

McArthur River Mine  
Overburden Management Project

# 15

## Environmental Management Plan

Draft Environmental Impact Statement

# 15 Environmental Management Plan

## 15.1 Purpose and Scope

The McArthur River Mine (MRM) commenced operations in 1995 and operates under an existing suite of regulatory obligations and commitments as defined under the following:

- the *Mining Management Act (NT)*, where MRM is currently operating in accordance with an approved Mining Management Plan (MMP) covering the operating period 2015 to 2018;
- *McArthur River Project Agreement Ratification Act (NT)* and the McArthur River Project Agreement;
- mineral lease conditions;
- waste discharge licence conditions issued pursuant to the *Water Act (NT)*;
- Commonwealth's *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) approval conditions;
- *Mineral Royalty Act (NT)*;
- Authority Certificates issued pursuant to the *Aboriginal Sacred Sites Act (NT)*;
- labour and employment agreements;
- service and supply agreements; and
- legally binding and non-legally binding commitments and promises (letters, references, records and documents).

The Environmental Management Plan (EMP) specifies, at a strategic level, the safeguards and controls proposed in order to manage potential environmental impacts, and incorporates commitments described throughout the various chapters of the Draft EIS. The documented controls will be incorporated into relevant, existing MRM operational plans, procedures and monitoring programs (refer to **Section 15.3**) as part of the Project's implementation.

This EMP includes an overview of MRM's environmental management framework; and specific management plans addressing the Project aspects including:

- water resources;
- biodiversity;
- overburden placement;
- cultural heritage;
- socio-economic;
- air quality; and
- health and safety.

## 15.2 Environmental Management Framework Overview

This EMP addresses the Project Environmental Impact Statement (EIS) Terms of Reference (TOR) and takes into account the EIS findings. Management strategies are expressed as measurable and auditable actions; they are based on measurable indicators, and include control strategies and actions to facilitate achievement of the objectives. The EMP also presents monitoring approaches used to validate assessments and modelling and to track environmental performance and management effectiveness.

## 15.2.1 Risk Management Framework

MRM has in place a well-established Risk Management Framework, which will be adopted in order to implement its corporate risk management measures. This includes established processes for the identification, assessment and management of environmental risks. Refer to **Section 7.4.2, Chapter 7 – Project Risk Assessment**, for further details.

## 15.2.2 Management Systems

Glencore seeks to implement and maintain management systems that are capable of underpinning performance and driving continuous improvement. The well-developed Health, Safety, Environment and Community Management System (HSEC MS) in place at MRM is based on the Glencore Zinc management procedures, which are designed to provide a consistent approach across all Glencore Zinc assets. The standards and procedures are based upon Glencore Corporate Practice (GCP); and ISO 14001:2004–Environmental Management Systems.

## 15.2.3 Environmental Incident Management

MRM has an established environmental incident management procedure which will be updated as required to incorporate relevant aspects of the Overburden Management Project (the Project). Components of the procedure include systems for:

- reporting all incidents and hazards;
- following up actions and outcomes resulting from incident investigations;
- site inductions and ongoing training of employees and contractors addressing the incident reporting process; and
- communicating incident investigation outcomes and learning experiences with employees and contractors.

## 15.2.4 Environmental Training

All Managers are responsible for identifying training and competency requirements for personnel under their management, and for ensuring that personnel have the requisite competencies, skills and training to carry out their assigned tasks. Managers are also responsible for ensuring training records are maintained. Training may include Inductions, Toolbox Meetings and Job Safety Environment Analysis (JSEAs).

MRM employees, contractors and visitors receive appropriate environmental awareness training. This is achieved through a variety of methods including induction training, formal presentations, and toolbox meetings. Specifically, MRM requires all employees, contractors and visitors to be provided awareness and procedural training in:

- their roles and responsibilities (including reporting environmental incidents);
- the environmental impacts (potential or actual) of their activities on site;
- the potential consequences of poor environmental performance; and
- site emergency procedures.

Environmental awareness training will be a regular feature of site-wide training, with records maintained of training content and attendance.

The induction process is not designed to train all new MRM employees and contractors in all aspects of environmental management. It provides a basic understanding of environmental risks, responsibilities and management requirements, and is supplemented as required by job-specific training. Training requirements are identified through the development of a Training Needs Analysis for each section or department. Additional training requirements can also be identified through the performance review process.

## 15.2.5 Environmental Communication

MRM has implemented the following environmental communication programs that will continue for the life of the Project.

### 15.2.5.1 Internal Stakeholder Communication (within McArthur River Mining)

Internal communications are facilitated through the following mechanisms:

- notice boards;
- MRM intranet web page, which includes links to relevant procedures, plans and guidelines;
- General Manager presentations (State of the Nation); and
- an MRM Sustainable Development Committee has been established with Health and Safety Representatives.

### 15.2.5.2 External Stakeholder Communication

MRM's community consultation program, carried out as part of the Project EIS, was well received by all stakeholders and MRM was encouraged to continue this program under a similar format throughout the Project's life. Accordingly, MRM has committed to maintain productive relationships with external stakeholders through the continuation of a number of existing formal and informal approaches including:

- Community access to a mobile phone application which is available for both iPhone and android technology. The application provides regular updates on mine site activities and developments, an emergency call button, important safety information and links to relevant websites.
- Weekly visits to Borroloola by MRM's Senior Community Relations Advisor, and regular visits to other communities and regions.
- Hosting a Community Reference Group (CRG), which provides the opportunity for local residents, businesses and representatives from other organisations to be informed of relevant Project developments. CRG meetings are held quarterly as a minimum in Borroloola, and are normally attended by MRM's General Manager, Senior Community Relations Advisor, Manager of Environment, Safety and People, Environmental Projects Manager as well as a representative from the Human Resources department.
- Ongoing consultation with custodians to incorporate appropriate cultural heritage related management measures into its construction and operational programs.
- Continuing MRM representation, where required, on industry and legislative committees and groups.

## 15.2.6 Responsibilities

MRM is responsible for the development and implementation of this EMP and monitoring ongoing performance against the closure objectives, commitments and approval conditions. Where required, it

will engage appropriately qualified consultants and contractors to carry out required activities in compliance with this EMP.

MRM will also be responsible for:

- contractually binding the contractors to compliance with this EMP;
- regularly monitoring contractors' environmental performance; and
- approval of contractor quality management procedures and systems prepared in accordance with this EMP.

Amongst other obligations, contractors will be responsible for:

- Developing systems, procedures and reporting mechanisms to demonstrate, in a tangible way, their compliance with the EMP and the MRM Contractors, Suppliers and Partners Procedure.
- Developing and implementing appropriate training to all staff and sub-contractors on the requirements of this EMP. This shall range from detailed training for supervisors, through to inclusion of environmental matters in project inductions for other workers.
- Participating in audits and reviews and undertaking corrective actions and system improvements when audit and review results deem necessary.

**Figure 15-1** provides a summary of the MRM site organisational structure. Note that this includes senior level positions or above and doesn't identify all site-based positions.

Specific MRM responsibilities include:

- MRM's General Manager - overall responsibility for ensuring that all environmental commitments are met. Work programs and monitoring are based around commitments documented in the MMP, Annual Operating Performance Report, Commonwealth Environmental Monitoring Plan and previous EIS and Public Environment Reports and commitments.
- Site managers – management of their specific department's performance including ensuring that personnel under their management have the requisite competencies, skills and training to carry out their assigned tasks.
- Superintendents - report on the implementation and performance of the EMP within their areas of responsibility, and (in the event of non-conformance) undertake appropriate investigation, reporting and implementation of corrective actions in accordance with MRM procedures.
- Environment team personnel – as outlined within their respective job descriptions. The team comprises a number of key components including monitoring, rehabilitation, projects and sustainable development. Contractors and consultants that conduct work for the environment team are normally managed by the Manager of Environment, Safety and People, although the Environmental Superintendent has input into various projects.
- All employees - responsible for the environmental performance of their activities, complying with the laws of the Northern Territory (NT) and Commonwealth and the day-to-day implementation of the requirements of the EMP.

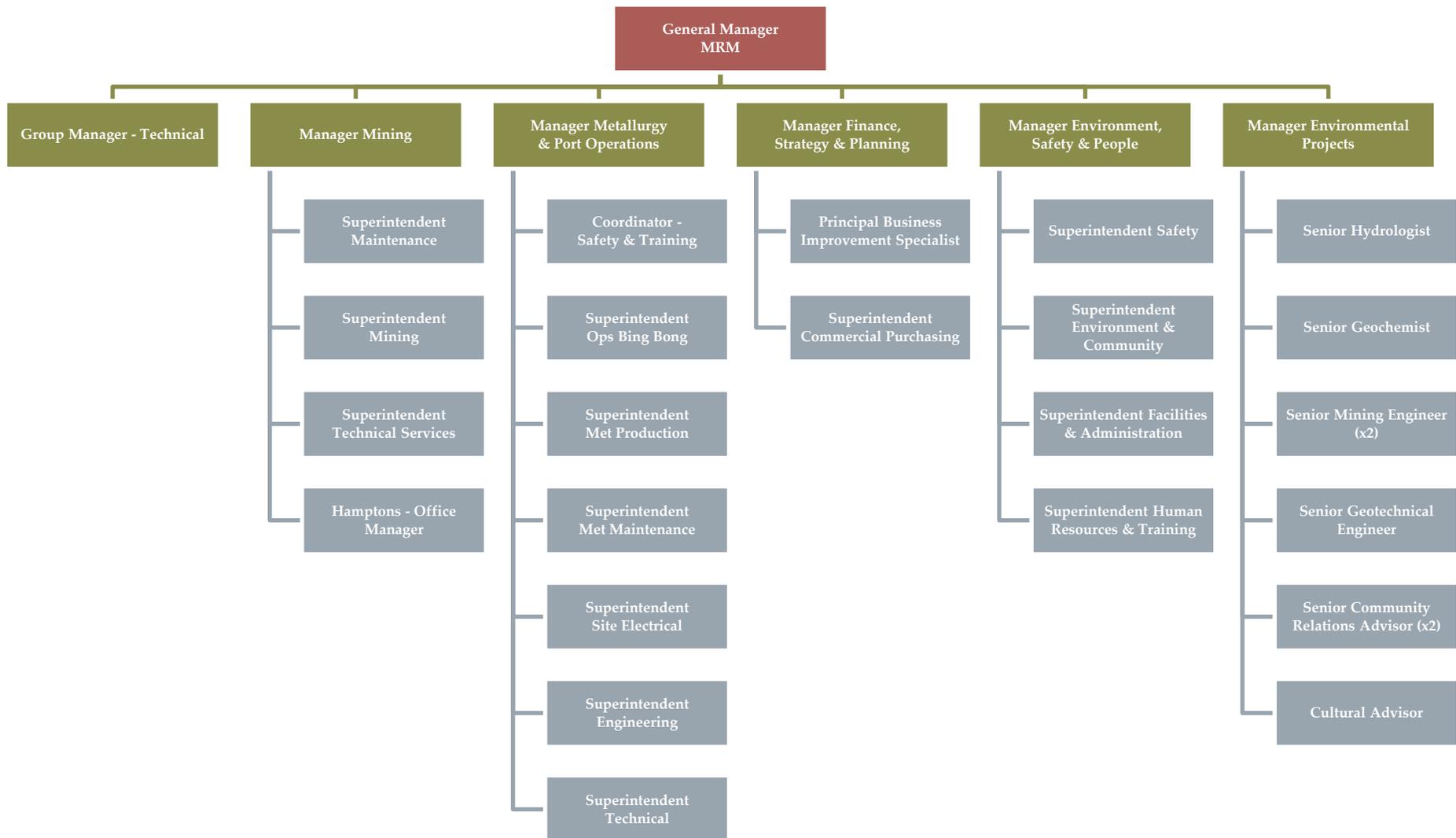


Figure 15-1 MRM Site Organisational Structure

## 15.2.7 Performance Indicators

Performance indicators and evaluation techniques have been developed so that environmental management activities achieve MRM's closure objectives, as described in **Chapter 4 – Decommissioning, Rehabilitation and Closure**. The closure objectives are discussed further in the context of each individual environmental discipline presented in **Section 15.3**.

It is anticipated that this EMP will be a dynamic document and subject to periodic reviews. The continual evaluation and review of management activities will assist in the implementation of environmental management measures that incorporate the latest available information including any improvements to standards and technology.

## 15.2.8 Corrective Actions and Contingency Arrangements

Corrective actions are adopted when monitoring indicates that current management measures are not adequately effective in mitigating impacts, or where a non-conformance with the management plan is identified. Contingency arrangements are triggered when management measures are ineffective due to unforeseen events such as human induced events (e.g., fire or spills) or naturally occurring extreme events (e.g., cyclones or floods).

## 15.2.9 Monitoring Requirements

A major feature of MRM's approach to life of mine and closure management is the consideration of both short-term and long-term management timeframes. This strategy acknowledges that the site will include residual environmental risks that will require ongoing monitoring and management at closure. As a result, MRM proposes to establish a number of closure monitoring and management phases, including short-term adaptive management; long-term proactive monitoring and long-term reactive monitoring programs (refer to **Chapter 3 – Project Description and Justification**). A number of contingencies have also been developed in the event that performance monitoring outcomes do not meet MRM's closure objectives.

Monitoring requirements have been documented within each specific management plan in **Section 15.3**, and will be implemented to inform the evaluation of mitigation and management effectiveness. The proposed monitoring programs will facilitate determination of compliance with environmental management strategies and will identify whether any environmental incidents have occurred. Monitoring results will feed back into the annual operational performance report, with consideration as to whether any variation to the MMP is to be submitted for approval.

Effective monitoring requires acquisition of baseline data to compare life of mine (LOM) impacts against pre-mining conditions; and therefore allow an assessment of the significance of any project related impacts. As such, baseline flora and fauna surveys and background groundwater and surface water monitoring have been conducted throughout the mine life as part of various impact assessment processes.

The environmental monitoring programme is designed to achieve the following objectives:

- confirm compliance with statutory regulations;
- evaluate the environmental performance against objectives and targets;
- assist in improving environmental management strategies;
- identify potential environmental impacts; and
- contribute to local knowledge on regional biodiversity.

Site environmental monitoring procedures and plans are maintained, which documents the following information:

- types of monitoring conducted;
- frequency of monitoring;
- monitoring locations;
- analysis conducted on samples;
- laboratories where samples are sent;
- dispatch procedures;
- invoicing procedures;
- data management;
- record keeping requirements; and
- safety issues associated with monitoring activities.

## 15.2.10 Reporting and Auditing

Monitoring and audit reports are produced and maintained on site. Relevant information is made available to the appropriate Managers and, when relevant, the regulatory authorities. Internal and external audit results are used to review management practices and update the EMP when required.

### 15.2.10.1 Audits

The MRM site is subject to both independent external audits and internal corporate audits, with auditing of the EMP compliance conducted and reported as part of the MMP review and renewal process.

#### 15.2.10.1.1 External Audits

An annual independent environmental audit is undertaken as part of the Independent Monitors' Annual Environmental Audit program, with audit reports publicly available at [www.mrm-independentmonitor.com.au](http://www.mrm-independentmonitor.com.au). The annual environmental audits are usually conducted during, or shortly after the wet season (access permitting) in order to best assess the effectiveness of erosion and sediment control measures.

Any reasonable improvements or upgrades to environmental practices, procedures or standards recommended after an environmental audit or assessment are implemented at the first available opportunity.

MRM understands the importance of maintaining high environmental standards and is committed to achieving the closure objectives through sound environmental practice.

#### 15.2.10.1.2 Internal audits

Monthly environmental data is reported to the Glencore head office for assessment of environmental performance in line with Glencore HSEC procedures. MRM has a compliance management system that identifies the environmental monitoring, sampling and reporting requirements for the operation. Regular reviews are undertaken to assess site compliance and identify any areas of improvement. Corrective actions are recorded in a corrective actions register (Site Safe) and reviewed on a regular basis to track progress and completion.

#### 15.2.10.2 Incident Reporting and Non-conformance

Incident reporting is recorded and tracked in McArthur River Mine's onsite safety system (Site Safe) and reviewed daily. Details of the initial incident, follow-up investigation details and corrective actions are recorded and registered in the site safety system. Corrective actions are reviewed on a monthly basis to track progress and completion.

Incident severity and potential severity rating are determined using the MRM risk assessment matrix to determine actual and potential environmental harm. Notification of incidents, both internally and (if required) to external regulatory agencies is undertaken in accordance with the MRM Incident Reporting and Investigation Procedure.

#### 15.2.10.3 Complaints Register

Any complaints from the public or specific Project stakeholders will be reported in the existing Complaints Register in accordance with the Complaints Management Procedure. Each complaint will be reviewed upon receipt by the appropriate manager, and all valid complaints addressed. Corrective actions and other recommendations including, where applicable, modifications to practices and procedures shall be documented and communicated under the direction of relevant personnel.

#### 15.2.10.4 Corporate Environmental Performance Reporting

MRM has established site environmental performance measures that align with Glencore's overarching Statement of Values. MRM undertakes reporting against the site environmental performance measures to corporate management on a monthly basis. A review of the data is undertaken regularly to assess site performance, identify opportunities for improvement and establish corrective actions.

### 15.3 Existing Environmental Plans, Procedures and Monitoring Programs

MRM has been operating on site for over 20 years, and as part of the ongoing development of its management system has established a comprehensive suite of environmental documentation including plans, procedures and monitoring programs (refer to **Table 15-1**).

Table 15-1 MRM Existing Environmental Management Plans, Procedures and Monitoring Programs

<b>Management Plans</b>	<b>Supporting Information</b>
Weed Management Plan	Guides the management of weeds on the MRM mining lease areas.
Cattle Management Plan	2014-2016 (includes inspection regime of fencing and maintenance requirements).
Rechannel Rehabilitation Plan	Primarily associated with McArthur River channel and Barney Creek channel.
Energy Efficiency and Greenhouse Gas Management Plan	Provides objectives and targets for site.
Fire Management Plan	Associated with controlled burns for the purpose of fuel reduction and weed control.
Dust and Air Quality Management Plan	Covers controls responsibilities and action plans.
<b>Procedures</b>	<b>Supporting Information</b>
<b>Incident and Complaints Management</b>	
Incident Reporting and Investigation Procedure	Defines the process, roles and responsibilities for the reporting and investigation of incidents, including environmental related incidents.
Complaints Management Procedure	Defines the process, roles and responsibilities for the management of complaints, including environmental related complaints.
Major Concentrate Spill – Trucking Incident	Includes clean up requirements and responsibilities.
Lead Concentrate Spill – Trucking Incident	Includes clean up requirements and responsibilities.
<b>Waste Management</b>	
Management and Disposal of Waste Oils	Includes storage, removal off site and responsibilities.
Management and Disposal of Waste Cooking Oils	Includes storage, removal off site and responsibilities.
Disposal of Aluminium Cans	Includes storage, removal off site and responsibilities.
Management of Contaminated Waste Disposal Area	Includes storage and responsibilities.
Waste Refuse Facility Management	Includes storage and responsibilities.
Waste Tyre and Conveyor Belt Management	Includes storage and responsibilities.
Putrescible Waste Facility Management	Includes storage and responsibilities.
Management and Disposal of Cardboard and Paper	Includes storage, removal off site and responsibilities.
Management and Disposal of Lead Acid Batteries	Includes storage, removal off site and responsibilities.
Management and Disposal of Medical Waste	Includes storage, removal of site and responsibilities.

Hydrocarbon Management	Includes transport, storage and site responsibilities.
<b>Biodiversity</b>	
Fauna Management	Includes both feral animal and native animal requirements and responsibilities.
<b>Water Resources</b>	
Natural Surface Water Monitoring	Objectives and procedures for the collection and chain of custody of surface water samples.
Groundwater Monitoring	Objectives and procedures for the collection and chain of custody of groundwater samples.
Artificial Surface Water Monitoring	Objectives and procedures for the collection and chain of custody of artificial water samples.
Fluvial Sediment Sampling	Objectives and procedures for the collection and chain of custody of fluvial sediment samples.
DGT Monitoring	Diffusive Gradients in Thin films (DGT). Analysis technique applied to coastal waters around Bing Bong, to determine the concentrations of bioavailable metals.
<b>Land Disturbance</b>	
Controlled Burning	Objectives and responsibilities.
Land Clearing and Digging Permit	Covers ground disturbance related procedures of more than 300 millimetres (mm) including clearing or digging. The process requires sign off from various authorised personnel.
Borrow Pit Design Process Guidelines	Guidelines on borrow pit site selection, determining design criteria & operational management, closure & rehabilitation protocols.
<b>Air Quality</b>	
Dust Monitoring	Objectives and procedures for the collection and chain of custody protocols for dust samples.
<b>Overburden Management</b>	
Grade control	In-pit grade control sampling, analysis & interpretation.
OEF Sampling	Covers Overburden Emplacement Facility (OEF) geochemical monitoring sampling and analyses.
Field Barrel Leaching	Covers sampling and analyses involved in the large scale field barrel leaching experiment.
Sulphur Dioxide Management	Both personal and large scale monitors.
NOEF Temperature and Gas Monitoring	Occurring on current North Overburden Emplacement Facility (NOEF).
<b>Tailings Storage Facility (TSF)</b>	
Sampling	Covers geochemical monitoring, sampling and analyses.
<b>Miscellaneous</b>	
Early Flood Warning System	Covers use, maintenance and responsibilities around the early warning flood system and other gauging stations.
Storage, Handling and Use of Refrigerant Gases	Covers storage, permits/licences and documentation required.

Monitoring Programs	Supporting Information
<b>Water Management (surface water related)</b>	
Surface water (natural flows)	As detailed in <b>Section 8.7.1.2, Chapter 8 – Water Resources</b> , a surface water monitoring network is in place which includes weekly monitoring at 32 locations across the site including upstream control, downstream and on-lease sites. As part of this program continuous water quality monitoring is conducted at SW11.
Artificial water storages	As detailed in <b>Section 8.7.1.2, Chapter 8 – Water Resources</b> , monthly water quality monitoring of water storage points occurs on site including in all dams, seepage collection points and drains.
Waste discharge	Flow meters are installed on piping infrastructure to measure discharges from selected site infrastructure including South Eastern Levee 1, WMD & Pete’s Pond 2.
Fluvial sediment	A program has been implemented to assess potential sediment contaminate fluxes in creeks and rivers within close proximity of the mine. Sites are the same location as for surface water sites.
Aquatic Macroinvertebrates	Aquatic fauna assessment program, developed in consultation with NT Department of Primary Industry and Resources (DPIR) and based on the NT Australian River Assessment System (AUSRIVAS) protocol.
Metals in aquatic fauna	Completed on a number of fish species from various locations in the freshwater streams and freshwater bodies around the mine; and To determine whether metals are entering the aquatic food chain as a result of mining activities.
Marine	Includes annual monitoring of: <ul style="list-style-type: none"> <li>• marine water quality;</li> <li>• nearshore sediments;</li> <li>• transshipment sediment;</li> <li>• seagrass; and</li> <li>• metals in marine biota, water and sediment.</li> </ul>
Mosquitoes	Conducted on a monthly basis at six different sites including two at Bing Bong.
<b>Water management (groundwater related)</b>	
Groundwater (site wide)	As detailed in <b>Section 8.7.1.1, Chapter 8 – Water Resources</b> , an established groundwater monitoring program is in place which: <ul style="list-style-type: none"> <li>• monitors potential impacts of drawdown on the local and regional groundwater regime;</li> <li>• determines extent of any contaminants in aquifers; and</li> <li>• assesses potential impacts on receiving environment from site activities.</li> </ul>
<b>Air quality</b>	
Dust	As detailed in <b>Section 13.2.4, Chapter 13 – Air Quality</b> , MRM has in place an established monitoring program which includes: <ul style="list-style-type: none"> <li>• monthly ambient air quality monitoring for particulate matter (dust and lead) at 31 low volume air sampler (LVAS) sites; and</li> <li>• monthly analysis for depositional dust at 18 dust gauges across the site.</li> </ul>

**Overburden management**

OEF monitoring	Monthly sampling of all active OEFs including non-acid forming material (NAF) stockpiles, potentially acid forming material (PAF) cells and Low Grade Ore; and Aims at controlling the correct placement of material types.
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**TSF**

Tailings Monitoring	Monthly sampling of deposited tailings for metal concentrations and Acid Base Accounting.
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**EPBC related**

Aquatic fauna	Annual monitoring program involving two separate periods. Monitors all fish but mainly around the movement of Freshwater Sawfish ( <i>P. pristis</i> ) and Barramundi ( <i>L. calcarifer</i> ) along the McArthur River, using acoustic monitoring and tagging techniques.
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Listed migratory shore birds and other wetland birds	Conducted in the austral summer and northern migration periods around Bing Bong.
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**Rehabilitation**

Rehabilitation	Annual monitoring of rehabilitation activities including assessment of: <ul style="list-style-type: none"> <li>• plant establishment;</li> <li>• growth, diversity and cover;</li> <li>• types of disturbances including flood; and</li> <li>• weeds, erosion and grazing.</li> </ul>
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<b>Other (Miscellaneous) Monitoring/Assessments</b>	<b>Supporting Information</b>
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Riparian birds	Biannual. Utilises the Buff Sided Robin and the Purple Crowned Fairy Wren as indicator species.
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Gouldian Finch	Annual surveys
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Chemicals and Dangerous Goods	Inspections of storage tanks and bulk containers; and Integrity inspections of bunded areas, pavements and associated containment systems.
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Soil	Monthly monitoring (conducted in unison with ambient air quality monitoring program).
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Geomorphic Condition Assessment of McArthur River and Barney Creek diversions	Full geomorphic condition assessment and erosion mitigation study, with development of prioritised work program.
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Pre-mining soil contamination	Review of baseline studies to map surface mineralisation to compare with data from the current site soil monitoring program.
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Mine Levee Wall Geotechnical Assessments	Geotechnical assessment of wall integrity by a qualified geotechnical engineer, focussing on higher risk sites including historically eroded areas and in proximity to the upstream end of the McArthur River diversion.
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## 15.4 Environmental Management Plans

### 15.4.1 Overview

The objectives of the EMP are to provide:

- evidence of practical and achievable plans for the environmental management of the Project so that MRM's regulatory and environmental obligations are complied with;
- MRM, the Northern Territory and Commonwealth government authorities with a framework to demonstrate compliance with relevant policies and requirements;
- a focus for management decisions; and
- the community with evidence that the Project is being managed in an environmentally acceptable and responsible manner.

The EMP will be reviewed and periodically updated, if necessary, to reflect knowledge gained during the course of operations. Changes to the EMP will be implemented in consultation with the relevant authorities where necessary via MRM's MMP and Environmental Monitoring Report.

Each of the following management plans have been prepared based on the recommended structure provided in the EIS TOR. They are based on existing experience at MRM and the predicted future project operations. They reflect commitments and approaches described throughout the various chapters of the Draft EIS.

It is anticipated that a final EMP will be prepared at the conclusion of the assessment process taking into consideration comments on the Draft EIS, the EIS Supplement, and incorporating any assessment report recommendations. As part of the implementation of this EMP, relevant mitigation and management measures will be incorporated into MRM operational documentation.

### 15.4.2 Management Elements

The following draft management plans have been prepared at a strategic level and provide a framework for the environmental management of the Project's specific management elements that have changed since the Phase 3 EIS (refer to **Chapter 3 – Project Description and Justification**). The implementation of the controls documented below will include incorporation into relevant, existing MRM operational plans, procedures and monitoring programs as summarised in **Section 15.3**.

Note that the definitions of terms used within the following EMPs are provided in the EIS Glossary.

#### 15.4.2.1 Water Resources Management Plan

Table 15-2 Water Resources Management Plan

##### Closure Objectives

- Manage surface water and groundwater such that environmental values and ecosystems are maintained downstream of the lease boundary in the short term (0-100 years), and within the McArthur River in the long term (100-1,000 years).
- rehabilitated areas will provide appropriate habitat for fauna utilization – abundance and diversity will be appropriate.
- foster economic opportunities for custodians and local communities.

## Target

To maintain protection of downstream environmental values including:

- aquatic ecosystems;
- primary industries including stock drinking water, irrigation and general water uses;
- recreation and aesthetics; and
- cultural values.

Performance Indicators:

- compliance with the Waste Discharge Licence under the provisions of the NT *Water Act*;
- assessment of ambient water quality monitoring in accordance with site-specific trigger levels;
- no erosion or deposition of sediment within the surface water courses beyond natural fluctuations; and
- optimise water reuse.

## Management Strategy (refer to Chapter 8 – Water Resources)

### Existing Water Management Controls/Actions

MRM's site water management system is based on the separation and targeted management of six (6) classes of water, as described below:

- Class 1 (upstream clean water) is diverted (where practicable) around or away from disturbed mining areas using diversion bunds and drains. This reduces the potential for erosion and contamination prior to downstream discharge from site.
- Class 2 – surface water sourced from cleared areas and benign stockpile areas around the perimeter of the NOEF and rehabilitated surface areas of the TSF. This water will be diverted through specifically located sediment management structure/s prior to release.
- Class 3 – treated “permeate” water from water treatment plant/s; and Class 4 – managed release runoff water, sourced from potentially non-benign areas on site, with typically elevated sulphate and/or metals concentrations in excess of downstream compliance trigger values. Both classes of water will be re-used for a variety of on-site purposes (and stored in purpose built site containment storages as required) or released downstream when river flows provide sufficient dilution in accordance with WDL conditions.
- Class 5 – poor quality water originating from on-site TSF and/or NOEF seepage or runoff from non-benign or underground void water. This water will be contained on-site within MRMs water management system including existing and proposed containment dams. The water will be allowed to evaporate, either passively or via enhanced evaporation.
- Class 6 – process water. This water class is typically water used within the Mill and TSF as well as other process streams including brine from a water treatment plant. This water class is contained within the MRM water management system.

The existing components of the site water management system include:

- separate mine affected water stored on site according to MRM's water classification system;
- limiting land disturbed by mining activities and commencement of rehabilitation as soon as possible , thus limiting the volume of Class 2, 4, 5 and 6 water generated at the mine site;
- divert Class 1 water away from mining activities;
- construction of sediment management structures to capture sediment from Class 2 water runoff prior to passive or active release to the environment;
- limit Class 2, Class 3 and Class 4 water use for mine water demands (such as dust suppression and mill makeup water) by using reclaimed Class 5 and Class 6 water from the TSF, 'brine' (predicted Class 6 water) from the water treatment plant and Class 5 water dewatered from the underground voids where possible;
- interception of surface water and groundwater from around the open cut before it comes in contact with the overburden material where practical;
- intercepting toe seepage from the TSF and NOEF in sumps and collection pits and storing it in the Class 5 and Class 6 water storages;

- intercepting Barney Creek surface water that is affected by residual groundwater bypassing upstream interception measures as required to maintain McArthur River surface water quality below the WDL trigger values at the downstream compliance point;
- use of sprinklers and evaporation fans in suitable areas to enhance evaporation losses from Class 5 water site inventories;
- limit the Class 5 water inventory on site by treating excess underground void water in a water treatment plant;
- store Class 3 and Class 4 waters in dedicated storages until they can be released under the conditions of the WDL;
- adequately sized containment storages to limit the risk of overflows of Class 5 and 6 waters to the environment;
- limiting the TSF central decant pond size to provide an adequate tailings beach around the perimeter of the dam against the walls reducing TSF seepage, the risk of spill, and the risk of wall failure, all of which may affect surface water;
- lining Class 5 and Class 6 water storages to limit basal and toe seepage;
- operate Class 5 and Class 6 water storages at their target operating levels to enhance evaporation losses and mitigate the risk of uncontrolled overflows;
- fixed pumping infrastructure to allow transfer of Class 5 and Class 6 water between storages as required to mitigate the risk of uncontrolled overflows;
- use the open cut as an ultimate fall-back for water storage to avoid unplanned releases into the receiving waters (noting that this may impede production);
- a four gigalitre process water dam (PWD) and two gigalitre water management dam (WMD) within the TSF domain;
- prioritising managed release of Class 3 and Class 4 water to the McArthur River when there is sufficient river flows for dilution in accordance with the WDL conditions;
- prioritising use of Class 5 and Class 6 water for mine water demands over Class 2, Class 3 and Class 4 water;
- limiting Class 1, Class 2, Class 3 and Class 4 water entering the Class 5 and Class 6 water circuit;
- construction of a series of seepage management structures along the toe of the TSF adjacent to Surprise Creek;
- construction of interim barriers on the OEFs where practicable to enhance runoff and reduce net percolation through these facilities; and
- periodic monitoring and recording of natural and artificial waters (including quality, volume, level and flow) at specified locations around the MRM site.

#### **Proposed (Project) Water Management Controls/Actions**

MRM's proposed site water management system will represent a continuation and further development of the existing water management system (discussed above). As the Project develops, the water management system will evolve to address potential impacts and risks as they change and develop.

Proposed additional controls/actions include:

- developing the site generally in accordance with the proposed Project mine plans presented in the Project EIS and undertake additional surface water and flood impact assessments if any material changes to the Project mine plans are proposed;
- upgrade the existing site water treatment plant to manage Class 5 and Class 6 water inventory on site;
- constructing and maintaining a low permeability final cover over the NOEF to reduce net percolation rates through the NOEF and subsequent seepage to the groundwater and waterways;
- removing the TSF and reprocessing the tailings, with spent tailings placed in the final void;
- storing collected NOEF toe seepage in the mine pit lake at closure;
- storing collected surface water from Barney Creek potentially impacted by groundwater within the mine pit lake at closure;
- upgrade to the Barney Creek surface water pumping structures;
- upgrades to Class 3 and Class 4 dedicated water containment storages;
- upgrades to Class 5 and Class 6 water containment storages;
- construction of a new NOEF East Perimeter Runoff Dam (EPROD) to augment the existing Class 5 and Class 6 water storage capacity in the 3 existing NOEF Perimeter Runoff Dams (PROD)s;

- implement an integrated water management system to allow transfers between all Class 5 and Class 6 water storages by installing additional pumping and pipeline infrastructure and using suitable target operating levels in the containment storages to limit the risk of overflows to the environment;
- install sediment management structures that passively or actively release Class 2 water to the receiving waters following sediment removal; and
- as part of closure, create a high flow connection between the McArthur River and the mine pit lake to maintain suitable water quality in the mine pit lake epilimnion.

### Performance Indicators

Adherence with Waste Discharge Licence trigger levels at SW11 and MMP

### Monitoring and Further Investigations

#### 1. Groundwater

##### a) Groundwater Monitoring

MRM's existing groundwater level and groundwater quality monitoring bore network will be maintained (refer to **Section 8.7, Chapter 8 – Water Resources**) throughout the LOM. Currently this includes the establishment of over 200 groundwater monitoring bores located within the vicinity of the open cut, NOEF, TSF and processing plant.

Where needed, this monitoring network will be expanded and designed to identify any significant departures from current aquifer conditions or EIS model predictions that may result in MRM not meeting their environmental objectives. The key areas of focus for the expansion of the groundwater monitoring program include:

- Groundwater level and quality directly down-gradient of the NOEF in the alluvium, weathered bedrock and shallow bedrock. This monitoring will include groundwater discharge as base flow to the Barney Creek channel. Groundwater monitoring bores positioned between the NOEF and the Barney Creek channel will provide early detection and ongoing development of plumes migrating from the NOEF before they discharge to the Barney Creek channel as base flow.
- Groundwater level and quality to the immediate north, east and south of the TSF in the alluvium, weathered bedrock and shallow bedrock. This monitoring will include groundwater discharge as base flow to Surprise Creek, Little Barney Creek and Barney Creek.
- Groundwater quality within and down-gradient of natural mineralised zones.
- Groundwater level and quality to the north, east and south of the open cut area alluvium, weathered bedrock and shallow bedrock. This monitoring will include groundwater discharge as base flow to Barney Creek Channel and McArthur River Channel. As the open cut breaches the Western Fault and begins to mine out the Cooley Dolomite, additional monitoring of pressure response in this water-bearing formation will be conducted to better understand the dynamic pathways between the NOEF, the Cooley Dolomite, and the Barney Creek Channel.
- Groundwater level and quality in the water-bearing formations that support base flow discharge to Djirrinmini waterhole.

##### b) Further Groundwater Investigations

To further support the results obtained from the monitoring plans (and modelling of the groundwater, waste management facilities and the surface water) MRM will continue to undertake ongoing groundwater characterisation. In addition to the existing groundwater monitoring network, the following targeted monitoring and investigations are being developed to improve understanding of the hydrogeological conceptual model, to strengthen the confidence in the understanding of the source-pathway-receptor processes, and to reduce uncertainty in the prediction and management of groundwater.

- Continuation of hydrogeochemical investigations on-site of mineralised zones in order to build up a dataset that will provide more understanding and appreciation of how these areas influence the water quality in down-gradient aquifer systems.
- Further monitoring of piezometric levels, moisture profiles and hydraulic response to increasing elevations of the TSF. This will allow improved confidence in the predicted fluxes and loads from the TSF.

- The updated geological model for the site is currently in preparation and will be compared to the conceptual site groundwater model. Future groundwater assessments will incorporate any refinements within the conceptual and numerical models in areas where updated information is available.
- Installation of a transect of monitoring bores situated perpendicular to the Barney Creek Channel (down-gradient of southeast Perimeter Runoff Dam (SEPROD)) to improve the understanding of groundwater discharge mechanisms to the Barney Creek Channel. Proposed hydrogeological investigations include longer-term pump testing, with consideration of conservative tracers to better quantify the interaction between the PRODs, groundwater bearing units and the Barney Creek Channel.
- MRM has completed a site-wide targeted drilling and aquifer testing program to better understand the physical and hydraulic character of key hydrostratigraphic zones. One of these zones is the Cooley Dolomite aquifer that is present directly down-gradient of the NOEF and represents an important seepage pathway. The outcomes from this field program will be used to update the conceptual model and numerical model for the site.
- A long-term pressure monitoring network will be established in the Cooley Dolomite to the south and north of the Barney Creek Channel. This monitoring will provide an appreciation of hydraulic gradients up-gradient of the Channel throughout the progression of the mine life.
- A dedicated streamflow gauging program will be conducted whereby concurrent measurements of flow are taken along select reaches of the major creeks, rivers and diversions across the site. Given the sensitivity of base flow to water management on-site (e.g., TSF seepage influences Surprise Creek base flow and South Perimeter Runoff Dam (SPROD) leakage influences Surprise Creek base flow), it would be beneficial to undertake these surveys regularly and develop an improved temporal understanding of how base flow is influenced by both natural processes (lower and higher recharge years) and mine-related influences.
- Specific dry season sampling of flows and adjacent groundwater monitoring points to verify the conceptual understanding and better delineate zones of current groundwater contributions to the surface water flows.

## 2. Surface Water

### a) Existing monitoring program

MRM has developed a comprehensive natural and artificial surface water monitoring program that incorporates a range of different monitoring techniques to help identify potential impacts from MRM operations on the receiving environment (refer to **Section 8.7, Chapter 8 – Water Resources**).

Currently, surface water is monitored at 32 natural surface water locations within and in the vicinity of the mine site. The specific objectives of the natural surface water monitoring program are to:

- measure the water quality in the McArthur River, Barney Creek, Surprise Creek, Emu Creek and the Glyde River;
- compare the measured water quality in the McArthur River with site specific trigger values;
- compare water quality from downstream monitoring sites with upstream control sites to help identify possible contamination of surface water;
- identify the potential sources of any contamination measured in the McArthur River or the local tributaries; and
- determine the efficacy of the controls implemented by MRM to prevent contamination of surface waters.

In addition, surface water is also monitored at 55 artificial surface water sites. The artificial surface water monitoring programme helps facilitate the sustainable management of water on-site by providing valuable data for the following:

- determination of water class;
- suitability of water for off-site discharge;
- suitability of water for different storage and transfer options;
- suitability of water for end uses such as milling ore, dust suppression, water treatment, potable use and clay conditioning; and
- identifying trends of key analytes which assist in identifying possible sources of catchment contamination.

**b) Proposed additional monitoring**

The following additions to the existing surface water monitoring program will be implemented:

- expanded natural surface water monitoring including:
  - installation of low flow monitoring stations along the McArthur River, Barney Creek and Surprise Creek to better estimate seepage flow rates and contaminants of concern (CoC) loads along streams through the mine site; and
  - installation of a water level gauge on the Glyde River to measure stream flows (subject to access constraints) located upstream of McArthur River backwater effects at a suitable hydraulic control for low flow and high flow monitoring.
- expanded artificial surface water monitoring including:
  - monitoring of the new mine water storages proposed for the site;
  - installation of flow meters on all future NOEF seepage collection sumps to estimate the rate of seepage expressing at the toe; and
  - monitoring of water treatment plant inflows and outflow water quality.
- mine pit lake
  - Establishment of surface water monitoring sites at closure (i.e., after 2047) to enable the estimation of flow and quality into and out of the McArthur River from the mine pit lake. These monitoring sites would be located at both the downstream mine levee wall opening and the upstream mine levee wall opening.

**3. Landform stability**

Stability monitoring of the Project’s domains will include annual monitoring for the first ten years following closure/rehabilitation, with the frequency of further monitoring after this period to be determined by the results of the initial ten years. This monitoring will comprise:

- aerial laser surveys (ALS) every five years during the adaptive management period to allow accurate quantification of any geomorphic changes;
- satellite imagery reviews in the years that ALS’s are not conducted; and
- monthly visual surveys in the early stages of domain closure.

**Reporting**

- The results of MRM’s water quality monitoring program will continue to be reported in the annual site’s environmental performance report; and
- water balance updates will be reported in the annual mine water balance.

**Corrective Actions**

Should monitoring identify that additional or alternative management intervention is required, MRM has developed a suite of management contingencies that can be drawn upon. These contingencies have been developed through a number of processes and include:

- groundwater interception trenches;
- vertical interception bores;
- increase water treatment plant capacity;
- increase water reuse;
- increase water storages; and
- decrease controlled water discharges.

**Responsibility**

Manager Environment, Safety and People

**Relevant Legislation, Guidelines and Standards**

- MRM’s Sustainable Development Standards and Procedures;

- Waste Discharge Licence pursuant to Section 74 of the *Water Act*;
- Environmental Protection (National Pollution Inventory) Objective 2004 ;
- ANZECC Guidelines for Fresh and Marine Water Quality 2000;
- AS 1940:2004. The Storage and Handling of Flammable and Combustible Liquids;
- AS 3780:2008. The Storage and Handling of Corrosive Substances;
- ICMM Sustainable Development Framework; and
- Enduring Value - The Australian Minerals Industry Framework for Sustainable Development 2005.

**Responsible Agency**

Northern Territory Environment Protection Authority  
 Department of Environment and Natural Resources  
 Department of Primary Industry and Resources

**15.4.2.2 Biodiversity Management Plan**

Table 15-3 Biodiversity Management Plan

**Closure Objectives**

- Post-mining landscape will be left in a condition safe and secure for humans and animals:
  - safe and secure for short term (0-100 years); and
  - safe for long term (100-1,000 years).
- Metal levels for fauna comparable to background levels.
- Rehabilitated areas will provide appropriate habitat for fauna utilization - abundance and diversity will be appropriate.
- Landform will host suitable vegetation for post-mining land use:
  - for traditional land use areas:
    - have similar environmental values as surrounding areas; and
  - for cattle grazing land use areas:
    - grasslands.

**Target**

- No disturbance to flora and fauna outside the authorised disturbance area; and
- prevent spread of weeds and feral pests.

**Management Strategy (refer to Chapter 9 – Biodiversity)**

**Safety of Animals**

- quality of surface waters downstream of SW11 will be maintained through measures outlined in **Table 15-2**; and
- air quality and dust deposition will be managed through measures outlined in **Table 15-7**.

**Metals in Aquatic Fauna**

- potential contamination of local waterways with metals will be managed and mitigated through measures outlined in **Table 15-2**.

**Habitat for Fauna**

- the Fire Management Plan will be updated in order to manage existing habitats to favour Gouldian Finches, Emus, Australian Bustards, Bush Stone-curlews, Spectacled Hare-wallabies and Northern Nailtail Wallabies;

- the cattle exclusion area will be extended to include an additional 909 ha of remnant woodland, which will be managed in accordance with the existing Cattle Management Plan;
- once newly-fenced riparian habitats have been demonstrated to be suitably recovered from grazing, Purple-crowned Fairy-wrens living within the disturbance footprint will be relocated to the newly fenced areas;
- rehabilitation of the TSF and NOEF after decommissioning will reintroduce native grasses important as food and/or cover for Gouldian Finches, Emus, Australian Bustards, Bush Stone-curlews, Spectacled Hare-wallabies and Northern Nailtail Wallabies;
- there will be barriers designed to restrict the entry of Largetooth Sawfish into the mine pit lake;
- fish way ramps will be installed on the mine pit lake inlets and outlets to facilitate aquatic fauna ingress and egress;
- mine pit lake inlets will be engineered with a gradual slope to prevent vertical drops that constitute a hazard to aquatic fauna;
- benches will be constructed around the edges of the mine pit lake to provide sections of shallow foraging habitat for Largetooth Sawfish; and
- large woody debris will be installed and riparian vegetation established around the mine pit lake's margins to provide habitat for fish that comprise the prey of Largetooth Sawfish.

### Vegetation

- small-scale trials will be undertaken to determine optimal site preparation, seed mixes and application rates for favourable establishment of local grass species and other key flora;
- mined areas and OEFs will be progressively rehabilitated to recreate the most suitable vegetation and habitat whilst addressing the rehabilitation constraints; and
- the current Weed Management Plan will be reviewed when required and adhered to.

### Performance Indicators

#### Safety of Animals

- surface water quality must meet standards defined in **Table 15-2**; and
- air quality and dust deposition rates must meet standards defined in **Table 15-7**.

#### Metals in Aquatic Fauna

- metal concentrations within fish are to be comparable to background levels; and
- no fish within the McArthur River are to contain lead in excess of the 0.5 milligrams per kilogram maximum permitted concentration (FSANZ 2009).

#### Habitat for Fauna

- no cattle are to be detected within the cattle exclusion area;
- no deaths of Largetooth Sawfish as a result of water level drawdown within the Djirrinmini Waterhole;
- riparian birds of conservation significance (Purple-crowned Fairy-wren and Buff-sided Robin) are not to decline by 15% or more within the MRM leases over any one five-year period;
- Purple-crowned Fairy-wrens and Buff-sided Robins are to recolonise rehabilitated riparian sites along re-channelled sections of the McArthur River and reach densities that are at least 25% of the density recorded in reference sites within 20 years of rehabilitation;
- the percentage ground cover of key food grasses for Gouldian Finches and other threatened fauna (i.e., *Triodia* spp., *Sorghum* spp., *Chrysopogon fallax*, *Alloteropsis semialata*, *Heteropogon triticeus*), measured at sites across the MRM leases, should not experience a net decline of more than 5% over any five-year period;
- fish communities within the McArthur River are not to be affected by the Project; with no decline in fish diversity or density to occur downstream of the Project (relative to reference sites upstream or in neighbouring catchments);
- aquatic macroinvertebrate communities within the McArthur River are not to be affected by the Project; and

- movement of Largetooth Sawfish upstream and/or downstream through the MRM leases is to be demonstrated at least once every five years.

### Vegetation

- rehabilitated areas are to possess a self-sustaining vegetation cover that presents features to support self-seeding and resilience to disturbances such as fire, drought and soil erosion;
- rehabilitated areas are to contain a diversity of native flora species across a number of strata that is comparable to analogue sites;
- weeds are not to be more prevalent within the Project area than on adjacent land;
- weed densities within rehabilitated sites are to be compatible with final land use;
- no infestations of invasive pasture grasses (including Gamba Grass (*Andropogon gayanus*), Para grass (*Urochloa mutica*), Olive Hymenachne (*Hymenachne amplexicaulis*) or Mission Grass (*Cenchrus polystachios*)), are to exist in the MRM leases;
- the mean grass cover over a five year period without grazing is to exceed the 10th percentile observed in reference sites;
- the mean tree biomass and species richness is to exceed the 10th percentile observed in reference sites; and
- canopy cover is to exceed the 10th percentile observed in reference sites.

### Monitoring

#### Safety of Animals

- the surface water monitoring program is summarised in **Table 15-2**; and
- the air and dust monitoring programs are summarised in **Table 15-7**.

#### Metals in Aquatic Fauna

- The existing monitoring program assessing metal concentrations in fish will be continued until data suggest that the current scale and/or frequency of survey effort is no longer warranted to provide confidence that no adverse environmental effects are occurring. This currently involves biannual assessments of fish tissues collected at over 20 sites across the McArthur River and its tributaries.
- The mine pit lake will be added to the existing set of sites surveyed for metals in fish.

#### Habitat for Fauna

- the existing quarterly monitoring program for cattle within the cattle-exclusion zone will be continued;
- the existing biannual monitoring of migratory shorebirds within the McArthur River estuary and nearby coastal areas will be continued until data suggest that the current scale and/or frequency of survey effort is no longer warranted to provide confidence that no adverse environmental effects are occurring; and
- the existing biannual riparian bird monitoring program will be continued until data suggest that the current scale and/or frequency of survey effort is no longer warranted to provide confidence that no adverse environmental effects are occurring.
- the existing annual monitoring program for Gouldian Finches and other woodland birds will be continued until data suggest that the current scale and/or frequency of survey effort is no longer warranted to provide confidence that no adverse environmental effects are occurring. Density of grass species at each monitoring site will be assessed in the mid- to late-wet season;
- the existing sawfish tagging program will be continued to assess whether connectivity of habitats through the mining leases is being maintained;
- the existing fish monitoring program will be continued until data suggest that the current scale and/or frequency of survey effort is no longer warranted to provide confidence that no adverse environmental effects are occurring;
- additional monitoring of aquatic fauna entering and exiting the mine pit lake will be undertaken to understand the effectiveness of fish ways and the role of the mine pit lake as a potential trap;
- aquatic macroinvertebrates will continue to be monitored annually according to the current program in place, until data suggest that the current scale and/or frequency of survey effort is no longer warranted to provide confidence that no adverse environmental effects are occurring;

- surveys will be undertaken on a regular basis (e.g., every three years) to investigate whether the terrestrial habitats created after rehabilitation are favourable for native fauna;
- surveys will be specially tailored to assess populations of key species potentially affected by the Project (e.g., Gouldian Finch, Purple-crowned Fairy-wren);
- the establishment, within non-riparian rehabilitated sites, of grasses important to Gouldian Finches, Emus, Australian Bustards, Bush Stone-curlews, Spectacled Hare-wallabies and Northern Nailtail Wallabies will be assessed as part of vegetation monitoring; and
- a register of road-killed fauna will be maintained.

#### **Vegetation**

- annual weed surveys will be undertaken in accordance with the existing Weed Management Plan;
- the existing monitoring program for assessing the development of vegetation in rehabilitated channels of the McArthur River and Barney Creek, as described in the Rechannel Vegetation Monitoring Plan, will be continued; and
- the Rechannel Vegetation Monitoring Plan will be adapted to extend to non-riparian rehabilitated sites. These sites will be monitored annually for the first three years, then subsequently every three years.

#### **Reporting**

- The results of MRM's biodiversity management program will continue to be reported in the annual Environmental Performance Report;
- MRM's biodiversity management program will continue to be audited by the independent monitor; and
- a summary report of site closure performance and achievement of mine closure criteria will be issued to stakeholders in the final year.

#### **Corrective Actions**

Failure to meet one or more performance indicators will result in the implementation of corrective actions. These are listed below.

#### **Safety of Animals**

- corrective actions to be implemented if surface water quality does not meet the relevant standards as described in **Table 15-2**; and/or
- corrective actions to be implemented if air quality or dust deposition rates fail to meet the relevant standards as described in **Table 15-7**.

#### **Metals in Aquatic Fauna**

In the event that fish are detected with metal concentrations exceeding the trigger levels, an investigation will be conducted into the potential sources of contamination, and remediation efforts will be implemented. For example, previous instances of lead deposition due to dust at the Barney Creek bridge triggered a suite of successful management measures that were targeted towards remediating the specific impacts, including:

- installation of a new sediment trap;
- installation of new batters between the haul road and creek; and
- mechanical excavation and removal of sediment from the creek bed.

#### **Habitat for Fauna**

- If cattle are detected within the cattle exclusion area, they are to be removed and fences repaired.
- In the event of a Largemouth Sawfish fatality as a result of water level drawdown within the Djirrinmini Waterhole, mitigation measures will be developed (including supplementary water provision) and implemented each subsequent dry season to prevent further deaths.

- In the event that local shorebird populations decline by 15% or more over a five-year period, an investigation will be conducted into the effect of MRM's activities on shorebird populations via analyses of metal concentrations in estuarine sediments and comparisons of migratory shorebird population trends with non-migratory shorebirds that are not exposed to pressures elsewhere in the East Asian-Australasian flyway. If MRM activities are deemed to cause the declines, additional mitigation and remediation measures will be developed.
- In the event that MRM populations of Purple-crowned Fairy-wrens and/or Buff-sided Robins decline by more than 15% over a five-year period, an investigation will be conducted to determine the proximate causes of this decline and determine the effect of the MRM operations. This investigation would involve comparing population trends at upstream and downstream sites, and at on-lease and off-lease sites. It would also utilise vegetation monitoring data to infer whether a decline in the health of riparian vegetation is a cause of declines. If MRM activities are deemed to cause the declines, additional mitigation and remediation measures will be developed and implemented.
- In the event that Purple-crowned Fairy-wrens and Buff-sided Robins fail to recolonise rehabilitated sites at adequate densities, the deficient habitat feature(s) will be identified and actions taken to improve these features.
- If a decline in the density of grasses eaten by Gouldian Finches is detected, an investigation into the proximate causes of this decline (e.g., inappropriate grazing intensity, fire regime, weeds and/or drought) will be conducted, and measures developed to reverse this decline.
- In the event that fish communities within the McArthur River are affected by the Project, an investigation will be conducted into the cause of the decline in diversity or abundance. Such impacts are anticipated to correspond with a failure of surface water quality to meet relevant standards, and corrective actions will follow those described in **Table 15-2**.
- In the event that aquatic macroinvertebrate communities within the McArthur River are affected by the Project, an investigation will be conducted into the cause of the decline in diversity or abundance.
- In the event that no Largetooth Sawfish are recorded migrating upstream and/or downstream through the MRM leases, the potential barriers to movement will be investigated and remediated.
- If insufficient densities of grass important for threatened fauna are found to establish within rehabilitated sites, remedial action will take place. Such actions will depend on the cause of failure, but may include supplementary planting, fertilising or weed control.

### Vegetation

- In the event that rehabilitated areas fail to fulfil criteria pertaining to grass cover, biomass, species richness, canopy cover, self-seeding or resilience to disturbances, trials will be undertaken to investigate the most effective remedial actions (e.g., supplementary planting, fire management, fertilising, weed control, etc.). The most appropriate remedial action will then be applied on a large-scale across all areas failing to meet performance indicators.
- In the event that weed infestations fail to meet performance indicators, additional weed control measures will be implemented in accordance with the Weed Management Plan.

### Site Responsibility

Manager for Environment, Safety and People

### Relevant Legislation, Guidelines and Standards

- MRM's Sustainable Development, Standards and Procedures;
- NT *Territory Parks and Wildlife Conservation Act*;
- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*;
- NT *Weeds Management Act*;
- ICMM: Good Practice Guidance for Mining and Biodiversity; and
- Enduring Value - The Australian Minerals Industry Framework for Sustainable Development 2005.

### Responsible Agency

Northern Territory Environment Protection Authority  
Department of Environment and Natural Resources

### 15.4.2.3 Overburden Placement Management Plan

Table 15-4 Overburden Placement Management Plan

#### Closure Objectives

- Post-mining landscape will be left in a condition safe and secure for humans and animals:
  - safe and secure for short term (0-100 years); and
  - safe for long term (100-1,000 years).
- Landform stability:
  - Geotechnical stability will be maintained at these standards:
    - NOEF: Long-term static drained Factor of Safety (FoS) of 1.5; Maximum Design Earthquake (MDE) – 1 in 1,000 year event;
  - Erosional stability; maintainable for these aspects:
    - Cover system and landform to maintain functionality;
    - Sediment release from erosion does not adversely impact on water quality;
    - Erosion does not affect functionality of the landform; and
    - Resulting suspended solids can be mitigated.
  - Geochemical stability will be defined, managed and monitored:
    - seepage water quality at toe/base of landforms; and
    - water quality within the mine pit lake.
- Manage surface water and groundwater such that environmental values and ecosystems are maintained downstream of the lease boundary in the short term (0-100 years), and within the McArthur River in the long term (100-1,000 years).
- Metal levels for fauna comparable to background levels.
- Landform will host suitable vegetation for post-mining land use:
  - for traditional land use areas:
    - have similar environmental values as surrounding areas; and
  - for cattle grazing land use areas:
    - grasslands.
- Rehabilitated areas will provide appropriate habitat for fauna utilization - abundance and diversity will be appropriate.
- Manage soil to meet post mining land use.

#### Targets

- Achieve effective identification, segregation and placement of the five overburden geochemical classes;
- limit the potential for geochemical impacts on surface and groundwater quality, resulting from mining activities; and
- prevent spontaneous combustion at the NOEF through a well-defined construction program which limits the potential for interaction of oxygen and water with overburden.

#### Management Strategy (refer to Chapter 6 – Materials Characterisation)

##### Existing Controls/Actions

- Material Classification Management:
  - only low salinity non-acid forming (high capacity) (LS-NAF(HC)) materials are used in the construction of the OEF cover systems as well as levees, growth media and buttresses in environmentally sensitive areas;
  - all metalliferous saline non-acid forming (MS-NAF) materials (high capacity) (MS-NAF(HC)) and (low capacity) (MS-NAF(LC)) encapsulated under a low permeability barrier in the final cover system of the OEFs;
  - only MS-NAF materials (MS-NAF(HC) and MS-NAF(LC)) used in the construction of the Halo between the cover system and the PAF core of the NOEF;
  - all PAF material (high capacity) (PAF(HC)) and (reactive) (PAF(RE)) is to be placed in core of

- NOEF and encapsulated under low permeability barrier; and
- the PAF(RE) material is placed in low lifts by paddock dumping.
- In-pit Grade Control Procedure:
  - all overburden blast blocks are sampled in accordance with the MRM grade control procedure to confirm material classification prior to load and haul operations. Final classification is validated by the Mine Geologist.
- Overburden Tracking System:
  - A GPS tracking system for haul trucks is in use at MRM. The material type being mined is entered into the system along with the allocated placement location for that type of material within the NOEF. The system sends alerts prior to placement of material if it is in the incorrect area of the NOEF.
- Spontaneous Combustion Management:
  - all PAF(RE) to be paddock dumped in lifts no higher than 2 metres (m);
  - all PAF cell outer batters to be dozed back to 1V:4H; and
  - temporary wet season alluvial caps are placed on the PAF cell prior to onset of the wet season.

### Proposed Controls/Actions

In addition to the existing controls as described above, the following additional material classification controls are proposed:

- The requirement for only LS-NAF(HC) materials to be used in the construction of the OEF cover systems as well as levees, growth media and buttresses in environmentally sensitive areas is maintained.
- The requirement for all MS-NAF materials MS-NAF(HC) and MS-NAF(LC) to be encapsulated under a low permeability barrier in the final cover system of the OEFs is maintained.
- The MS-NAF materials (MS-NAF(HC) and MS-NAF(LC) to be used in the construction of the Halo between the cover system and the PAF core of the NOEF are to be placed in lifts no higher than 7.5 m.
- Segregation of PAF(HC) and PAF(RE) materials.
- All PAF(HC) material to be placed in the core of the NOEF and encapsulated under a low permeability barrier. The material is either placed in low lifts by paddock dumping or placed in lifts up to 7.5 m (consisting of a 2 m paddock dumped base and a 5.5 m tip head) with regular fine grained air advection barriers.
- All PAF(RE) material is to be segregated from other materials and placed within dedicated cells with the following features:
  - PAF(RE): will be exclusively paddock dumped and compacted to limit oxygen ingress and avoid particle size segregation. This constitutes leading industry practice in the management of reactive material. The PAF(RE) cells will be built in maximum 2 m lifts, with 100 mm of compacted fine grained alluvial sheeting above every lift.
  - Dry season mining: in order to limit to a maximum the possible ingress of water into PAF(RE) cells, the reactive PAF will be mined primarily during the dry season over the LOM.
  - Wet Season covers: prior to every wet season, a 1 m compacted fine grained alluvial cover will be placed to enclose the PAF(RE) cells to limit both oxygen and water ingress into the cell. This will in turn be protected from erosion by a 1.5 m layer of MS-NAF.
- Low permeability cover system specifications are set at 5-10% net percolation and 5 mol/m<sup>2</sup>/yr to limit both water and oxygen ingress into the OEF.

### Performance Indicators

- materials must be placed in the correct location in the OEFs;
- materials must be placed using the correct methodology for each type;
- major spontaneous combustion events must not occur on the NOEF during the operational phase, and no spontaneous combustion must occur following closure;
- sulphur dioxide emissions must be below criteria (closure plan); and
- OEFs cover system performance must conform to specifications.

## Monitoring

### Existing Monitoring Program

- A global positioning system (GPS) tracking system is used to identify incorrect placement of material prior to it occurring.
- Geochemical Sampling
- Monthly geochemical sampling of overburden is undertaken on the active OEFs. The program includes systematic sampling of NAF cells, PAF cells as well as low grade ore. It includes elemental analyses as well as standard Acid-Base Accounting (ABA) sampling.
- Spontaneous Combustion
  - Thermal monitoring is undertaken prior to and during drill and blast operations enabling the early detection of potentially problematic material.
  - Daily visual and thermal inspections of the NOEF are conducted by mining personnel for early detection of reacting material. This allows MRM to identify areas showing early signs of increased reactivity (abnormal surface moisture, elevated temperatures, cracks, heaving, or efflorescent salts) prior to the onset of spontaneous combustion.
  - Daily gas monitoring measurements including sulphur dioxide levels are undertaken on the OEFs to identify potential hazards and areas requiring remediation/intervention.
  - Weekly hazard maps of the OEFs are generated showing areas of concern with regards to gas levels.
- Internal gas and temperature Monitoring in the NOEF
  - As part of the existing NOEF remediation program, a total of 29 monitoring bores were drilled into the NOEF, with 15 of these focussing on groundwater monitoring and 14 on temperature and gas monitoring.
  - Bores which extend through the full thickness of the PAF cells (ca 40 m) are equipped with thermocouples and gas ports at different depths; enable gas sampling and the ongoing monitoring of internal temperatures within the NOEF.

### Proposed Monitoring Program

In addition to the existing monitoring program as described above, the following additional monitoring is proposed to assess NOEF performance:

- Ongoing monitoring of gas concentrations and temperature within the NOEF in order to manage geotechnical and hydrogeochemical processes and the potential impact on groundwater and surface water systems. This internal monitoring will also provide validation of the impacts of overburden placement practices, and an understanding of the internal controls of AMD production and release.
- Additional gathering of information on various components of the water balance such that multiple lines of evidence can be developed to inform cover system performance.
- Monitoring of net percolation and gases below the cover system as per the NOEF monitoring plan (refer to **Appendix O – NOEF Closure Monitoring System Report**).
- A large-scale lysimeter will be suitable for assessing net percolation rates reporting from the NOEF cover system to the halo zone below the Compacted Clay Layer (CCL). In conjunction with sensors associated with the lysimeter installation, soil monitoring equipment will be installed within each unit of the NOEF cover system (including growth medium and CCL); and halo. These sensors will allow for changes in in-situ volumetric water content, matric suction, temperature and oxygen to be understood. Pore-gas sampling systems will be installed throughout the depth of the facility allowing for manual gas sampling and to monitor pore gas pressures (refer to **Appendix O – NOEF Closure Monitoring System Report**).
- Monitoring of water quality in the NOEF sediment management structures during operations until it can be demonstrated that the water quality is within acceptable limits prior to release into receiving waters. If runoff and/or interflow from the NOEF final cover is found to be inappropriate for passive release, adaptive management measures will be required and/or additional storage volume will be needed to contain it within the Class 4 and/or Class 5 and 6 water management systems. Furthermore, where monitoring identifies runoff from the rehabilitated NOEF is suitable for direct release, the sediment management structures will be decommissioned.

**Further Investigations**

Although extensive geochemical studies have been completed, field and laboratory testing (in particular kinetic testing) will be ongoing through the LOM in order to validate and update the geochemical and hydrological conceptual models of the NOEF.

**Reporting**

- Incorrect placement of material will be reported internally to the shift supervisor and Mining Manager; and
- NOEF monitoring results will be incorporated in the annual environmental performance report.

**Corrective Actions**

Where incorrect placement of material is identified, it will be removed or appropriately managed to reduce its environmental risk to an acceptable level.

**Site Responsibility**

Mining Manager

**Relevant Legislation, Guidelines and Standards**

Mining Management Plan under the NT *Mining Management Act*.

**Responsible Agency**

NT Department of Primary Industry and Resources

**15.4.2.4 Cultural Heritage Management Plan**

Table 15-5 Cultural Heritage Management Plan

**Closure Objectives**

- Post-mining landscape will be left in a condition safe and secure for humans and animals:
  - safe and secure for short term (0-100 years); and
  - safe for long term (100-1,000 years).
- maintain custodians’ access to areas of cultural significance; and
- foster economic opportunities for Custodian and local communities.

**Targets**

- To relocate MRM 4 to preserve its cultural significance to the community;
- no valid complaints of limited access to sacred sites or ceremonial areas by Custodians; and
- no unauthorised disturbances to sacred sites.

**Management Strategy (refer to Chapter 11 – Cultural Heritage)**

The following proposed actions will constitute a continuation of existing management practices:

- comply with all conditions attached to the site’s Aboriginal Areas Protection Authority (AAPA) certificates, including (for relevant nominated sacred sites):
  - no entry;
  - no ground-disturbing works;
  - no damage to vegetation other than for purposes specified in the relevant site conditions;
  - no storage of material and parking of machinery on sites, or within a certain radius of sites;
  - installation of highly visible temporary protective fences along the perimeter of specified areas (e.g., along the outer perimeter of work areas in the vicinity of sacred sites) and maintenance of such fencing while works are in progress; and/or
  - rehabilitation of specified areas to allow natural re-growth of vegetation.

- notification of the Aboriginal custodians of the sacred sites and provision of the opportunity to supervise restoration works carried out on the site;
- maintain a cultural heritage awareness component into site induction programs for new Project employees; and
- continue the implementation of a permit to dig/clear system which requires all ground disturbance activities and all works that impact vegetation to be assessed and approved by MRM Community relations and environmental personnel, in the company of custodians.

#### Performance Indicators

No unauthorised access to sacred sites

#### Monitoring

- visual inspections of sacred site boundaries;
- custodians to undertake cultural heritage clearances before disturbances are undertaken; and
- review custodian feedback.

#### Reporting

Cultural issues will be reported on in the annual Environmental Performance Report and to AAPA

#### Corrective Actions

- The following constitutes an incident or failure to comply:
  - unauthorised disturbance of sacred sites; and/or
  - non-compliance with AAPA certificate conditions.
- In the event of a failure to comply, investigations will be undertaken into the cause of the incident or failure to comply and appropriate corrective or preventative action/s undertaken to limit the risk of the incident reoccurring.

#### Site Responsibility

Manager Environment, Safety and People

#### Relevant Legislation, Guidelines and Standards

- Glencore's Health, Safety, Environment and Community Management System;
- Northern Territory *Heritage Act*;
- Northern Territory *Aboriginal Sacred Sites Act*;
- The Commonwealth *Environment Protection and Biodiversity Conservation (EPBC) Act, 1999*;
- The (Australian) National Heritage List and the Commonwealth Heritage Register, which list heritage sites protected under the EPBC Act;
- *The Torres Strait Island Heritage Protection Act 1984*; and
- Enduring Value - The Australian Minerals Industry Framework for Sustainable Development 2005.

#### Responsible Agency

Department of Tourism and Culture  
Aboriginal Areas Protection Authority

### 15.4.2.5 Socio-economic Management Plan

Table 15-6 Socio-economic Management Plan

#### Closure Objectives

- Post-mining landscape will be left in a condition safe and secure for humans and animals:
  - safe and secure for short term (0-100 years); and
  - safe for long term (100-1,000 years).

#### Targets

- No complaints about social or community impacts;
- a 20% indigenous employment rate;
- to enrich the community with opportunities for work and education through the mine; and
- provide economic benefits to Borroloola and the Gulf Statistical Local Area (SLA), Darwin and Australia through direct or indirect activity.

#### Management Strategy (refer to Chapter 12 – Socio-economic Environment)

The following proposed actions will constitute a continuation of existing management practices:

- ongoing coordination of the MRM Community Reference Group (CRG), which serves as an overarching management tool to enable MRM to monitor impacts on the community and facilitate the provision of Project information and feedback. The focus of the CRG is to:
  - respond to community enquiries and complaints;
  - resolve disputes with stakeholders;
  - develop action plans with stakeholder involvement for ongoing social and community support;
  - report on the progress of activities and commitments;
  - monitor through stakeholder feedback the effectiveness of their community engagement processes; and
  - adjust mitigation strategies to achieve the best outcomes for all parties.
- use of a range of communication tools so that the local community is kept informed of MRM's operations (i.e., memorandums, reports, flyers and announcements, and meetings);
- continue the role of MRM's Community Relations Officer as an active member of a number of local community organisations;
- undertake ongoing stakeholder engagement throughout the Project life and include Indigenous individuals input into the implementation of the mine's long-term monitoring program;
- continued economic contribution to Borroloola and the Gulf Statistical Local Area (SLA) through direct employment at the mine or via purchase of supply services;
- continuation of the Community Benefits Trust (CBT), which will deliver community benefits for the duration of the operation phase (20 years) in the same form as it has since its creation in 2008;
- continued support for businesses in Borroloola and Darwin throughout the life of the Project via purchase of supplies; and
- continued contribution to the Australian and NT economies via payment of payroll taxes and royalty payments as well as employment and services where needed.

#### Performance Indicators

- Positive contributions to the community such as sponsorships, employment or delivery of local services;
- comprehensive database maintained on complaints, employee health and social issues; and
- recurring issues will be analysed and addressed.

#### Monitoring

Review feedback from the local community and stakeholders

**Reporting**

Community members will always be informed of ongoing mine activities in CRG meetings and fact sheets where significant changes are going to take place.

**Corrective Actions**

- The following constitute an incident or failure to comply:
  - justified complaints about social and community issues;
  - failure of MRM local community initiatives due to lack of support; and
  - cessation of training and employment opportunities for local residents.
- In the event of a failure to comply, investigations will be undertaken into the cause of the incident or failure to comply and the appropriate action taken address the issues. This may include reallocation of resources, improvement in communication or provision of alternative services.

**Site Responsibility**

Manager Environment, Safety and People

**Relevant Legislation, Guidelines and Standards**

- Glencore’s Health, Safety, Environment and Community Management System;
- IAP2 (International member association which seeks to promote and improve the practice of public participation or community engagement); and
- Enduring Value - The Australian Minerals Industry Framework for Sustainable Development 2005.

**Responsible Agency**

Northern Territory Environment Protection Authority  
 Northern Territory Department of Housing and Community Development  
 Department of Health

**15.4.2.6 Air Quality Management Plan**

Table 15-7 Air Quality Management Plan

**Closure Objectives**

- Post-mining landscape will be left in a condition safe and secure for humans and animals:
  - safe and secure for short term (0-100 years); and
  - safe for long term (100-1,000 years).
- manage surface water and groundwater such that environmental values and ecosystems are maintained downstream of the lease boundary in the short term (0-100 years), and within the McArthur River in the long term (100-1,000 years).
- metal levels for fauna comparable to background levels.

**Targets**

- To achieve compliance with the relevant ambient standards;
- meet MRM’s obligations under the *National Greenhouse and Energy Reporting Act 2007*; and
- control greenhouse gases (GHG) per tonne mined.

**Management Strategy (refer to Chapter 13 – Air Quality)**

**Dust Management**

The following dust emission management control strategies will continue to be implemented:

- General:

- site induction is to include air quality requirements to ensure employee awareness of visual dust plumes and potential for dust impacts.
- Hauling on unsealed and sealed roads:
  - watering of haul road surfaces;
  - prevent material being deposited/spilled on haul roads;
  - speed limits on all roads;
  - trafficable areas clearly marked, minimised, and vehicle movements restricted to these areas;
  - trafficable areas and vehicle manoeuvring areas regularly maintained;
  - disused roads to be rehabilitated as soon as practicable; and
  - visual monitoring and inspections of dust from unsealed roads to determine control effectiveness.
- Material extraction/unloading:
  - prior to extraction, application of water on dusty areas using dust suppression sprinklers;
  - water truck with water cannon to supply selective dust suppression when required;
  - minimise the double handling and stockpiling of material;
  - minimise the fall distance of materials during loading and unloading; and
  - relocate/reschedule operations during high dust periods, where practicable.
- Dozer and grader operations:
  - travel speed minimised in dusty conditions;
  - travel on defined routes between work areas, and pre-water route where feasible;
  - water haul roads immediately after grading, where possible; and
  - visual monitoring and inspections of dust levels from dozer operations.
- Exposed areas:
  - only the minimum area necessary for mining will be disturbed;
  - overburden emplacement areas rehabilitated as soon as feasible;
  - stabilisation on areas inactive for extended periods; and
  - regular watering of cleared areas where appropriate.
- Processing plant:
  - water sprays to minimise dust when unloading run of mine (ROM) to hopper;
  - slower tipping at ROM hopper during adverse weather conditions;
  - use visual triggers for implementation of further dust mitigation;
  - enclose facility with internal water sprays at feeder, crusher, conveyor and transfer points as necessary;
  - enclosed conveyors and transfer points;
  - all conveyors to be fitted with appropriate cleaning and collection devices;
  - regularly clean areas where spilt material can build up, e.g., under transfer chutes and conveyors; and
  - water sprays, enclosures and wind breaks for crushers and screens.
- ROM stockpiles:
  - minimise drop heights when stacking;
  - manual implementation of water sprays and/or water cart during dusty periods; and
  - visual surveillance of dust plumes during activity.
- TSF:
  - consolidation of cells 1 and 2 and operation as a wet slurry facility;
  - maintaining moist beaches; and
  - tailings deposition via spigots around the periphery of the tailings cells, where these spigots are operated on a rotation/cycle of approximately 35 to 40 days to keep the exposed tailings surface periodically damp.

### **Sulphur Dioxide Emission Management**

Sulphur dioxide will be managed through the implementation of a protocol for selective handling and emplacement of overburden material. The protocol has been implemented to minimise the potential ingress of water and oxygen to pyritic material encapsulated in the NOEF, and therefore reducing the risk of spontaneous combustion.

Additionally, spontaneous combustion will be managed through multiple monitoring techniques, including:

- in-pit monitoring;
- thermal monitoring, to be undertaken prior to and during drill and blast operations to enable the early detection of potentially problematic material;
- daily visual and thermal inspections by Mining personnel for early detection of reacting material. The aim is to identify areas showing early signs of increased reactivity (abnormal surface moisture, elevated temperatures, cracks, heaving, or efflorescent salts) prior to the onset of spontaneous combustion;
- gas monitoring;
- daily gas measurements including sulphur dioxide levels on the NOEF in order to identify potential hazards and areas requiring remediation/intervention;
- generation and communication of weekly NOEF hazard maps identifying areas requiring additional management or controls with regards to temperatures and gas levels; and
- personal monitors and personal protective equipment (PPE) to be utilised for workers working near areas of potential sulphur dioxide emissions.

Further information on the management of overburden geochemistry for the limitation of gas emissions is provided in **Chapter 6 – Materials Characterisation** and **Chapter 3 – Project Description and Justification**.

### **GHG Emission Management**

Direct means of reducing GHG emissions will include such measures as:

- minimising clearing at the site where possible;
- integrating transport for the Project with other local industries, so that GHG emissions from the construction and running of transport are minimised;
- maintenance of heavy mobile equipment (including tyres) and roads;
- using renewable energy sources where practicable;
- replacing some diesel powered light towers with mains connected LED's at the mine installing timers to control lighting across the site;
- upgrading to more efficient heavy equipment in the mining fleet to reduce diesel derived GHG emissions; and
- using driver simulation software for bulldozers and loaders instead of equipment when training personnel.

### **Performance Indicators**

- Dust managed sufficiently so that it does not become a health or nuisance issue;
- GHG controlled per tonne mined as per current targets; and
- MRM has outlined emission goals within **Chapter 13 – Air Quality**.

### **Monitoring**

The following monitoring measures are already in place at MRM and will continue throughout the duration of the Project:

- LVASs
  - 31 LVASs including two control sites, which have been established to measure ambient particulate matter (PM10) including particulate lead and particulate zinc; and
  - monthly monitoring conducted over a 24 hour period.
- Deposition dust
  - 18 depositional dust gauges are located strategically around the mine and undergo laboratory analysis on a monthly basis.
- Sulphur dioxide
  - two sulphur dioxide monitors, one at Borroloola and the other adjacent to the Carpentaria Highway, west of the current NOEF provide representative air quality data;
  - the monitors capture sulphur dioxide levels, wind speed and wind direction throughout the day; and

- results from this monitoring are made available on the MRM website.

### Reporting

- MRM's air quality performance will continue to be reported in the annual environmental performance report;
- MRM will continue to quantify GHG emissions and submit annual reports to the federal Department of Climate Change and Energy Efficiency on performance against emission management targets; and
- Results from the sulphur dioxide monitoring will be published on the MRM website as monthly reports as well as weekly summary reports and raw data.

### Corrective Actions

An assessment to validate the monitoring data will be made on a monthly basis or in response to a measured exceedance of criteria (i.e., to confirm whether or not the exceedance is a non-compliance). This will be implemented as per three escalating levels (Level 2 and 3 are applied as necessary):

- Level 1 – this assessment will involve checking that all calibration and maintenance work due for that month has been completed and an examination of the data against the previous months;
- Level 2 – where data is assessed as being invalid, detailed examination of the available field records, laboratory notes, calibrations, etc. shall be made and this may include site inspection of monitoring equipment; and
- Level 3 - Where anomalous or potentially invalid data are found and the issue is significant (e.g., may indicate an exceedance or equipment fault) and a level 1 or 2 evaluation cannot determine the cause; engage a professional air quality expert to examine the issue.

### Site Responsibility

Manager Environment, Safety and People

### Relevant Legislation, Guidelines and Standards

- National Environmental Protection Council;
- Australian Standard 3580.10.1.2003 Methods for Sampling and Analysis of Ambient Air - Determination of Particulate Matter - Deposited Matter - Gravimetric Method;
- Australian Standard 3580.4.1 – 2008 Methods for sampling and analysis of ambient air. Method 4.1: Determination of Sulphur dioxide – Direct reading instrumental method;
- Intergovernmental Panel on Climate Change; and
- GHG policies:
  - United Nations Framework Convention on Climate Change;
  - Kyoto Protocol; and
  - COP21.

### Responsible Agency

Northern Territory Environment Protection Authority  
Department of Primary Industry and Resources

## 15.4.2.7 Health and Safety Management Plan

Table 15-8 Health and Safety Management Plan

### Closure Objectives

- Post-mining landscape will be left in a condition safe and secure for humans and animals:
  - safe and secure for short term (0-100 years); and
  - safe for long term (100-1,000 years).

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**Targets**

Zero reportable injuries and work-related illnesses on site or off site

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**Management Strategy (refer to Chapter 14 – Health and Safety)**

There is a number of existing operational Health and Safety risks that will continue to be relevant as part of proposed Project activities. These risks will be managed in accordance with MRMs existing system-based and hazard-specific mitigation strategies, as described within **Section 14.6.1** of the Health and Safety chapter.

Additional key Health and Safety risks associated with proposed Project activities have been identified through the Project risk assessment (refer to **Chapter 6 – Project Risk Assessment**). These additional risks, and proposed management controls include:

- Spontaneous Combustion (Open Cut in-pit dump):
  - Reactive material will be temporarily stored at the east overburden emplacement facility EOEF and only later transferred into the final void as a means to reduce environmental effects of overburden management and reduce the amount of PAF(RE) stored at the NOEF. In-pit dumping has also been proposed in the final six years (approximately) of the mine life with limited overburden to allow early rehabilitation of the NOEF. MRM will undertake monitoring within the open cut final void to assess the levels of gas during this time.
  - To ensure the health and safety of employees working within the open cut, proposed controls to manage sulphur dioxide related exposure would include ventilation, adoption of trigger points for withdrawal and worst case use of appropriate PPE. The in-pit dumping will be nominally constructed in 16 m lifts. However, if risk assessments indicate that enhanced management of oxidation is required, then lift heights may be lowered and/or advection barriers implemented around problematic material to mitigate the risk, using methods that would have been established during operation of the NOEF for the preceding ten-plus years. Refer to Chapter 3 – Project Description and Justification for additional details.
- Spontaneous Combustion (NOEF):
  - Sulphur dioxide emissions from the NOEF will be controlled through mitigating spontaneous combustion from the area. MRM has proposed a new design as part of the Project with the aim of securely encapsulating materials to limit the possibility of spontaneous combustion. Refer to Chapter 3 – Project Description and Justification for design criteria.
- Piping Failure of TSF Embankment – this hazard would be a result of either poor operation and management, or inadequate design and planning. Therefore risk management is proposed to include a combination of design and operational controls including:
  - combining Cell 1/Cell 2 storages, which will ultimately reduce the risk of a high pond level (greater surface water storage capacity);
  - minimum beach length/freeboard design and improved beach and water management (operating controls on water level);
  - installation of new spillway to decrease risk associated with high pond level during spill event;
  - installation of piezometers to monitor soil moisture levels and other relevant parameters;
  - improved tailings management practices (eg. undertake regular routine and intermediate surveillance inspections during operation);
  - Operation, Maintenance and Surveillance (OMS) with training, audits, inspections, critical operating parameters of water height (and proximity of water to embankment - monitored via an online system with alarm set points); and
  - development of a Trigger Action Response Plan (TARP), to be documented in the TSF OMS manual.
- Spontaneous Combustion (TSF) – the improper handling of tailings could potentially lead to the risk of spontaneous combustion and release of toxic gas. The adoption of appropriate

administrative and operational controls is proposed including:

- adoption of a safety management system in accordance with Glencore's HSEC Management system which includes identification of hazards and application of work methods to avoid exposure to (or provide protection from) hazards whilst working in the proximity. This will include use of cabins, PPE, sprinklers, etc.; and
- development of a work method statement for conduct of tailings construction activities (e.g., avoiding loose tailings being left in stockpiles, tailings that are being re-handled for construction purposes to be track rolled).
- TSF Embankment – the MRM Operational Management System includes a number of control measures designed to mitigate the potential impacts from any seismic event. These include:
  - regular inspections of the TSF and surrounds;
  - construction standards of TSF walls and foundations; and
  - TSF design considerations including dam safety (seismicity) allowances.
- Managing the risk of embankment failure due to excessive rate of tailings rise will include a combination of:
  - design controls which stipulate beach dimensions, water management controls and dam spillway design parameters;
  - operating controls (e.g., water height/freeboard limits);
  - condition monitoring incorporating piezometers, surveillance inspections and on-line alarm systems; and
  - response systems, including a TARP.
- The risk of embankment failure due to Surprise Creek flooding will be controlled through adoption of the following:
  - flood studies of Surprise Creek and Little Barney Creek undertaken to assess flood levels and flow velocities;
  - design allows for rock armouring of toe of embankment adjacent to waterway;
  - monitoring of toe of the TSF during / following extreme flood events; and
  - relocation of tailings to the final void as part of tailings reprocessing and rehandling.
- TSF Tailings Face Failure due to Hydraulic Mining – the following controls will be implemented:
  - operating management system in place for tailings re-mining, which covers procedures and monitoring;
  - Work Method Statements (WMS) will be in place;
  - geotechnical analysis will be undertaken;
  - bench heights are limited to 10 m; and
  - embankments and adjacent tails will be de-constructed using conventional methods.
- Risk to Unauthorised Third Parties at Closure:
  - A combination of controls is proposed and these will be documented in MRMs Security Management Plan including active monitoring and the installation of fencing, warning signs and barricades where deemed appropriate, etc. during the operations and adaptive management phases. Longer term management will be developed in consultation with relevant landholders input.
  - As part of the proposed Project activities, a continual review of these existing mitigation measures will be undertaken and modifications to current practices undertaken if necessary.

### Performance Indicators

- Number of incident reports;
- frequency rates for Lost Time Injuries, Medical Treatment Injuries and Disabling Injuries;
- severity of incidents (e.g., fatality, injury, major spill);
- % compliance with H&S procedures; and
- % compliance with corrective action procedures.

### Monitoring

MRM is committed to continuous improvement through the regular auditing of the site's health and safety health systems both internally and externally.

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**Reporting**

- The relevant safety personnel report to the Management Team on a daily basis on any health and safety issues that need to be addressed;
- the results of all health and safety audits will be reported to the General Manager; and
- MRM's existing electronic incident reporting process will be used to report all incidents.

**Corrective Actions**

MRM will investigate, respond to and take appropriate corrective and preventative actions following a health and safety incident.

**Site Responsibility**

General Manager; Manager Environment, Safety and People; and Site Management Team.

**Relevant Legislation, Guidelines and Standards**

- Glencore Zinc HSEC Management System;
- NT WorkSafe;
- *Work Health and Safety (National Uniform Legislation) Act*;
- AS/NZS 4801:2001; and
- Enduring Value - The Australian Minerals Industry Framework for Sustainable Development 2005.

**Responsible Agency**

NT WorkSafe