change significantly. The closure objectives are based on returning a landscape to a condition suitable to continue current uses.

The key closure objectives are to:

- Be compatibility with agreed post-mining land use
- Achieve compliance with regulatory requirements
- Ensure the health and well-being of people and fauna
- Remove all unwanted infrastructure and any removable non mining wastes from the site
- Create safe, stable, non-polluting and sustainable landforms
- Achieve establishment of vegetation that is self-sustaining and demonstrates a return of ecosystem functions and is resilient to the local predicted fire regime
- Maintain water quality and flows in waterways
- Minimise long-term visual impact by creating acceptable landforms, compatible with the adjacent landscape
- Achieve mining lease relinquishment without a requirement for on-going active intervention.

3.3 Identification of closure obligations and commitments

This section will be developed to include the relevant components of the EIS Assessment Report and Mining Management Plan pertaining to rehabilitation and closure.

It will provide Sherwin with a register of legal obligations and associated timing of delivery of such obligations required to be performed during the life of the project.

At closure, this can be used as a checklist to demonstrate that all conditions, commitments and obligations have been met.

3.4 Collection and analysis of closure data

Where applicable, collection and analysis of closure data will be designed and implemented to meet the following minimum requirements:

- Use of recognised or acceptable methodologies and standards
- Incorporate appropriate quality management systems and procedures (e.g. ISO 9000)
- Consideration of the wider receiving environment, receptors and exposure pathways
- Provide a basis to develop specific criteria or indicators for closure monitoring and performance.

3.4.1 Environmental data

Detailed baseline information on the ecology, surface and groundwater conditions of the site exists and is presented in the project EIS. General soil studies have been started and aspects of soils more relevant to rehabilitation will be part of on-going studies. Geochemical and waste material characterisation studies have been performed (Campbell & Associates 2011; Outback Ecology 2011) and will continue throughout the life of the project.

3.4.2 Analysis of data

Analysis of the collected data is a critical element in understanding the issues impacting mine closure and identifying knowledge gaps (ICMM 2008) which may affect the rehabilitation and closure outcomes. Where appropriate, the data analysis should take into account the natural background levels of particular elements and possible environmental impacts from other sources, which may affect the closure strategy or management of the site.

3.5 Stakeholder consultation

Stakeholder consultation is a key component of the mine closure planning process.

There have been no land use objectives identified beyond the current land uses, which are focussed on the use of the natural environment for pastoral, social, cultural and subsistence style activities (Appendix K). The site will obviously be altered but good planning, implementation and monitoring of the rehabilitation and closure should result in no loss of these values once the site is relinquished.

Further consultation regarding closure criteria will be undertaken as part of the on-going Social Impact Assessment review, consultation and communication process.

3.6 Post-mining land use

As far as possible, the landforms will be designed to be compliant with the post-mining land use agreed to by the relevant stakeholders. It is important that the reinstated landforms are capable of supporting a sustainable ecosystem. The post rehabilitation landforms of in-filled pits, ROM pads and infrastructure areas will generally conform as far as practicable to the pre-mining topography with an earthen cover and a vegetated surface.

It is likely that post-mining the area will return to pastoral production. There will be on-going opportunity through the life of project via the social impact assessment and consultation process to establish more specific details about rehabilitation and site-specific requirements.

3.7 Identification and management of closure issues

At this pre-approvals stage of the project, closure issues that have been identified include the potential for:

- Acid and/or metalliferous drainage (AMD)

- Adverse impacts on surface and/or groundwater quality
- Dust emissions
- Impacts on flora and/or fauna species diversity
- Visual amenity
- On-going erosion control (dispersive materials)
- Closure requirements for surface water management structures
- Contaminated sites.

The pre and during project management for these and other potential issues are identified in the Project EIS and EMP (Appendix D). It is expected that where needed, advanced plans for the management of these issues for closure will be developed during the early stages of the projects operation.

3.8 Development of completion criteria

Completion criteria are necessary to provide the basis on which successful rehabilitation and mine closure, and achievements of closure objectives are determined. The criteria need to be reviewed and refined throughout the development and operation of the project to respond to information from monitoring and research trials, and any other information or change, as appropriate.

Once developed, the completion criteria will include performance indicators to demonstrate that rehabilitation trends are following the desired performance. This will enable tracking of the progressive rehabilitation of the site.

Indicative completion criteria can be determined from the key closure objectives, as outlined in Section 3.2 above. However, the completion criteria and associated performance indicators will be site-specific, scientifically supported and capable of objective measurement or verification of performance or success, in order to provide certainty for reporting and auditing to define rehabilitation endpoints (ANZMEC/MCA 2000).

Table 1. Closure objectives and completion criteria

Closure Objectives	Indicative Completion Criteria	Completion Criteria	Measurement Tools
Compatibility with agreed post-mining land use.	Agreement regarding end use of land with DME and other relevant stakeholders.	Post-mining land use defined and achieved.	Documented agreement on post-mining land use.
Ensure the health and well-being of people and fauna.	Residual toxic material such as chemicals and fuel removed.	No exposure to toxic materials.	No records of people requiring medical attention from exposure to hazardous materials. No records of fauna displaying signs of exposure to hazardous materials.
Create safe, stable, non-polluting and sustainable landforms.	Conceptual engineering designs.	Detailed final landform designs including slopes, surface water and drainage design parameters and erosion rates.	Audit of construction for compliance with design specifications/ required standards.
			Monitoring of surface drainage.
Removal of all unwanted infrastructure and any removable non mining wastes from the site.	Removal of equipment and facilities unless they are to remain for an agreed purpose.	Site returned to a similar condition as existed pre mining.	Quantitative vegetation monitoring.
	Unwanted haul roads and tracks to be ripped and rehabilitated.		
	All fuels, chemicals, domestic and construction wastes to be removed from site.		
Achieve establishment of vegetation that is self-sustaining and demonstrates a return of ecosystem functions and is resilient to the local fire regime.	Stand structure, species composition, canopy and ground cover of rehabilitated areas are similar to, or progressing towards, analogue areas.	Structure, composition and cover of revegetated areas will show continue progress towards targets based on baseline studies and investigation of analogue areas.	Quantitative vegetation monitoring.
Rehabilitation areas weeds free.	Rehabilitated areas remain weed free.	No increased abundance of weeds relative to surrounding areas.	Weed surveys.

Closure Objectives	Indicative Completion Criteria	Completion Criteria	Measurement Tools
Maintain water quality and flows in waterways.	Water quality and flows comparable to pre-mining condition.	Physical and chemical characteristic of water leaving lease areas is comparable to those upstream and condition pre-mining.	Monitor flows and sample analysis using accredited laboratory and field measures.
Minimise long-term visual impact by creating acceptable landforms, compatible with the adjacent landscape.	Conceptual engineering designs.	Final landform conforms to surrounding contours.	Visual amenity.
Achieve mining lease relinquishment without a requirement for on-going active intervention.	Rehabilitation stable and revegetation self-supporting.	No requirement for on-going maintenance confirmed through monitoring.	No regulatory requirement for on-going maintenance. Mining lease relinquished.

3.9 Financial provision for closure

The objective of financial provisioning for closure is to ensure that adequate funds are available at the time of closure and that the community is not left with an unacceptable liability. It is therefore essential that the cost of closure be estimated as accurately and early as possible. The financial provisioning must be based on the life of mine closure costs, and the cost estimates must take into account all aspects of rehabilitation and closure.

The financial security associated with rehabilitating the site is required to be developed as part of the initial MMP and must be developed according to standard NT Government costing rates and must be accepted by the Security Assessment Board. Payment (in the form of cash or a bank guarantee) is required prior to authorisation being granted.

The default requirement for operators of mining interests regulated under the NT *Mining Management Act* is to submit 100% of the security calculated for rehabilitation plus an additional 15% for contingencies. This provides stakeholders with some comfort that rehabilitation can occur irrespective of the financial state of the operator. The calculation of securities is based on the actual cost of rehabilitation commensurate with the size, environmental risk and expected project life. Securities will be regularly reviewed and adjusted as required, taking into consideration progress in rehabilitation, as well as new or expanded activities.

3.10 Closure implementation

Closure work programs developed at the project approval stage are rarely able to contain more than broadly identified tasks and indicative timeframes, which will be refined or expanded in subsequent reviews and updates of the RMCP.

Key closure issues and criteria have been identified above and a Closure Task Register will be immediately developed, to incorporate the criteria into the design of the closure and the management of key issues.

3.10.1 Research, investigation and trials

The rehabilitation and closure objectives and actions identified in this draft RMCP are within the current standard and acceptable practices of mining companies.

Regular updates of this plan to reflect operational changes and/or new information will guide closure implementation activities throughout the life of the mine. This new information may come from general research, industry information, and on-site research, investigation and trials associated with progressive rehabilitation. Progressive rehabilitation will provide information for on-going refinement of:

- The design of final landforms and drainage structures
- Estimating, reconciling and scheduling rehabilitation material inventories
- Landform surface treatments (ripping, selective application of topsoil, placement of materials)
- Revegetation activities
- Rehabilitation performance monitoring.

3.10.2 Progressive rehabilitation

Mining and subsequent rehabilitation of the deposits will progress sequentially. Progressive rehabilitation will:

- Allow trials of rehabilitation techniques to refine and optimise these over the life of the mine
- Ensure the smallest possible area will require rehabilitation in the event of unexpected or temporary mine closure
- Minimise exposed soil.

3.10.3 Unexpected or temporary closure

Although practical planning for unexpected or temporary closure (e.g. care and maintenance) is generally not done in the early stages of the project, consideration must be given for how to deal with such a closure scenario which may arise from economic, environmental, safety or other external pressures. There are contingencies for this planning within the security rehabilitation bond, although site-specific experience and knowledge will dramatically assist this process. The most important factor to consider for unexpected closure is the confirmation that appropriate materials are available on site and contingencies provided to make landforms such as waste dumps secure and non-polluting.

If temporary closure occurs the mine will be put into Care and Maintenance.

3.10.4 Decommissioning

Since the decommissioning phase takes place at the end of mine life and the details regarding final landform and environmental aspects are detailed elsewhere in the RMCP, a decommissioning plan is not proposed to be included in the RMCP until the project is advanced and the actual infrastructure is in place and the potential future of the project has been further defined.

3.11 Closure monitoring and maintenance

A closure monitoring and maintenance program will be designed and implemented to meet the following minimum requirements:

- Use of recognised and acceptable methodologies and standards
- Recognising the wider receiving environments, receptors and exposure pathways
- Incorporating appropriate quality control systems and procedures in the sampling, analysis and reporting of results, such as the ISO 9000 quality management system

- Showing trends against expected or predicted performance based on statistically robust data
- Providing intervention and contingency strategies if key environmental indicators move outside agreed parameters.

Relevant baseline data collection has commenced and will continue throughout the project development phase. This includes terrestrial flora and fauna, aquatic fauna, surface and ground water and rock and soil characterisation.

3.11.1 Revegetation monitoring plan

The broad closure objective is to return disturbed areas, post-mining, to a similar state which existed prior to mining and to the satisfaction of the key stakeholders. Sherwin will be responsible for rehabilitating and maintaining areas up to an agreed and quantifiable end point. Land which is deemed to have reached the endpoint for rehabilitation may be able to be relinquished.

Progress, success and the endpoint of rehabilitation will be assessed by an industry best practice monitoring regime, designed to test if the rehabilitation is on a trajectory towards the desired self-sustaining community exhibiting landscape functionality and resilience.

Rehabilitation completion criteria will be established through discussion with stakeholders. The process of monitoring and reporting on core attributes will be refined through on-going work and lead to the production of a Rehabilitation Monitoring Procedure. Comprehensive monitoring will continue for the life of mine. The development of these procedures will be in accordance with the following guiding principles:

Scientific assessment: to provide data on specific indicators from rehabilitated sites throughout Sherwin lease areas.

Continuous improvement: to provide results that allows refinement of rehabilitation techniques and practices and assessment of specific management options.

Evaluation of ecosystem development: to quantify the condition of sites to enable assessment of status or position of different aged rehabilitation sites on a trajectory of rehabilitation states directed toward completion criteria.

Based on Sherwin's understanding of current monitoring programs and priorities, the monitoring and assessment activities should enable:

- Classification and quantification of rehabilitation status
- Comment on progress of rehabilitation, forecast trajectories and succession trends and highlight any alterations which need to feed back into management interventions
- Enhance an appreciation of the complexity, requirements and criteria delimiting successful rehabilitation for the local context
- Determine an endpoint to intervention post mining (i.e. satisfaction of completion criteria).

Sherwin are aware of the need for all aspects of the project, including the rehabilitation planning and monitoring, need to fit within the whole of project management cycle. Scientific assessment, evaluation of ecosystem development and continuous improvement are important components of this cycle. In particular we see a need to strengthen how monitoring may inform management practices.

Rehabilitation end-point criteria will be developed to assess the status of rehabilitated sites toward a post-mining land use agreed to by the relevant stakeholders with a sustainable ecosystem, conforming as far as practicable to the pre-mining topography with an earthen cover and a revegetated surface.

Rehabilitation criteria will consider both the components of the developing ecosystem and the functional processes linking the components of that ecosystem. The trajectory towards a functioning woodland ecosystem may include the following key indicators:

- Density of desired species

- Vegetation biodiversity
- Ground cover characteristics
- Fauna
- Resilience.

Indicators utilised to measure the end point criteria will evolve over time as additional information is compiled. The Rehabilitation Monitoring Procedure will ensure that there is a comprehensive linkage between management and monitoring. Data from the monitoring program will be more meaningful and readily interpreted if there is a contextual understanding and record keeping of core information associated with the key management interventions for successful rehabilitation, such as:

- Rehabilitation techniques applied (including the methods and redistribution of top soil, contouring and any seeding or tube stock used)
- Weed management actions and results– aligned with a weed management plan
- Fire management actions and results - aligned with a fire management plan.

3.12 Management of information and data

A key intention is to standardise data collection and maintain continuity, and reliable comparisons and assessment through minimising variability associated with different observers.

Sherwin emphasise the need to build contextual documentation and understanding of operational practices (namely: rehabilitation techniques and practices and on-going weed and fire management). This is necessary to strengthen interpretation of the rehabilitation outcomes as well as the connection between monitoring and management to complete the cycle of continuous improvement.

Sherwin's goal is to develop the operational approach to management and record keeping (e.g. a 5 year plan with triggers for improved intervention) in collaboration with the operational team. Data will be stored in an ISO9001 QMS compliant document management system.

The value of site knowledge will not be underestimated and it is essential to have a system in place to capture all relevant closure knowledge in the event of key personnel leaving the site. Electronic mine closure systems that can store large amounts of data are suitable for this purpose.

3.13 Acronyms

AMD	Acid and/or metalliferous drainage
DME	NT Department of Mines and Energy
DSO	Direct shipping ore
EIS	Environmental impact statement
EL	Exploration Lease
ESCP	Erosion and Sediment Control Plan
EMP	Environmental Management Plan
LG	Low Grade (ore)
MLA	Exploration Lease Application
MMP	Mining Management Plan
NT	Northern Territory
OMU	Overburden management unit
PAF	Potentially acid forming
QMS	Quality Management System
RMCP	Rehabilitation and Mine Closure Plan
ROM	Run of mine

3.14 References

Australian and New Zealand Minerals and Energy Council (ANZMEC) and Minerals Council of Australia (MCA) 2000, *Strategic Framework for Mine Closure*, Australian and New Zealand Minerals and Energy Council, Canberra.

Campbell and Associates 2011, *Sherwin Iron Roper River Project: Geochemical Characterisation of Mine-Waste Samples – Implications for Mine-Waste Management*, Draft Report to Engenium.

Department of Industry, Tourism and Resources (DITR) 2006, *Leading Practice Sustainable Development in Mining – Mine Rehabilitation*, Commonwealth of Australia, Canberra.

International Council on Mining and Metals (ICMM) 2008, *Planning for Integrated Mine Closure: Toolkit*, International Council on Mining and Metals, London.

Outback Ecology 2011, *Sherwin Iron – Roper River Characterisation of Overburden and Footwall Materials*, Perth.

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