
Report

# Eliwana Mine Closure Plan

Long Term Mine Planning

**February 2018**
**EW-PL-EN-0001 Rev 0**

| | **Eliwana Mine Closure Plan** | | |
|---|---|---|---|
| **Document_Revision Number** | EW-PL-EN-0001 Rev 0 | | **21/02/2018** |
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| **Author** | Kirsty Beckett | Signature | 16/02/2018 |
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| **Approved** | Ivor Jezdik | Signature | 21/02/2018 |
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# 1. CLOSURE GUIDELINE CHECKLIST

| | Mine Closure Plan (MCP) checklist | Y/N /NA | Page | Comments | Change Y/N | Page | Summary |
|---|---|---|---|---|---|---|---|
| 1 | Has the Checklist been endorsed by a senior representative within the tenement holder/operating company? | Y | 6 | | | | |
| **Public Availability** | | | | | | | |
| 2 | Are you aware that from 2015 all MCPs will be made publicly available? | Y | | | | | |
| 3 | Is there any information in the MCP that should not be publicly available? | N | | | | | |
| 4 | If "Yes" to Q3, has confidential information been submitted in a separate document/section? | NA | | | | | |
| **Cover Page, Table of Contents** | | | | | | | |
| 5 | Does the MCP cover page include:<br>• Project Title<br>• Company Name<br>• Contact Details (including telephone numbers and email addresses)<br>• Document ID and version number<br>• Date of submission (needs to match the date of this checklist) | Y | | | | | |
| **Scope and Purpose** | | | | | | | |
| 6 | State why the MCP is submitted | Y | 15 | To support the Eliwana Mine Part IV referral | | | |
| **Project Overview** | | | | | | | |
| 7 | Does the project summary include:<br>• Land ownership details (include any land management agency responsible for the land / reserve and the purpose for which the land / reserve [including surrounding land] is being managed)<br>• Location of the project;<br>• Comprehensive site plan(s);<br>• Background information on the history and status of the project. | Y | 18 | | | | |
| **Legal Obligations and Commitments** | | | | | | | |
| 8 | Does the MCP include a consolidated summary or register of closure obligations and commitments? | Y | 24 | | | | |
| **Stakeholder Engagement** | | | | | | | |
| 9 | Have all stakeholders involved in closure been identified? | Y | 24 | | | | |

| | Mine Closure Plan (MCP) checklist | Y/N /NA | Page | Comments | Change Y/N | Page | Summary |
|---|---|---|---|---|---|---|---|
| 10 | Does the MCP include a summary or register of historic stakeholder engagement with details on who has been consulted and the outcomes? | N | - | New project | | | |
| 11 | Does the MCP include a stakeholder consultation strategy to be implemented in the future? | Y | 24 | | | | |
| **Post-mining land use(s) and Closure Objectives** | | | | | | | |
| 12 | Does the MCP include agreed post-mining land use(s), closure objectives and conceptual landform design diagram? | Y | 23 | | | | |
| 13 | Does the MCP identify all potential (or pre-existing) environmental legacies, which may restrict the post mining land use (including contaminated sites)? | Y | 45 | | | | |
| 14 | Has any soil or groundwater contamination that occurred, or is suspected to have occurred, during the operation of the mine, been reported to DER as required under the Contaminated Sites Act 2003? | N | | | | | |
| **Development of Completion Criteria** | | | | | | | |
| 15 | Does the MCP include an appropriate set of specific completion criteria and closure performance indicators? | Y | 35 | No consultation with stakeholders to date | | | |
| **Collection and Analysis of Closure Data** | | | | | | | |
| 16 | Does the MCP include baseline data (including pre-mining studies and environmental data)? | Y | 45 | | | | |
| 17 | Has materials characterisation been carried out consistent with applicable standards and guidelines (e.g. GARD Guide)? | Y | 55 | | | | |
| 18 | Does the MCP identify applicable closure learnings from benchmarking against other comparable mine sites? | N | | | | | |
| 19 | Does the MCP identify all key issues impacting mine closure objectives and outcomes (including potential contamination impacts)? | Y | 45 | | | | |
| 20 | Does the MCP include information relevant to mine closure for each domain or feature? | Y | 79 | | | | |
| **Identification and Management of Closure Issues** | | | | | | | |
| 21 | Does the MCP include a gap analysis/risk assessment to determine if further information is required in relation to closure of each domain or feature? | Y | 113 | | | | |
| 22 | Does the MCP include the process, methodology, and has the rationale been provided to justify identification and management of the issues? | Y | 113 | | | | |

| | Mine Closure Plan (MCP) checklist | Y/N /NA | Page | Comments | Change Y/N | Page | Summary |
|---|---|---|---|---|---|---|---|
| **Closure Implementation** | | | | | | | |
| 23 | Does the MCP include a summary of closure implementation strategies and activities for the proposed operations or for the whole site? | Y | 119 | | | | |
| 24 | Does the MCP include a closure work program for each domain or feature? | Y | 79 | | | | |
| 25 | Does the MCP contain site layout plans to clearly show each type of disturbance as defined in Schedule 1 of the MRF Regulations? | Y | 16 | | | | |
| 26 | Does the MCP contain a schedule of research and trial activities? | Y | 121 | | | | |
| 27 | Does the MCP contain a schedule of progressive rehabilitation activities? | Y | 123 | | | | |
| 28 | Does the MCP include details of how unexpected closure and care and maintenance will be handled? | Y | 124 | | | | |
| 29 | Does the MCP contain a schedule of decommissioning activities? | N | | | | | |
| 30 | Does the MCP contain a schedule of closure performance monitoring and maintenance activities? | Y | 127 | | | | |
| **Closure Monitoring and Maintenance** | | | | | | | |
| 31 | Does the MCP contain a framework, including methodology, quality control and remedial strategy for closure performance monitoring including post-closure monitoring and maintenance? | Y | 127 | | | | |
| **Financial Provisioning for Closure** | | | | | | | |
| 32 | Does the MCP include costing methodology, assumptions and financial provision to resource closure implementation and monitoring? | Y | 135 | | | | |
| 33 | Does the MCP include a process for regular review of the financial provision? | Y | 135 | | | | |
| **Management of Information and Data** | | | | | | | |
| 34 | Does the MCP contain a description of management strategies including systems and processes for the retention of mine records? | Y | 136 | | | | |

**Corporate endorsement:**

I hereby certify that to the best of my knowledge, the information within this Mine Closure Plan and checklist is true and correct and addresses all the requirements of the Guidelines for the Preparation of a Mine Closure Plan approved by the Director General of the Department of Mines and Petroleum.

Name: _____ Signed: _____

Position: _____ Date: _____

## TABLE OF CONTENTS

## List of Tables

## LIST OF FIGURES

## LIST OF APPENDICES

# 2. PURPOSE AND SCOPE

## 2.1 Purpose

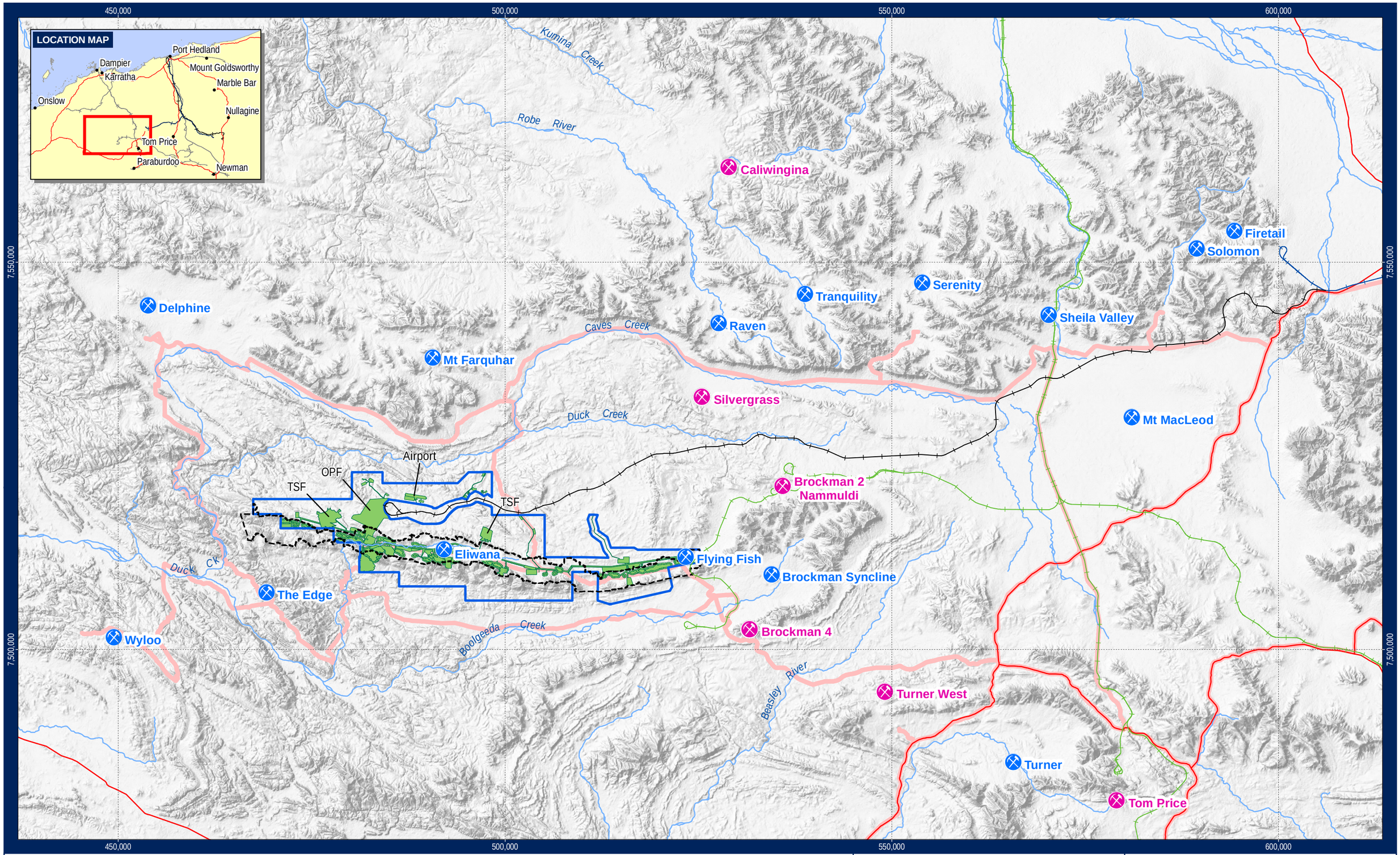
The purpose of this mine closure plan (**MCP**) is to outline the closure strategy for Eliwana and Flying Fish mine areas (**Eliwana** or **the mine**) at the Fortescue Metals Group Ltd (**Fortescue**) Western mine hub (**Western Hub**), in support of the *Eliwana Iron Ore Mine Project* referral under Part IV of the *Environmental Protection Act 1986*.

This closure plan has been developed in accordance with the Government of Western Australia Department of Mine and Petroleum and Environmental Protection Authority *Guidelines for Preparing Mine Closure Plans* May 2015 (**Closure Guidelines**).

## 2.2 Scope

This MCP outlines the closure strategies proposed as part of the initial Western Hub development, including:

- Eliwana below water table pits and waste dumps,
- Flying Fish above water table pits and waste dumps, and
- Western Hub mine support services, excluding the rail.




Fortescue Projects/Mines
Rio Tinto Mines
Major Drainage
Access Routes
FMG Rail Alignments
Proposed Rail Alignment
Rio Tinto Rail
Mine Development Envelope
Indicative Mine Footprints
Mine Valley

Data Sources:
Landgate: Towns, Roads, Drainage, Landgate.
GA.:SRTM,
All other data, FMG, 2017.

N

0 5 10 15 20 25
Kilometres

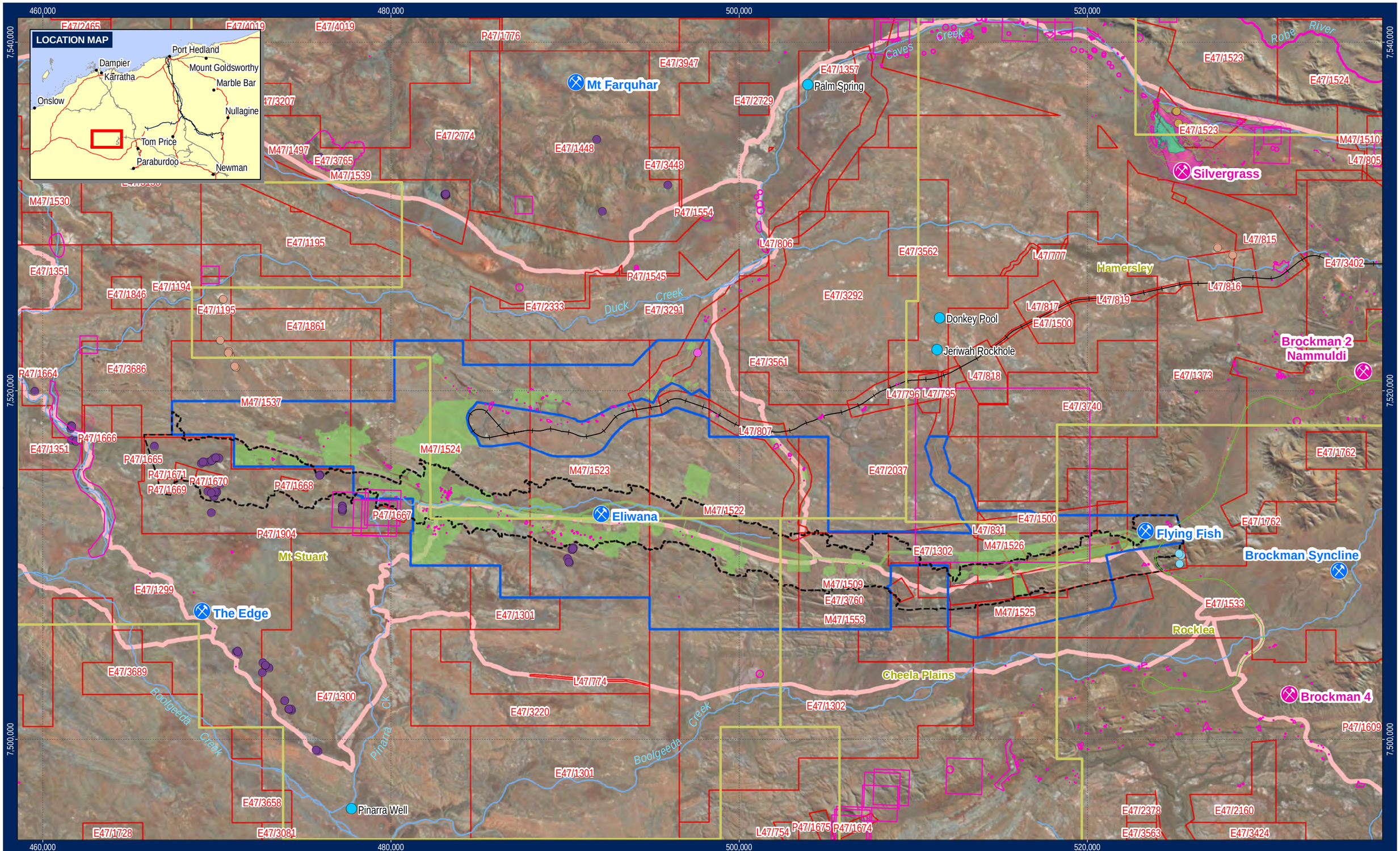
Requested By: K. Beckett
Drawn By: J. Burke
Revised By: nrappa
Approved By: P. Mastalir
Scale: 1:450,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: 750EW_MP_OP_0006.001_r0

Date: 8/27/2018
Size: A3L
Revision: 1
Confidentiality: 1



**Figure 1**
Western Mining Hub with Deposits

Fortescue Metals Group Ltd
The New Force in Iron Ore




- Major Drainage
- Access Routes
- Proposed Rail Alignment
- Rio Tinto Rail
- FMG Tenements
- Mine Development Envelope
- Indicative Mine Footprints
- Mine Valley
- DPLH Heritage Site

**Priority 1 Species**

- Euphorbia inappendiculata var. queenslandica
- Hibiscus campanulatus
- Hibiscus sp. Mt Brockman (E. Thoma ET 1354)
- Sida sp. Hamersley Range (K. Newbey 10692)
- Triodia aff. karijini
- Vittadinia sp. Coondewanna Flats (S. van Leeuwen 4684)

Data Sources:
Landgate: Towns, Roads, Drainage, Landgate.
GA.:SRTM,
Imagery: Esri
All other data, FMG, 2017.

N

0 2 4 6 8 10
Kilometres

Requested By: K. Beckett
Drawn By: J. Burke
Revised By: nrappa
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# Figure 2
Eliwana Mining Operation and Surrounds

Fortescue Metals Group Ltd
The New Force in Iron Ore

# 3. PROJECT SUMMARY

## 3.1 Ownership

Eliwana is 100% owned by FMG Pilbara Pty Ltd (ACN 106943828), a wholly owned subsidiary of Fortescue. Eliwana is located within pending and existing Mining, Exploration, Prospecting and Miscellaneous Leases as listed in Table 1.

The contact details for Fortescue are:

Fortescue Metals Group Ltd,

Level 2,

87 Adelaide Terrace,

East Perth WA 6004

**Table 1. Land tenure**

| Leases | | | |
|---|---|---|---|
| M47/1509 | E47/1194 | E47/1533 | E47/3760 (Pending) |
| M47/1522 (Pending) | E47/1195 | E47/1861 | P47/1650 |
| M47/1523 (Pending) | E47/1196 | E47/2037 | P47/1667 |
| M47/1524 (Pending) | E47/1300 | E47/3291 | P47/1668 |
| M47/1525 (Pending) | E47/1301 | E47/3292 | P47/1669 |
| M47/1526 (Pending) | E47/1302 | E47/3334 | P47/1670 |
| M47/1537 (Pending) | E47/1357 | E47/3561 | P47/1671 |
| M47/1553 (Pending) | E47/1373 | E47/3562 | L47/806 |
| | E47/1500 | E47/3686 | L47/807 |

## 3.2 Description of operation

### Overview

Fortescue is proposing to develop the Eliwana iron ore mine as part of the Western Hub development, approximately 90 km west-north-west of Tom Price in the Pilbara region of Western Australia (Figure 1). The area is characterised by a mountainous area of Proterozoic sedimentary ranges and plateaux, rising from 330m to 1020m AHD, dissected by gorges. Local vegetation is broadly described as including *Eucalyptus leucophloia* over *Triodia* species on skeletal soils on the ranges and mulga low woodland over bunch grasses on fine textured soils in valley floors. The mine will be located adjacent to Rio Tinto's Brockman 2 / Nammuldi iron ore mine, and close to Rio Tinto's Brockman 4 and Silvergrass iron ore mines.

The mine will be comprised of two iron ore deposits: Eliwana and Flying Fish, and one ore processing facility (**OPF**). Pits and waste dumps etc. will be, dominantly, developed within a ~60km long unnamed valley ('the mine valley'), bound by characteristically rugged Pilbara ridgelines of outcropping iron rich geology. The iron ore pits will be developed using standard drill and blast, truck and shovel excavation.

Iron ore will be transported via haul truck and / or conveyors to the OPF, where the ore will be crushed, screened and then transported to Port Hedland via The Pilbara Infrastructure's owned and operated rail for sale. Later in the mine life there is also the potential for the iron ore to be washed, to remove impurities such as clays and silicates, and to improve the ore grade. The waste fines, also known as tailings, generated from the washing processes would be stored in a tailings dam.

The mine life for Eliwana is expected to exceed 20 years. At the point of closure Eliwana is expected to be comprised of:

- Multiple open cut pits that accessed ore above and below the water table;
- Waste rock landforms (**WRL**) including waste dumps located outside and inside mined pits; and
- Mine support services, including but not limited to:
    - OPF, potentially a tailings storage facilities (**TSF**), haul roads and associated supporting mine infrastructure;
    - Waste water treatment plant(s) and landfill sites; and
    - Administration, camps, workshops, laydowns, explosives magazine, airport(s), linking access roads and other supporting facilities;

- Water supply borefield.

The location of these features, existing disturbance types and naming convention used for the various areas is provided in Figure 1.

The mine support services will mainly be established on land tenure classified as unallocated Crown land to the north of the mine valley. The land tenure within the mine valley is classified as Pastoral (Figure 2), including the Pastoral Leases of Mt Stuart, Cheela Plains and Rocklea. The mine valley will be topographically separated from the adjacent pastoral land by the Hamersley Range proper, which rises at Rio Tinto's Brockman 2 mine, near Mount Brockman, and runs west through Flying Fish and Eliwana deposits before reaching Duck Creek, immediately west of Eliwana.

Nearby receptors linked to environmental and / or aboriginal heritage values include:

- Creeks and water features (Figure 2): Ephemeral Duck Creek and associated semi-permanent pools, its tributary Caves Creek and its associated permanent pool Palm Springs; ephemeral Pinarra Creek; and semi-permanent water holes of Donkey Pool and Jeriwah Rockhole.
- Vegetation: Two vegetation communities (ElAcAarTwTspr and ElApTspr) that are representative of the Priority 3 Ecological Community *Triodia sp. Robe River assemblages of mesas of the West Pilbara*; multiple Groundwater Dependent Ecosystems (GDE) vegetation dominated by either *Melaleuca argentea* or *Eucalyptus camaldulensis*; multiple Priority flora species, including Priority 1 species *Hibiscus* sp. Mt Brockman, *Sida* sp. Hamersley Range (K. Newbey 10692) and *Vittadinia* sp. Coondewanna Flats; and habitat linked to conservation significant fauna species.
- Multiple archaeological and ethnographic places, including 11 registered and 132 lodged places recorded in the Department of Planning, Lands and Heritage (DPLH) Aboriginal Heritage Inquiry System.

## Mine development stages

Fortescue intends to develop Eliwana in stages. Figure 3 provides a conceptualisation of how an individual mining stage may be related to the ore deposits, as part of the hub development.

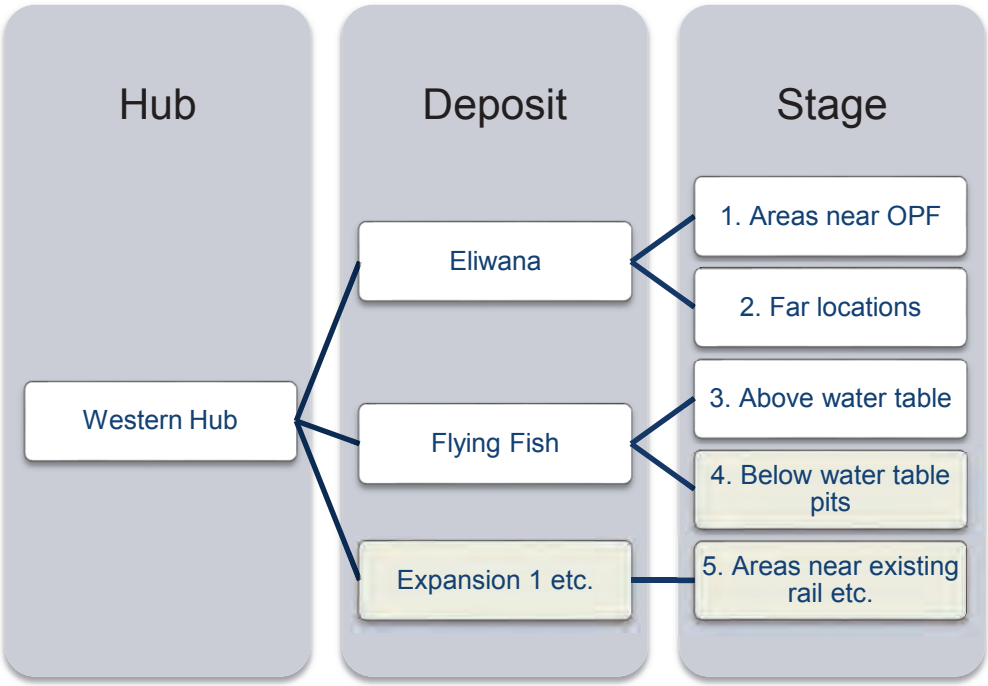



**Figure 3. Conceptualisation of the Eliwana mine development stages. Examples of deposits and stages that are not within the scope of the *Eliwana Iron Ore Mine Project* referral have been greyed out.**

Areas disturbed and activities encompassed by each mine stage will be developed over the mine life, influenced by:

- Our customers iron ore demand in terms of quality and grade;
- Our developing understanding of the available ore quality, grade and volume;
- Our capacity to blend ore from different Fortescue operated mine ('Hubs') to create the required iron ore product; and
- Our ability to access the ore in accordance with Government regulatory approvals and contractual obligations.

It is important for closure planning to consider how the mine will be developed during each stage, as each stage will only be progressed if there is sufficient ore demand. Consequently, it will be necessary to re-develop the closure plan as each mine stage is defined, based on an assumption that mine closure will occurs at the end of that stage.

Each mining stage will be referred to the Department of Mines, Industry Regulation and Safety (**DMIRS**) under the *Mining Act 1978* for approval prior to commencement.

Note, for the purpose of identifying potential environmental impacts in support of the *Eliwana Iron Ore Mine Project* referral, a singular closure scenario was established (the 'PER scenario') and used in the used in subsequent technical studies. The PER scenario represents the maximum disturbance extent requested within the *Eliwana Iron Ore Mine Project* referral, and may not represent conditions at the end of a mine stage.

# 4. CLOSURE OBLIGATIONS AND COMMITMENTS

A closure obligations register for Eliwana is presented in Appendix 1. The register identifies legislation, standards and guidelines that may be relevant to closure of mine sites in general. As the mining approvals process progresses, additional obligations arising from the following instruments will be integrated into the MCP:

- Ministerial Statements issued under Part IV of the *Environmental Protection Act 1986* (**EP Act**)*;*
- EPBC Decision Notices issued under *Environment Protection and Biodiversity Conservation Act 1999* (**EPBC Act**)*;*
- Tenement conditions issued under *Mining Act 1978* (**Mining Act**)*;*
- Relevant leases held pursuant to *Land Administration Act 1997* (**Land Act**)*;* and
- Land Access Agreements / Indigenous Land Use Agreements entered into with Native Title Partners.

A comprehensive legal review will be required as closure approaches to ensure that all recent and relevant obligations are identified and actioned.

# 5. STAKEHOLDER ENGAGEMENT

## 5.1 Key stakeholders

Fortescue's stakeholder engagement strategy aims to establish open dialogue between key stakeholders, using face-to-face modes of engagement wherever practicable. For engagement on closure planning and closure related aspects, this strategy includes:

- Transparency in disclosure of project characteristics and closure processes;
- Awareness of, and responsiveness to, stakeholder views and concerns;
- Seek agreement on closure objectives and closure criteria; and
- Understand stakeholder visions on post-mining land use.

Stakeholder consultation on the Eliwana project was initiated in 2017. Eliwana's key stakeholders and the approaches used for engagement across the Fortescue operated sites are listed in Table 2.

Most of the key stakeholders identified for Eliwana are also key stakeholders in the closure planning at other Fortescue operated sites. Consequently Fortescue holds discussions relating to closure, closure planning, rehabilitation and / or contamination management with most of Eliwana's key stakeholders on a semi-regular basis.

**Table 2. Eliwana mine closure key stakeholders**

| Stakeholder group | Fortescue engagement forum and style |
|---|---|
| Environmental Protection Authority (**EPA**) | • Ad hoc meetings with representatives during assessment under Part IV of the EP Act.<br>• Annual statutory reporting. |
| Department of Water and Environmental Regulation (**DWER**) | • Ad hoc meetings with nominated assessors, during assessment under Part IV and Part V of the EP Act, and to verify compliance to Ministerial Statements and license conditions.<br>• Ad hoc meetings with technical staff, to provide updates on technical aspects relating to closure environmental outcomes.<br>• Annual statutory reporting. |
| Department of Mines, Industry Regulation and Safety (**DMIRS**) | • Regular meetings (more than 10 a year) with technical staff, to provide updates on technical aspects relating to closure outcomes.<br>• Ad hoc meetings with nominated assessors, during assessment under the Mining Act, to review status of MCP development.<br>• Annual statutory reporting. |
| Department of Biodiversity, Conservation and Attractions (**DBCA**) | • Ad hoc meetings with technical staff, to provide updates on technical aspects relating to closure environmental outcomes |
| Department of Planning, Lands and Heritage (**DPLH**) | • Ad hoc meetings with the nominated parties. |

| Stakeholder group | Fortescue engagement forum and style |
|---|---|
| Department of the Environment and Energy (**DoEE**) | • Ad hoc meetings with nominated assessors, during assessment under EPBC Act.<br>• Annual statutory reporting. |
| Puutu Kunti Kurruma People and the Pinikura Peoples (**PKKP**) Native Title Group | • Regularly scheduled meetings with nominated representatives, cover a broad range of subjects including closure |
| Eastern Guruma Native Title Group | • Regularly scheduled meetings with nominated representatives, cover a broad range of subjects including closure |
| Mt Stuart Pastoral Station | • Ad hoc meetings, when issues arise |
| Cheela Plains Pastoral Station | • Ad hoc meetings, when issues arise |
| Rocklea Pastoral Station | • Ad hoc meetings, when issues arise |
| Shire of Ashburton | • Ad hoc meetings on a “as needs” basis. |

## 5.2 Ongoing consultation summary

Consultation specific to Eliwana to-date has focused on the project development and considerations for closure planning as part of the environmental approvals process. Issues, concerns and considerations raised by stakeholders with respect to the closure of Fortescue’s operations in general and / or specifically relating to Eliwana have been summarised in Table 3. Where more context is available and relevant to the MCP, additional supporting stakeholder summaries have been included in the sections below.

**Table 3. Stakeholder concerns and considerations.**

| Stakeholder | Issue / Aspect | Proposed resolution |
|---|---|---|
| EPA | See Section 5.2.1 | Ongoing development of solution:<br>Development and implementation of a Mine Closure Plan, in accordance with the Closure Guidelines. |
| DMIRS | See Section 5.2.2 | Ongoing development of solutions:<br>Further refinement of solutions, research, trials and monitoring plans are required prior to requesting Mining Approval under the Mining Act.<br>Regular review and update of MCP, incorporating stakeholder feedback, is being addressed through changes to Fortescue’s internal closure management framework. |
| DWER | Groundwater recovery, pools and water chemistry | Ongoing development of solution:<br>Strategies and a monitoring programme have been integrated in this closure plan to address groundwater recovery and water chemistry, although further work is required during the life of the mine to validate the post-closure outcomes.<br>Ongoing consultation required throughout the mine life and closure periods |

| Stakeholder | Issue / Aspect | Proposed resolution |
|---|---|---|
| DPLH | Traditional Owner consultation during closure | During closure phase:<br>Relevant Traditional Owners will be consulted prior to mine closure, in accordance with Fortescue's LAA obligations, processes and protocols, established during the life of the mine. |
| DBCA | Revegetation quality, weed and conservation area management | Ongoing development of solution:<br>Revegetation trial results will be used in the review and revision of revegetation completion criteria. (Trials have yet to commence.)<br>During closure phase:<br>Land management aspects, including weed and feral animal management, will be developed as part of the general monitoring and maintenance activities. |

Discussions with the key stakeholders will be continued throughout the approvals process and through the mine development stages. As consultation progresses, a register of the consultation will be provided in Appendix 2.

### 5.2.1 Environmental Protection Authority (EPA)

The EPA regulates a range of environment-related factors and has established objectives relating to each factor, as presented in Table 4. The EPA no longer has an objective specific objective pertaining to closure and rehabilitation, preferring that each factor be managed in accordance with the factor based objective inclusive of closure and rehabilitation.

**Table 4. EPA environmental factors and objectives**

| Theme | Key environmental factors | EPA objectives |
|---|---|---|
| Land | Flora and Vegetation | To protect flora and vegetation so that biological diversity and ecological integrity are maintained |
| | Subterranean Fauna | To protect subterranean fauna so that biological diversity and ecological integrity are maintained |
| | Terrestrial Fauna | To protect terrestrial fauna so that biological diversity and ecological integrity are maintained |
| Water | Hydrological Processes | To maintain the hydrological regimes of groundwater and surface water so that environmental values are protected |
| | Inland Waters Environmental Quality | To maintain the quality of groundwater and surface water so that environmental values are protected |
| Air | Air Quality | To maintain air quality and minimise emissions so that environmental values are protected |
| People | Social Surroundings | To protect social surroundings from significant harm |

### 5.2.2 Department of Mines, Industry Regulation and Safety (DMIRS)

DMIRS' closure objective is for rehabilitated mines to be (physically) safe to humans and animals, (geo-technically) stable, (geo-chemically) non-polluting/ non-contaminating, and capable of sustaining an agreed post-mining land use.

## 5.3 Site specific stakeholder values for closure planning

Through the process of developing a mine aspects of the environment, the landscape and social amenity may be altered, impacted or removed. Those aspects that Fortescue and its stakeholders identify and agree must be retained and / or returned when the mine closes are considered to be the key values for the site.

At Eliwana, the key values include environmental and heritage aspects. These values will be reviewed regularly with key stakeholders, then used to inform Fortescue's closure management options analysis process as illustrated in Figure 4.

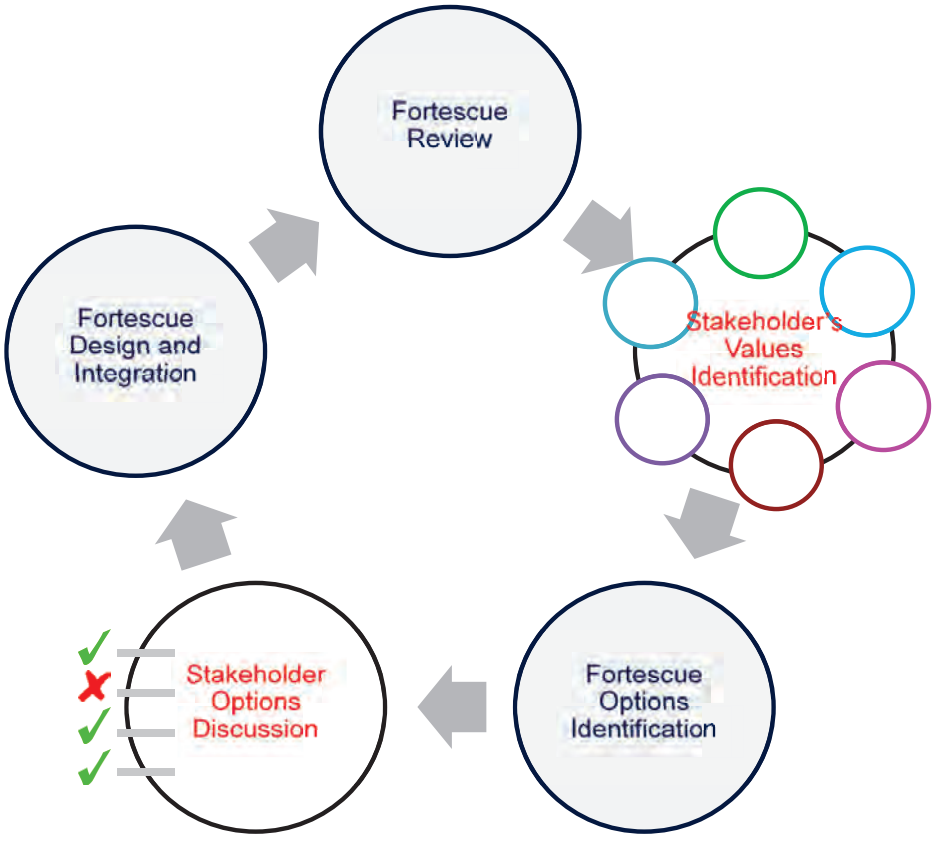



**Figure 4. Closure planning consultation cycle.**

### 5.3.1 Key environmental values

In the context of this MCP key environmental values include aspects of the land, water or air that require protection under existing legislation and regulatory instruments, or are recommended to be maintained on advice from an environmental regulatory authority. Table 5 summarises the key environmental values.

At this stage of the mine development, discussions with regulators with respect to site specific environmental values are in their infancy, and as a result the key closure-related environmental values currently reflect general concerns. It is expected that these values will be further developed once stakeholders are provided with more opportunity to review the results from recent environmental surveys and modelling outcomes, and have had more opportunity to familiarise with the planned mining activities.

**Table 5. Key environmental values. These values will be updated based on feedback from key stakeholders.**

| Aspect | Description |
|---|---|
| Boolgeeda Creek | Surface water should continue to flow down Boolgeeda Creek (proper) within natural norms (quantity and quality), to support the creek associated ecosystem services along the main branch. |
| Duck Creek | Surface water should continue to flow down Duck Creek (proper) within natural norms (quantity and quality), to support the creek associated ecosystem services including local pools along the main branch. |
| Conservation significant flora and vegetation | Maintain the land condition of areas of conservation significant flora and vegetation retained within the Part IV approval Mine Disturbance Envelope, where indirect impacts have not been approved. |

### 5.3.2 Key heritage values

No European historic heritage values have been identified at Eliwana. Accordingly, in the context of this MCP, heritage values relate to a place's natural and cultural importance in the context of Indigenous heritage value. Aboriginal heritage places have been identified within and adjacent to the Eliwana mine. It is likely that heritage places will also be identified progressively as more detailed archaeological and ethnographic surveys and consultation are undertaken during the life of the mine.

Table 6 summarises the key heritage values identified to date. These values will be updated based on feedback from key stakeholders.

Table 6. Key heritage values. These values will be updated based on feedback from key stakeholders.

| Aspect | Description |
|---|---|
| Closure strategies | The pre-existing environment or the environment existing in adjacent areas should be re-established to the maximum reasonable extent on closure. |
| Progressive revegetation | Areas should be progressively revegetated with local native plant species similar in density and abundance to that existing prior to the commencement of Project Operations, in order to form an ecosystem the long term viability of which will not require a maintenance regime significantly different from that appropriate to those adjacent areas. |
| Water | Natural hydrological systems should not be not unreasonably damaged or adversely altered. |
| Erosion | Erosion in rehabilitation areas should be limited, as far as can reasonably be achieved, to that characteristic of similar land forms in surrounding undisturbed areas. |
| Land access | Traditional Owners will continue to have access to land and the flora and fauna of that land for hunting or cultural purposes during operations and following closure. |

Fortescue manage Aboriginal cultural heritage in consultation with the relevant Native Title Party, with its LAA obligations, in compliance with the *Aboriginal Heritage Act 1972,* in accordance with Fortescue's *Guideline for the Management of Aboriginal Cultural Heritage*, and with the *EPA Guidance Statement Number 41: Assessment of Aboriginal Heritage* and the *Aboriginal Heritage Act 1972.*

Following agreement with Traditional Owners on the appropriate management for a specific heritage place, and where it is agreed it is appropriate to publish the management to the General Public, the place and the required management may be documented within future updates to this MCP.

# 6. POST-MINING LAND USE AND CLOSURE OBJECTIVES

## 6.1 Post-mining land use

Rangeland cattle grazing for beef production and mining are the dominant commercial industries in the local area. These activities are supported by the underlying land tenure established under the Land Act, which at Eliwana includes:

- Pastoral Leases, within the valley containing the majority of the mine activities, e.g. pits and waste dumps; and
- Unallocated Crown Land, north of the mined valley where the majority of the mine support services are located.

Traditional Owners may access places of cultural value in the local area, to exercise their traditional rights and connection to country. This connection to the country is the basis for the formal recognition of Traditional Owner native title rights and interests. This connection to land and water, including agreed heritage places at Eliwana, will need to be maintained as a post-closure land use.

Towards the end of the mine life, post-mining land use options will be investigated. Once the post-mining land use is formerly established, post-closure land condition and associated management will be negotiated between the relevant parties.

Until the post-mining land use can be formerly established, it is assumed that the minimum requirement for closure will be to return the land to a condition compatible with the land management of unallocated Crown Land; that is a native, self-sustaining ecosystem(s) on stable land.

## 6.2 Closure objectives

The overarching aim of this MCP is to: “Create safe, stable and non-polluting landforms which support self-sustaining ecosystems appropriate to the final post-mining land use and to achieve mining lease relinquishment without future liability to the company or community”.

In consideration of this vision, closure objectives have been established (Table 7) to target key closure-related issues specific to the successful closure of Eliwana. The rationale behind the establishment of the nominated closure objectives is also provided in Table 7.

These closure objectives may be further refined following ongoing stakeholder engagement and as the mine develops, to encompass the various closure obligations and commitments that may arise following mine start-up through the various legal instruments.

**Table 7. Eliwana 2017 closure objectives**

| Eliwana closure objectives | | Rationale |
|---|---|---|
| 1. | Infrastructure is removed or retained in line with agreements reached with future land users and managing authorities. | Some infrastructure may be retained at the request of the next land-users. For example, roads may be retained to facilitate ongoing land management (e.g. for monitoring access) or to replace roads / access removed during mining (e.g. for cultural land access).<br>Transfer of the liability and accountability for managing retained infrastructure requires a legal agreement between parties. |
| 2. | Waste rock landforms are safe to people and animals and geotechnically stable. | Numerous landforms will be constructed from waste rock and borrow materials over the life of the mine. These landforms will remain post-closure and will need to be suitably stable for a future land use.<br>The waste rock may also contain fibrous and / or deleterious materials, which must be contained so as not to negatively impact the health of people and animals. |
| 3. | Rehabilitated areas support local native, self-sustaining vegetation and native fauna foraging. | In lieu of a formalised post-mining land use, self-sustaining ecosystems will be established in order to minimise ongoing management.<br>Native vegetation is required as the impact of introducing non-native species is unknown. The use of native species of local prevenance is preferred to maintain the local gene pool.<br>While the vegetation may not necessarily replicate pre-mining vegetation communities, the rehabilitated vegetation should not inhibit native fauna foraging activities.<br>Where possible, the rehabilitation should also seek to reconnect habitat that has been disconnected during mining. |
| 4. | Sediment movement within and downstream of rehabilitated areas does not adversely impact environmental or heritage values. | There is the potential for sediment to impact environmental and heritage values if:<br>- Sediment movement increases erosion rates within drainage lines adjacent to valued sites / places, potentially undermining or flooding the site / place (depending on the substrate conditions), or<br>- Erosion rates are too low and cause excessive siltation of pools or smother valued vegetation, or<br>- Sediment contains deleterious materials that impact plant or fauna health.<br>In the Pilbara, vegetation cannot be used as a reliable means of erosion control, due to the naturally sparse vegetation density and propensity for bush fires to burn vegetation. Constructed landforms and disturbed ground will need to be shaped as part of rehabilitation activities to maintain natural erosion rates. |
| 5. | Water quality does not adversely impact downstream environmental or heritage values. | Deleterious materials found in waste rock or eroded from pit walls have the potential to impact water quality if they are left in contact with water and oxygen, and if the water / materials interact with the environment. The volume of deleterious material that may be encountered is relatively low (<8% of total waste rock) and geochemical analysis suggests there is a low potential for acid and / or metalliferous drainage to occur.<br>If pit lakes remain on closure, the effects of evaporation, biological and biological-geochemical processes also have the potential to influence water quality. |

| Eliwana closure objectives | | Rationale |
|---|---|---|
| | | Compartmentalisation of the groundwater system suggests there are limited opportunities for water to move through the ground to interact with the environment. However, creek flow may need to be re-established via some pits (which may also host pit lakes), providing a connection between the mined areas and the downstream environment. |
| 6. | Changes to hydrological regimes do not adversely impact downstream environmental or heritage values | Duck Creek and Boolgeeda Creek have environmental and heritage values that must be maintained post-closure.<br>Pits will be developed within a narrow valley with limited or no room for local tributaries to the major creeks to be diverted around the pits. During mining creek flow within the tributaries may be reduced or terminated. Termination of the tributaries is not predicted to impact the hydrological regime or ecological function of Duck Creek and Boolgeeda Creek.<br>On closure the extensive changes to the topography associated with mining may prevent the creeks from being restored or the regularity of flows maintained over the long term. Changes in flows may alter water availability within the tributaries and in the subsurface (surficial) aquifers. These changes may in turn influence vegetation species abundance and structure of riparian vegetation. |
| 7. | Pit lakes do not present a significant risk to human health or a significant ecological threat. | There is the potential for pit lakes to remain/develop in some pits post-closure, if all other closure objectives can also be achieved. Retention of pit lakes will be discussed and negotiated with key stakeholders on a pit by pit basis, in consideration of impacts to local values and post-closure land use.<br>Permanent pit lakes can be attractive to fauna and people alike; providing opportunities for increased breeding habitat (changed migratory paths) and increased predation for fauna, and sites for recreation, fishing and hunting for humans if safe egress is available. Where the pit lake is connected to a creek system, the creek can supply the pit lake with sediment laden nutrients, seeds and aquatic fauna to sustain an aquatic ecosystem.<br>However, the water body may also attract waterborne pests, algae or bacteria that may pose a risk to public health. |

## 6.3 Conceptual landform

For simplicity during the environmental approvals stage, Eliwana's conceptual closure landforms have been illustrated using closure domains (Table 8). The closure domains represent areas with similar levels of disturbance and types of activities, which reflect a commonality of decommissioning and rehabilitation actions required to successfully close the area. Figure 5 illustrates the distribution of closure domains, based on a preliminary mine planning assessment and potential mine area development.

As mine planning progresses, and prior to mining approval under the Mining Act, the planned disturbance footprints and associated closure strategies for each feature will be further developed. Subdomains will be established where closure strategies differ due to the presence of location specific considerations, such as local creeks, downstream sensitive receptor, (potentially) different post-mining land uses etc.

**Table 8. Closure domain types**

| Closure domain name | | Description |
|---|---|---|
| Light Disturbance | | Locations that retain their original topography and connectivity to undisturbed vegetation. As part of the disturbance activities soil and vegetation have (usually) been removed and stockpiled adjacent to the area prior to disturbance.<br>Areas classified as Light Disturbance include drill holes, drill pads tracks, access roads, shallow borrow areas, some laydown areas and linear infrastructure disturbance.<br>Areas of Light Disturbance may only be used for a limited time, such as during construction, and can provide opportunities for progressive re-vegetation during the mine life. |
| Heavy Disturbance | | Characterised by heavily altered or compacted soils, relatively small (usually less than 5m high) modifications to the pre-mining topography and blocked or diverted minor water courses, resulting from the construction of landforms to accommodate mine infrastructure.<br>Areas classified as Heavy Disturbance include, but are not limited to:<br>- Significant infrastructure: including the ore processing facilities, administration and workshop areas and water storage structures;<br>- Footprints of waste rock dumps that are reclaimed on closure (also known as temporary waste dumps) leaving less than 5m of waste rock above the pre-mining topography; and<br>- Land bridges constructed from waste rock that rise up to 5 m above the local terrain. |
| Indirect Impact | | During operation of the mine, sites of high environmental value and places of heritage value, located downstream of or immediately adjacent to disturbed areas with the potential for indirect impacts will be managed by environmental or heritage management plans. This management will be adapted, if required, and continued on closure.<br>Indirect Impact areas usually do not require rehabilitation, but are monitored and / or maintained to, for example, preserve the original condition of the site (e.g. a heritage place) or to transition the site to a new stable condition (e.g. a creek). |
| TSF | | Locations that contain mineral waste fines also known as tailings. |
| Pit | Pit X subdomain | Any large excavation that extends more than 5 m below ground. Pits developed below the water table may contain permanent water bodies on closure, as may some above water table pits if they intersect a sufficiently large creek. |
| | Pit Y subdomain | |
| | Pit Z subdomain | |
| | Etc. | |
| WRL | | All landforms greater than 5m high constructed from waste rock that are adjacent, and therefore connected, to a natural or rehabilitated landscape.<br>WRL includes waste rock stored in waste dumps outside a pit, waste rock stored inside a pit if the landform is connected to natural topography, and built up haul roads and landbridges. |

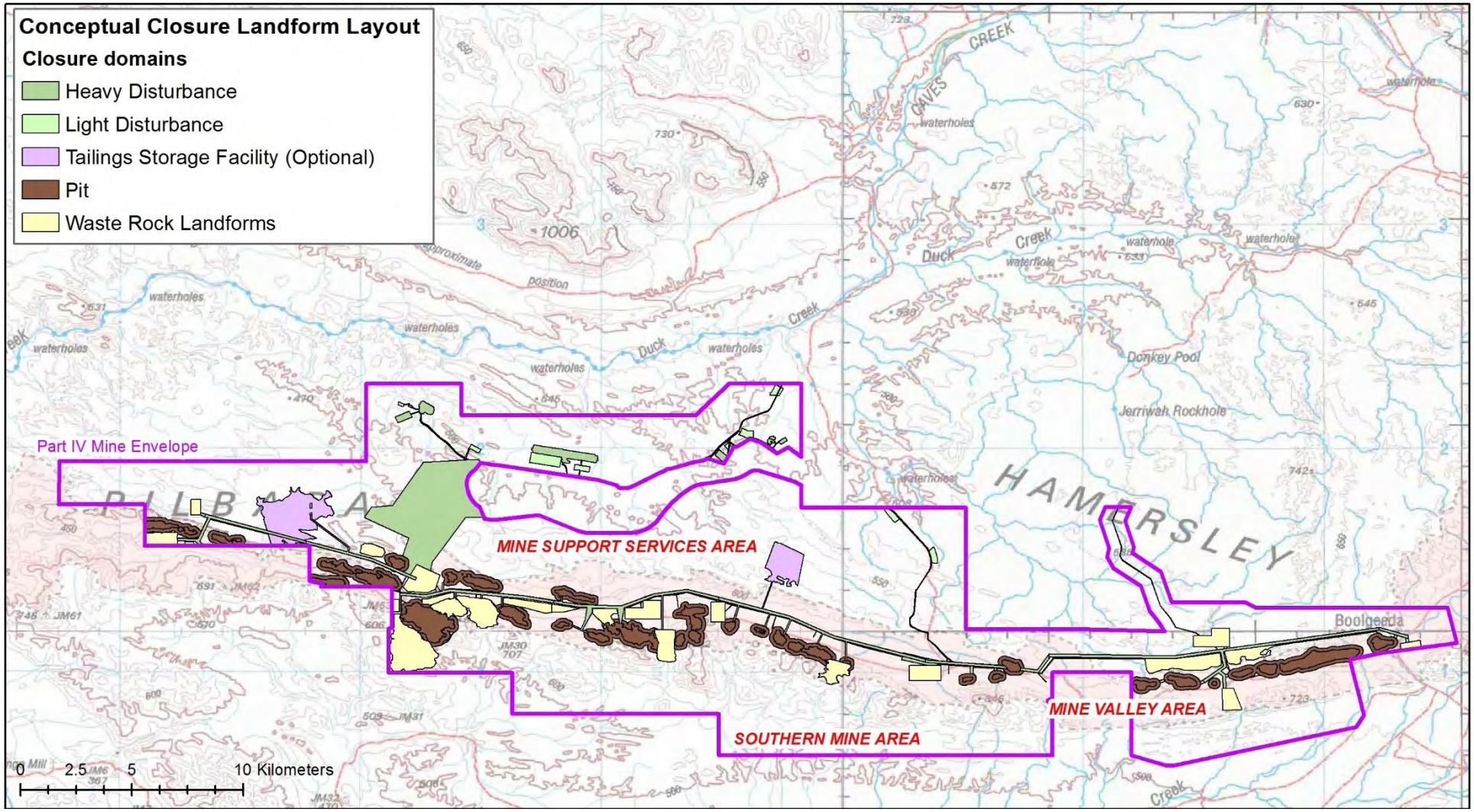



Figure 5. Conceptual closure landform (closure domain) plan layout.

# 7. COMPLETION CRITERIA

## 7.1 Completion criteria rationale

Completion criteria are the measures Fortescue will use to demonstrate to our key stakeholders that the closure objectives have been achieved. The completion criteria established for Eliwana are summarised in Table 9, and presented in context with the proposed measurement approach and performance indicators in Table 10. The completion criteria provide a definitive and clear pass or fail, such that achievement of the criteria indicates that appropriate management practices, including those documented within this closure plan, have been employed and that the closure objective has been achieved.

The completion criteria were developed with subject matter experts and established in consideration of measurable outcomes related to Eliwana's closure objective rationale (Table 7), with the aim of evolving, from indicative to numeric, to be:

- Measurable, scientifically quantifiable;
- Achievable or realistic in the opinion of the subject matter expert;
- Relevant to the objective; and
- Time-bound so that the criteria can be monitored over an appropriate time frame (when required) to ensure that results are robust to facilitate relinquishment.

The indicative completion criteria will be reviewed and refined over the life of the operation, following feedback from key stakeholders and to reflect improvements in the knowledge base.

As each completion criterion is achieved, monitoring and/or maintenance associated with the criterion is ceased. When all of the completion criteria are met, mine closure is considered to have been successfully implemented and the land tenure can be relinquished to the State. Land tenure may be relinquished in one block when all areas have met completion criteria, or smaller blocks of land tenure may be progressively relinquished as each block achieves all of the completion criteria.

**Table 9 Summary of 2017 closure objectives and (indicative) completion criteria**

| Closure objective | | Domain | Indicative completion criteria |
|---|---|---|---|
| 1. | Infrastructure is removed or retained in line with agreements reached with future land users and managing authorities. | Site wide | a) Provision of documented evidence that agreements have been satisfied and, where appropriate, liability transferred to a third party. |
| | | LD, HD, TSF | b) Site inspection demonstrates there is no visual presence of infrastructure where it has not been subject to a legal agreement. |
| 2. | Waste rock landforms are safe to people and animals and geotechnically stable. | HD, WRL, TSF | a) Rehabilitated waste rock landform design static conditions have a modelled geotechnical performance that achieves or exceeds an overall slope stability factor of safety of 1.5. |

| Closure objective | | Domain | Indicative completion criteria |
|---|---|---|---|
| | | WRL, TSF | b) At least five years after closure implementation is completed, inspection shows there is no evidence of geotechnical failure mechanisms. |
| 3. | Rehabilitated areas support local native, self-sustaining vegetation and native fauna foraging. | LD, HD, WRL, TSF | a) At least five years after rehabilitation, three consecutive years of monitoring shows key plant species coverage is within the agreed reference range (as defined in the revegetation plan). |
| | | LD, HD, WRL, TSF | b) At least five years after rehabilitation, three consecutive years of monitoring shows the percentage of bare ground is less than the agreed maximum (as defined in the revegetation plan). |
| | | LD, HD, WRL, TSF | c) At least five years after rehabilitation, maturation and self-regeneration is demonstrated through the presence of viable seed within the topsoil of locally identified perennial plant species. |
| | | Site wide | d) At least five years after rehabilitation, a qualified assessor identifies at least one prey species for each conservation significant fauna species observed at Eliwana:<br>• *Dasyurus hallucatus* (Northern Quoll)<br>• *Liasis olivaceus barroni* (Pilbara Olive Python)<br>• *Macroderma gigas* (Ghost Bat)<br>• *Rhinonicteris aurantia* (Pilbara Leaf-nosed Bat)<br>• *Falco hypoleucos* (Grey Falcon)<br>• *Falco peregrinus* (Peregrine Falcon) |
| | | Site wide | e) At least five years after rehabilitation, a qualified assessor agrees rehabilitation has re-established habitat connectivity between the northern and southern flanks of the mine valley. |
| 4. | Sediment movement within and downstream of rehabilitated areas does not adversely impact environmental or heritage values. | HD, WRL | a) At least five years after rehabilitation, digital terrain models demonstrate that erosion rates averaged over a five year period are below 6 t/Ha/yr. |
| | | II | b) At least five years after rehabilitation, sediment samples and visual inspection concludes sediment deposition has not adversely impacted environmental or heritage values. |
| 5. | Water quality does not adversely impact downstream environmental or heritage values | WRL | a) Independent review confirms that materials likely to generate acid or metalliferous drainage are absent from the upper 10 m of each WRL. |
| | | II | b) Independent review of water models and associated environmental impact assessment agrees that pit outflow will not degrade the values of nominated downstream surface water receptors. |
| 6. | Changes to hydrological regimes do not adversely impact downstream environmental or heritage values. | II | a) At least five years after mine closure, a qualified assessor agrees ecosystem functions within the terminated creek tributaries have successfully adapted to the change in water availability. |
| 7. | Pit lakes do not present a significant risk to human health or a significant ecological threat. | Pit | a) Independent review of the groundwater model agrees that water in pit lake 'sinks' will not interact with nominated downstream sensitive receptors. |
| | | Pit | b) Independent review by qualified assessor agrees that appropriate deterrents have been constructed to minimise mammal and human inadvertent access to pit lake 'sinks'. |

| Closure objective | Domain | Indicative completion criteria |
|---|---|---|
| | Pit | c) At least 10 years after closure activities are completed, an independent review by a qualified assessor agrees metal levels within lower order species is unlikely to impact vertebrate fauna health or reproduction. |
| | Pit | d) Independent review by qualified assessor agrees pathogenic microorganisms within pit lakes are unlikely to cause health issues through incidental water contact. |

Closure domains: HD – Heavy Disturbance, LD – Light Disturbance, WRL – Waste Rock Landform, II – Indirect Impact.

## 7.2 Performance indicator and control measures

Performance indicators are the measures used to assess and/or track the progress towards achieving the closure objective. Unlike completion criteria, which are focussed on the end outcome, performance indicators can provide stage gates, milestones, and other qualitative measures that can be used by a technical specialist, independent of the completion criteria, to advise on whether long-term outcomes are likely to be achieved.

Performance indicators have the advantage of changing over time, in response to emerging issues and the developing knowledge base. Accordingly, performance indicators include activities undertaken during the operation to support closure objectives, key milestone activities and later, as the MCP matures, quantitative indicators associated with trends over time developed from predicative models or field based studies.

As with the completion criteria, the performance indicators presented will be refined over time, in consideration of the expanding knowledge base. Pre-closure performance indicators currently in use are discussed further in Section 13.1 *Pre-closure monitoring and maintenance triggers*.

Controls, such as designs, procedures and management plans, are required to provide Fortescue staff with greater direction and detail, to ensure the closure activities are performed in a manner that is consistent with the MCP. Some controls have already been developed and have been implemented, while others will be developed later in the mine life or immediately prior to closure.

Table 10. Closure objectives and completion criteria with measurement approach and suggested performance indicators.

| Closure objective | | Domain | Indicative completion criteria | Measurement approach | Performance indicators | Controls |
|---|---|---|---|---|---|---|
| 1. | Infrastructure is removed or retained in line with agreements reached with future land users and managing authorities. | Site wide | a) Provision of documented evidence that agreements have been satisfied and, where appropriate, liability transferred to a third party. | Infrastructure transfer agreements or other suitable legal documentation | • Working relationships with other land users and land managers maintained.<br>• Discussion with land users regarding safe access routes required for community use e.g. to maintain connection to country, heritage place monitoring.<br>• Discussion with land users regarding roads / access tracks required to be retained for ongoing monitoring.<br>• Discussion with land users regarding water bores and other water infrastructure with potential future uses.<br>• Infrastructure removal kept in costings until agreement in place.<br>• If no agreement in place removal to be included in decommissioning plan. | Decommissioning and Demolition Plan |
| | | LD, HD, TSF | b) Site inspection demonstrates there is no visual presence of infrastructure where it has not been subject to a legal agreement. | Audit report showing conditions following removal or burial of infrastructure. | | |
| 2. | Waste rock landforms are safe to people and animals and geotechnically stable. | HD, WRL, TSF | a) Rehabilitated waste rock landform design static conditions have a modelled geotechnical performance that achieves or exceeds an overall slope stability factor of safety of 1.5. | Independent review of geotechnical evaluation based on final landforms present on closure.<br>Modelled design scenarios based on industry accepted practice. | • Acid and/or Metalliferous Drainage Plan continues to confirm waste rock is benign.<br>• Deleterious waste rock is flagged and tracked in mine models.<br>• Closure designs are generated for waste rock landforms higher than 10m.<br>• Geotechnical modelling of closure design static conditions with overall slope stability achieving ≥1.5 factor of safety.<br>• Deleterious material destination locations are tracked in the waste dump.<br>• As-built survey of waste dumps with supporting geotechnical evaluations. | Ground Control Management Plan<br><br>Waste rock landform designs<br><br>TSF Operations Surveillance and Monitoring Manual(s) |
| | | WRL | b) Independent review confirms that materials likely to generate acid or metalliferous drainage are absent from the upper 10 m of each WRL. | Report on deleterious materials tracking, supported by random field samples. | | |
| | | WRL, TSF | c) At least five years after closure implementation is completed, inspection shows there is no evidence of geotechnical failure mechanisms. | Audit report completed by qualified geotechnical engineer | | |

| Closure objective | | Domain | Indicative completion criteria | Measurement approach | Performance indicators | Controls |
|---|---|---|---|---|---|---|
| 3. | Rehabilitated areas support local native, self-sustaining vegetation and native fauna foraging. | LD, HD, WRL, TSF | a) At least five years after rehabilitation, three consecutive years of monitoring shows key plant species coverage is within the agreed reference range (as defined in the revegetation plan). | Key plant species distribution variability based on revegetation plan.<br>Monitoring report based on annual field assessment of random 50 m x 50m quadrats or alternative / emerging technologies (such as LiDAR)<br>Minimum of three 50 m x 50m quadrats for every 1,000 Ha of rehabilitation. | • Revegetation plans are developed based on post-closure soil/water/landform conditions, area / shape of disturbance and connectivity to undisturbed land.<br>• Key plant species and associated coverage are agreed with post-closure land managers based on conditions identified in revegetation plans.<br>• Prey associated with conservation significant fauna are agreed with post closure land managers. Flora, vegetation and / or other habitat linkages to prey are integrated into the revegetation plans.<br>• Native seed of local provenance is utilised, where required (unless confirmed individual species genetic diversity is wide spread).<br>• Rehabilitation monitoring and maintenance is implemented.<br>• Weed monitoring and controls are implemented as appropriate during operations and following rehabilitation. | Revegetation plans<br><br>Weed Management Plan<br><br>Remedial actions and weed controls |
| | | LD, HD, WRL, TSF | b) At least five years after rehabilitation, three consecutive years of monitoring shows the percentage of bare ground is less than the agreed maximum (as defined in the revegetation plan). | Spatial assessment report of aerial photography or satellite remote sensing, average per 10 Ha. | | |
| | | LD, HD, WRL, TSF | c) At least five years after rehabilitation, maturation and self-regeneration is demonstrated through the presence of viable seed within the topsoil of locally identified perennial plant species. | Seed viability test report of field samples collected within 50 m x 50m quadrats established for every 1,000 Ha of rehabilitation.<br>Plant species determined from pot trials or other emerging technology e.g. DNA sequencing. | | |
| | | Site wide | d) At least five years after rehabilitation, a qualified assessor identifies at least one prey species for the following conservation significant fauna within rehabilitated areas: | Report describing required habitat for each species, linked to rehabilitated vegetation communities | | |

| Closure objective | | Domain | Indicative completion criteria | Measurement approach | Performance indicators | Controls |
|---|---|---|---|---|---|---|
| | | | - Dasyurus hallucatus (Northern Quoll)<br>- Liasis olivaceus barroni (Pilbara Olive Python)<br>- Macroderma gigas (Ghost Bat)<br>- Rhinonicteris aurantia (Pilbara Leaf-nosed Bat)<br>- Apus pacificus (Fork-tailed Swift)<br>- Falco hypoleucos (Grey Falcon)<br>- Falco peregrinus (Peregrine Falcon) | | | |
| | | Site wide | e) At least 5 years after rehabilitation, a qualified assessor agrees rehabilitation has re-established habitat corridors between the northern and southern flanks of the mine valley. | Report describing the ecosystem services provided by the rehabilitated land corridors and any rehabilitated water bodies within the mine valley. | | |
| 4. | Sediment movement within and downstream of rehabilitated areas does not adversely impact environmental or heritage values. | HD, WRL | a) At least five years after rehabilitation, digital terrain models demonstrate that erosion rates averaged over a five year period are below 6 t/Ha/yr. | Report on elevation changes | • Establish the list of valued sites and places that may be sensitive to sediment movement in consultation with key stakeholders.<br>• Design waste rock landforms / backfill landforms to achieve erosion rates of less than 5 t/Ha/yr and integrate sediment controls into designs where erosion rates may exceed 5 t/Ha/yr.<br>• Identify large waste rock landforms (>10m elevation) and develop location specific closure designs as per waste rock dumps, to achieve erosion rates of less than 5 t/Ha/yr. | Waste dump and backfill designs<br><br>Surface Water Management Plan |
| | | II | b) At least five years after rehabilitation, sediment samples and visual inspection concludes sediment deposition has not adversely impacted environmental or heritage values. | Audit report describing environmental and heritage values and impact of sediment deposition. | | |

| Closure objective | | Domain | Indicative completion criteria | Measurement approach | Performance indicators | Controls |
|---|---|---|---|---|---|---|
| | | | | | • Integrate sediment containment into designs where erosion rates may exceed 5 t/Ha.yr.<br>• Model final landform design to review predicted erosion rates and integrate sediment controls into landform where erosion rates may exceed 5 t/Ha.yr.<br>• Design re-constructed creeks to minimise erosion.<br>• Undertake rehabilitation trials to validate landform performance.<br>• Implement maintenance monitoring plan to correct implementation issues before erosion problems compromise landform performance / impact value. | |

| Closure objective | | Domain | Indicative completion criteria | Measurement approach | Performance indicators | Controls |
|---|---|---|---|---|---|---|
| 5. | Water quality does not adversely impact downstream environmental or heritage values | II | a) Independent review of water models and associated environmental impact assessment agrees that pit outflow will not degrade the values of nominated downstream surface water receptors. | Water balance models<br>Environmental impact assessment<br>Monitoring report to validate source-pathway-receptor model(s) | • Establish the list of valued sites and places that may be sensitive to water quality change in consultation with key stakeholders.<br>• Acid and/or Metalliferous Drainage Plan is implemented during the life of the operation.<br>• Surface water models developed for the post-closure landform<br>• Water quality monitoring during groundwater recovery.<br>• Indirect impact monitoring programs | Waste dump and backfill designs<br>Acid and/or Metalliferous Drainage Plan<br>Groundwater Operating Strategy<br>Surface Water Management Plan<br>Indirect impact management plans (if required) |
| 6. | Changes to hydrological regimes do not adversely impact downstream environmental or heritage values. | II | a) At least 5 years after mine closure, a qualified assessor agrees ecosystem functions within the terminated creek tributaries have successfully adapted to the change in water availability. | Environmental condition report | • Establish the list of valued sites and places that may be sensitive to hydrological regime change in consultation with key stakeholders.<br>• Heritage places valued due to a connection with the local creeks are established in consultation with key stakeholders.<br>• Traditional Owners are consulted regarding changes to hydrological regimes during the life of the mine.<br>• Where appropriate, management plans are established for sites and places with the | Indirect impact management plans (if required)<br>Cultural heritage management plans |

| Closure objective | | Domain | Indicative completion criteria | Measurement approach | Performance indicators | Controls |
|---|---|---|---|---|---|---|
| | | | | | potential to be indirectly impacted by changes to the hydrological regime.<br>• Cultural heritage is managed during the life of mine and during closure, in consultation with key stakeholders. | |
| 7. | Pit lakes do not present a significant risk to human health or a significant ecological threat. | Pit | a) Independent review of the groundwater model agrees that water in pit lake 'sinks' will not interact with nominated downstream sensitive receptors. | Monitoring report to validate source-pathway-receptor model(s) | • Establish the list of valued sites and places that may be linked to each pit lake in consultation with key stakeholders.<br>• Groundwater models calibrated based on monitoring data during mine life. | Groundwater Operating Strategy |
| | | Pit | b) Independent review by qualified assessor agrees that appropriate deterrents have been constructed to minimise mammal and human inadvertent access to pit lake 'sinks'. | Report describing deterrents. | • Identification of potential hazards to the general public and land use/users.<br>• Identification of potential hazards to terrestrial fauna – mammals, e.g. cattle<br>• Test and evaluate the success of management plans to minimise inadvertent access of people and cattle etc.<br>• Where deterrents fail or are not appropriate, test and evaluate alternate management options to minimise harm to people and animals associated with open water bodies. | |
| | | Pit | c) At least 10 years after closure activities are completed, an independent review by a qualified assessor agrees metal levels within lower order species is unlikely to impact vertebrate fauna health or reproduction. | Field sample campaign report | • Kinetic geochemical tests completed on waste rock samples to identify and predict the long term leaching potential of deleterious water rock.<br>• Water quality monitoring during the life of mine, during groundwater recovery and in the pit lake. | |

| Closure objective | Domain | Indicative completion criteria | Measurement approach | Performance indicators | Controls |
|---|---|---|---|---|---|
| | | | | • Identify food web, bioaccumulation and biomagnification pathways for site specific pit lakes.<br>• Understand the influence of lake water stratification on water quality and linkages to biological activities.<br>• In consultation with key stakeholders, establish acceptable quality limits for water, based on potential pathways for contamination.<br>• Demonstrate predicted pit lake water quality and lake conditions over time are within acceptable limits. | |
| | Pit | d) Independent review by qualified assessor agrees pathogenic microorganisms within pit lakes are unlikely to cause health issues through incidental water contact. | Field sample analysis | • Predict pit lake water quality evolution<br>• Identify pathogenic microorganisms present in the pit lake and in water bodies in nearby open water bodies.<br>• Establish potential for identified pathogenic microorganisms to cause health issues, based on observed local conditions. | |

Closure domains: HD – Heavy Disturbance, LD – Light Disturbance, WRL – Waste Rock Landform, II – Indirect Impact.

# 8. CLOSURE DATA - BASELINE

The following section summarises the local environmental conditions at Eliwana. Information presented in this section is derived from technical studies and corporate management plans, listed in Section 16 *References*. Over the life of the mine this section will be updated to reflect the most recent information and understanding of the local environment.

## 8.1 Climate

Eliwana experiences a semi-arid climate characterised by hot, wet summers and relatively warm, dry winters, typical of the Köppen Grassland – hot, persistently dry climate class.

The most representative open weather station is located at Paraburdoo (Paraburdoo / Paraburdoo Aero) approximately 117 km to south west of Eliwana and is operated by the Bureau of Meteorology (BoM) (Figure 6). Rainfall data has been collected at Paraburdoo since 1974, and temperature data since 1996. In 2017 BoM reported the monthly mean maximum temperature at Paraburdoo range from 24.8°C in July to 40.6°C during January; Mean minimum temperature range from 9.8°C in July to 25.9°C in January.

Figure 6 also includes the mean rainfall data from the Hamersley rainfall gauge (BOM station 5005). The Hamersley rainfall gauge, located near the headwaters of Duck Creek, commenced operation in 1912; although data collection has been sporadic over the past decade. The higher rainfall levels recorded at the Hamersley gauge over the longer term and over the same timeframe as the Paraburdoo gauge (since 1974) suggests that rainfall is likely to be higher at Eliwana than the rainfall recorded at Paraburdoo.

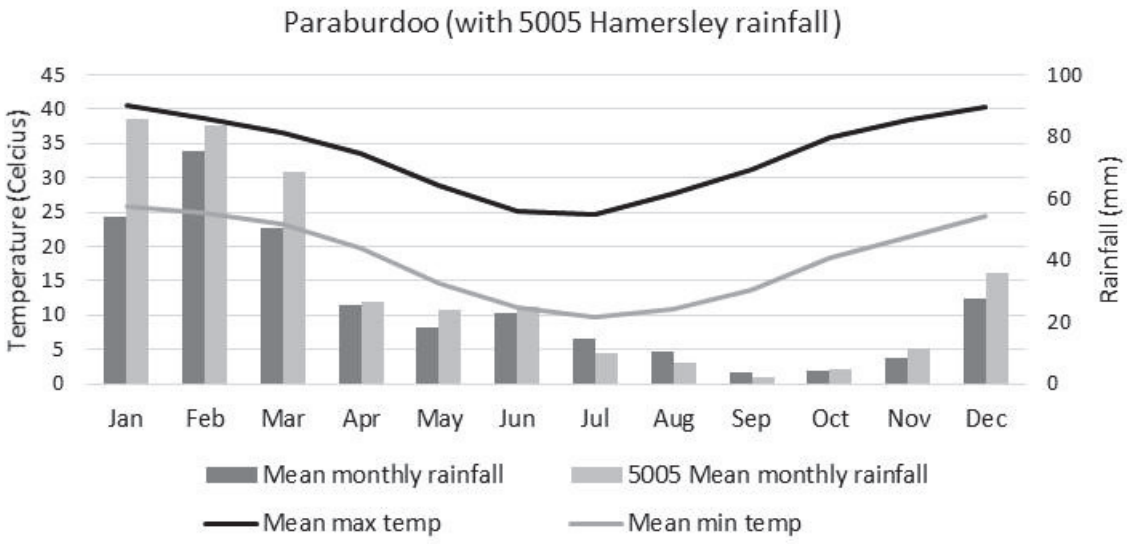



**Figure 6. Paraburdoo Aero climate record (BoM).**

Precipitation is predominantly from tropical cyclones and monsoonal thunderstorms that occur during the summer months (December to February). Mean monthly rainfall reported by BoM for

Paraburdoo ranged from <4 mm in September to 76 mm in February, with a mean annual rainfall of 325 mm. Rainfall in the region often falls in short period intense events. Over a 72 hour period, for example, for a 100 year event the rainfall intensity is estimated to be around 3.75 mm/hr, over which time 270 mm of rain could fall.

The region also experiences high rates of evaporation. The average annual evaporation rate for the region, reported by BoM, is approximately 3,400 mm. This significantly exceeds annual rainfall and exceeds the average areal actual evapotranspiration rate, reported by BoM to be around 300 mm per year.

The Commonwealth Scientific and Industrial Research Organisation (CSIRO) publication Climate Change in Australia (2017) reports average temperatures in the large “Rangelands North” subcluster, which includes the Pilbara and central Australia, will continue to rise. However, future rainfall trends have yet to be resolved, and in the near future natural variation is predicted to be greater than those changes that can be attributed to climate change.

The impacts from, and implications of, climate change on Pilbara ecosystems remains uncertain. As carbon dioxide levels in the atmosphere increase (a major contributing factor to climate change), for example, some Pilbara plant species may be able to use water more efficiently. On a local scale, this could mean less water is used by plants so that more plants or larger plants could prosper, with the surplus contributing to increased groundwater recharge. Consequently, while climate change is considered to be a factor in this MCP, management of the ecosystem and landforms for the recorded climate variability is expected to be sufficient to address climate change issues.

## 8.2 Land

### 8.2.1 Setting

Located within the Hamersley subregion (PIL3) of the Interim Biogeographic Regionalisation of Australia (IBRA, Version 7), the broad land systems that may be disturbed during development of the mine are listed in (Table 11). These units include the Newman, Boolgeeda and Platform systems, where mining activities will be undertaken, and the Rocklea land system where mine support service activities will be undertaken.

Table 11. Dominant land systems in the Project area (after Payne et al., 1988).

| Land systems | | Description |
|---|---|---|
| Depositional | Boolgeeda | Level to gently undulating hardpan wash plains with abundant to very abundant surface mantles of ironstone pebbles and prominent grove patterns of vegetation, widely spaced tributary drainage channels, low rises and dissected slopes.<br>Gently undulating hardpan plains supporting groved mulga shrublands and hard spinifex. |
| Erosional | Rocklea | Rough hill and mountain tracts predominantly of basalt, the largest land system in the survey area and widespread throughout.<br>Basalt hills, plateaux, lower slopes and minor stony plains supporting hard spinifex (and occasionally soft spinifex) grasslands. |
| | Newman | Rugged jaspilite plateaux, ridges and mountains supporting hard spinifex grasses. Drainage features of this landsystem tend to have abundant mantles of pebbles and cobbles. Associated with the Boolgeeda Landsystem. |
| | Platform | Dissected slopes and raised plains supporting shrubby hard spinifex grasslands. |
| | Robe | Conspicuous chains of limonite mesas and buttes with steep breakaway faces, source of iron ore as pisolitic limonite.<br>Low limonite mesas and buttes supporting soft spinifex (and occasionally hard spinifex) grasslands sloping down to gravelly plains and drainage floors and channels. |
| | Table | Low calcrete plateaux, mesas and lower plains supporting mulga and *Senna* shrublands and minor spinifex grasses. |

This MCP uses land units to classify and summarise the topographical, land system, soil and vegetation aspects of the Eliwana landscape prior to disturbance; similar to the habitat classification system used in fauna surveys. Four land units (Table 12) have been identified at Eliwana: Ridgeline, Low Rise, Stony Plain, and Drainage Line. The land units will be used in later updates to the MCP to inform and describe the Eliwana closure landform design and revegetation strategies.

Table 12. Land units at Eliwana.

| Land unit | Description |
|---|---|
| Ridgeline<br>  <br>Ridgeline disturbance demarcates the hills of the mine valley, will be associated with pit, waste dump and TSF development. | Associated with the Newman, Robe and Platform land-systems, the Ridgeline land unit is dominated by plateaux, ridges, mountains and hills with incised gullies. The plateaux are usually rounded and the mountains have frequent vertical upper cliff faces and moderately inclined to very steep upper scree slopes.<br>Stony surface mantles cover much of the areas and comprise of pebbles, cobbles and stones of ironstone, jaspilite, chert and other rocks over shallow soils. Narrow drainage lines dissect the ridges.<br>Soils are generally very shallow, single-grained with little to no structure and are interspersed throughout the large coarse (competent rock) fragments. Soil texture is highly variable, ranging from clay loam to sandy loam.<br>The vegetation is dominated by hummock grasslands with low tree steppe: scattered shrubs and trees predominantly of *Acacia* sp., *Senna* Sp. and *Eucalyptus* sp. notably *Eucalyptus leucophloia* (snappy gum) over *Triodia* sp.<br>Native animals that like to use this habitat include:<br>• Mammals: Woolley's False Antechinus (*Pseudoantechinus woolleyae*) and Common Rock-rat (*Zyzomys argurus*).<br>• Birds: Grey Shrike-thrush (*Colluricincla harmonica*), Western Bowerbird (*Ptilonorhynchus guttatus*), Grey-headed Honeyeater (*Lichenostomus keartlandi*), Black-faced Cuckoo-Shrike (*Coracina novaehollandiae*), Painted Finch (*Emblema pictum*), Little Woodswallow (*Artamus minor*).<br>• Reptiles: *Egernia cygnitos,* and Pilbara Rock Monitor (*Varanus pilbarensis*).<br>Conservation significant species that can utilise this habitat and have been recorded in the area include the Northern Quoll (*Dasyurus hallucatus*), Pilbara Leaf-nosed Bat (*Rhinonicteris aurantius*), and Olive Python (*Liasis olivaceus*). |
| Low Rise<br>  <br>Low Rise disturbance will be associated with the mine services area | The Low Rise land unit is associated with low hills and lower hill slopes of the Rocklea land system.<br>Low Rise is characterised by gentle, rounded and dissected slopes and low plateaux with narrow creek-lines. Stony plateaux are a feature of the land unit and these have gently inclined surfaces abundant pebbles and cobbles of ironstone and other rocks.<br>The soil is generally classified as skeletal, gravelly fine sandy loam with a gravel mantle. The soils are non-hardsetting, have moderate to rapid drainage, and are slightly acidic, non-saline with a low amount of plant-available nutrients. Ca and Mg concentrations tend to be higher due to the presence of dolomite and other similar 'calcrete' geological units.<br>Vegetation is dominated by a mosaic of shrub steppe and hummock grasslands of *Triodia* sp. with scattered trees and shrubs including *Corymbia hamersleyana* and/or *Eucalyptus* sp., *Acacia* sp. and *Grevillea wickhamii*.<br>Native animals that like to use this habitat include: Kaluta (*Dasykaluta rosamondae*), Ningaui (*Ningaui timealeyi*), Plaingale (*Planigale* sp.), Euro (*Macropus robustus*), Zebra Finch (*Taeniopygia guttata*), Painted Finch (*Emblema pictum*), Diamond Dove (*Geopalia cuneata*), Spinifex Pigeon (*Geophaps plumifera*).<br>The Australian Bustard (*Ardeotis australis*) is the only conservation significant species that likes to utilise this habitat. |

| Land unit | Description |
|---|---|
| Stony Plain<br>  <br>Stony Plain disturbance is confined to the mine valley, and will be associated with pit, waste dumps and haul road development. | The Stony Plain land unit is associated with Boolgeeda land system. The Stony Plain unit is characterised by wide, expansive areas with gentle slopes and a surface mantle of fragmented ironstone, cobbles and pebbles.<br>Deep, loamy sandy soils dominate the Stony Plain land unit. Notwithstanding the rocky mantle, Stony Plain soils have a relatively low amount of coarse fragments within the upper layers (0 - 20 cm depth). These soils may be hardsetting and subject to erosion when the mantle is removed.<br>Dominant vegetation is *Eucalyptus gamophylla* mid sparse mallee shrubland over *Acacia atkinsiana, A. bivenosa, A. exigua* tall sparse shrubland over *Triodia epactia, T. wiseana* mid hummock grassland.<br>Native animals that like to use this habitat include: Kaluta (*Dasykaluta rosamondae*), Ningaui (*Ningaui timealeyi*), Plaingale (*Planigale* sp.) , Euro (*Macropus robustus*), Zebra Finch (*Taeniopygia guttata*), Painted Finch (*Emblema pictum*), Diamond Dove (*Geopalia cuneata*), Spinifex Pigeon (*Geophaps plumifera*). Areas of dense shrubs may be used by Singing Honeyeater (*Lichenostomus virescens*), Brown Honeyeater (*Lichmera indistincta*), Black-faced Woodswallow (*Artamus cinerus*), and the Variegated Fairy-Wren (*Malurus lamberti*).<br>The Australian Bustard (*Ardeotis australis*) is the only conservation significant species that likes to utilise this habitat. |
| Drainage Line<br>  <br>Drainage Line disturbance will be largely associated with pit development, with minor disturbance occurring when transport corridors cross creeks. | The Drainage Line land unit is a spatially constrained unit comprised of the lowest points of the landscapes and transects all land systems. They are subject to fairly regular surface water flow, including overbank flooding from major channels and watercourses. The unit includes the creek bed, banks and overbank areas associated with drainage lines.<br>The soils consist of deep alluvial, silty loams characterised by a greater proportion of silt and clay than other land units, but also contain coarse fragments. Bank and overbank areas typically demonstrate a substantially increased soil depth compared to the surrounding landscape, with soil depth increasing to over 2 m adjacent to major channels.<br>Vegetation within the Drainage Line unit is similar to that of the neighbouring land units, although vegetation abundance and vigour on is characteristically elevated compared to the neighbouring units, except along the creek bed where vegetation is absent.<br>Animals that like to utilise this habitat include:<br>• Mammals: Ningaui (*Ningaui timealeyi*), Planigale (*Planigale* sp.), Desert Mouse (*Pseudomys desertor*) and more specialised species such as Delicate Mouse (*Pseudomys delicatulus*) and Sandy Inland Mouse (*Pseudomys hermannsburgensis*).<br>• Birds: White-plumed Honeyeater (*Lichenostomus penicillatus*), Sacred Kingfisher (*Todiramphus sanctus*), Little Corella (*Cacatua sanguinea*), and Southern Boobook (*Ninox novaeseelandiae*).<br>Conservation significant bird species, Rainbow Bee-eater (*Merops ornatus*) and Bush Stone-curlew (*Burhinus grallarius*), like to utilise this habitat. Northern Quolls (*Dasyurus hallucatus*), Pilbara Leaf-nosed Bats (*Rhinonicteris aurantius*), and Olive Pythons (*Liasis olivaceus*) may also use the habitat for feeding and dispersal. |

## 8.2.2 Soil

### Soil characteristics

A summary table of the soil characteristics by land system and land unit is provided in Table 12. Across the region the soils are dominantly red/brown massive sandy loams in texture. Soil depths ranged from 0.1 m on hillslopes to >1.3 m in valleys, generally contained roots in the <0.5 m depth of soil and very shallow (<0.1 m) on the (limited distribution) Robe 'mesa' land system that hosts the *Triodia* sp. *Robe River* Priority Ecological Community. In general the soils are not water repellent but exhibit poor aggregate stability, with most samples slaking and dispersing in water. This suggests the soils are likely to be hardsetting and erodible once their rock mantle is disturbed.

The soils were generally non-sodic and non-saline with variable low acidity (Table 13). Soils on the Rocklea and Table land systems tended to contain higher Ca and Mg concentrations and subsequently higher soil alkalinity, associated with the underlying and adjacent erosional calcareous and dolomitic geological units.

**Table 13. Soil nutrients**

| | Nutrient status | | | | | | |
|---|---|---|---|---|---|---|---|
| | pH 1:5 | EC 1:5 (µS/cm) | Organic Carbon % | Total Nitrogen % | Available P (mg/kg) | Available K (mg/kg) | Available S (mg/kg) |
| Min | 5.1 | 4 | 0.1 | 0.02 | 2 | 59 | 0.6 |
| Mean | 6.5 | 19 | 0.6 | 0.07 | 5 | 161 | 3.2 |
| Max | 7.3 | 68 | 2.4 | 0.17 | 13 | 461 | 13 |

**Table 14. Soil chemistry**

| | Exchangeable cations (cmol+/kg) | | | | | Elements potentially of concern (mg/kg) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Ca | Mg | K | Na | Al | As | Cd | Co | Cr | Mo | Pb | Se |
| Min | 1.0 | 0.3 | 0.1 | 0.0 | 0.0 | 3 | <0.1 | 3.6 | 69 | 0.2 | 6 | 0.5 |
| Mean | 4.3 | 1.3 | 0.3 | 0.0 | 0.1 | 14 | 0.1 | 11 | 118 | 1.2 | 16 | 1.7 |
| Max | 17 | 6.6 | 1.1 | 0.1 | 0.3 | 23 | 0.2 | 44 | 209 | 1.6 | 39 | 3.4 |

Nutrient levels (Table 13 nitrogen, phosphorus and sulfur) were low, concentrated in the first 10 cm of the soil profile and correlated to organic carbon level of the soil. Concentrations of metals (Table 14) such as arsenic, chromium, lead, and cobalt were elevated compared to soil norms, but are likely to reflect natural background geological conditions. When these values were compared against the Ecological Investigation Levels recommended by DWER (2010), the one sample taken from the Boolgeeda land system was found to have arsenic elevated above the trigger level.

## Topsoil management

| Valley loam soil | |
|---|---|
|  |  |
| Surface | Subsurface |
| **Skeletal stony soil** | |
|  |  |
| Surface | Subsurface |

**Figure 7. Soil classes: Deep valley floor loam (left) and skeletal stony soil (right) (Soilwater 2017).**

On reviewing the soils across the area, for the purposes of soil management during mining, Soilwater (2017) concluded soils can be grouped into two soil classes (Figure 7):

- Deep valley floor red/brown non-cracking clay and red shallow loam associated with the Boolgeeda land system / Stony Plain land unit. This unit is confined to the floor of the mine valley; and
- Skeletal stony soils in all other areas.

The soil classes can be differentiated on the basis of the particulate size with a higher percentage of gravel, higher EC (salinity) and slightly higher soil fertility found in the stony soils. Otherwise the soils are very similar in nature.

The absence of differentiating features between the two soil classes and similarity in vegetation communities supported by the soil classes suggests there is limited benefit to storing the recovered topsoil in separate stockpiles. Similarly, there was no notable differentiation in soil profile characteristics that would warrant specialised reconstruction of a soil profile during rehabilitation to support revegetation performance. However, the development of local topsoil stockpiles in the mine services area is preferred, in comparison to a large centralised facility, in order to preserve the seedbank diversity where possible.

The skeletal soil that dominates the area is expected to be very difficult to recover in the Ridgeline land unit, due to the rugged terrain. As a consequence most of the topsoil stockpiled is expected to be recovered from Low Rise land units in the mine services and associated transportation corridors, and from the Stony Plain land unit within the mined valley.

Soil will be managed in accordance with Fortescue's *Corporate Vegetation Clearing and Topsoil Management Procedure*. Fortescue employs a ground disturbance permit system to track and ensure land disturbance is only undertaken within permit limits. Requirements for the topsoil recovery and storage are specified in these permits. This includes stockpiling woody debris separately and topsoil strip depth. In general Fortescue aim to strip 100 mm for topsoil stockpiling. Soil stockpiles are subsequently mapped, tracked and inspected, to minimise soil loss and control weeds.

It is assumed that around 100 mm of soil will be returned across the disturbed areas, excluding pits, as part of the rehabilitation activities. Given it is unlikely that soil will be recovered from the Ridgeline land units, the mine valley area is likely to have a topsoil deficit. However, as the majority of the Ridgeline land unit disturbance is associated with pit development, where topsoil is not used on closure, the topsoil deficit is likely to be very small.

There is the potential to recover additional subsoil from the Boologeeda land system / Stony Plain land unit in the mine valley to meet this gap, if required. Additional subsoil may also need to be collected if, for example, geochemical unsaturated flow studies determine that a fine soil cover is required over the waste dumps to minimise infiltration.

Table 15. Soil description (SoilWater 2017)

| Characteristics | | Land unit | | | | |
|---|---|---|---|---|---|---|
| | | Stony Plain | Ridgeline | | | Low rise |
| Land systems | | Boolgeeda | Newman | Platform | Robe | Rocklea |
| WA soil group classification | | 622/522 | 203 | 203 | 203 | 203 |
| Samples | | EW11, EW12, EW17, EW18,EW19,EW20 | EW010, EW02, EW02A, EW06, EW07, EW08, EW09, EW10, EW13, EW14, EW16, EW21, EW28,EW30,EW31 | EW15, EW15A, EW22, EW22A, EW23, EW26, EW27 and EW29 | EW3, EW3A, EW5 | EW4 |
| Landscape position | | Flat to low slope angle topography | Mid to upper slopes | Flat to low slope angle topography, toe of slopes | Mid to lower slopes | Toe of slope (between two ridges) |
| | | | | | | |
| Physical | Colour | Red/brown | Red/brown | Red/brown | Red/brown | Red/brown |
| | Soil texture | Sand, loamy sand or sandy loam | Clay loam or sandy loam | Loamy sand | Sand to loam | Sandy loam |
| | Gravel content (%) | 1-80 % dependent on depth | 63-84% | 63-78 | 11-91% | 34-57 |
| | Aggregate stability | Slaked and highly dispersive in water | Slaked and highly dispersive in water | Slaked and highly dispersive in water | Mostly slaked and highly dispersive in water | Slaked and dispersive |
| | Modulus of rupture (kPa) | At risk of hardsetting | At risk of hardsetting | At risk of hardsetting | Most materials are at risk of hardsetting | Not tested |
| | Plant available water (volumetric water content) | 3.1-14.2% | 13-18% | 12.8-17.6% | 5-15% | 11.6-14.7% |
| | Hydraulic conductivity (Ksat) | 0.54 m/d (moderate to moderately rapid) | Not tested | Not tested | Not tested | Not tested |
| Chemical | pH | Slightly acid to neutral (6.4-7.1) | Moderately – slightly acid (5-6-6.5) | Neutral (6.6-6.7) | Strongly acid to neutral (5.1-7.3) | Neutral (6.9-7.2) |
| | Salinity class (mS/m) | Mostly non-saline (0.38-2.15) | Non-saline (0.05) | Mostly non-saline (1.34-2.46) | Non-saline to slightly saline (0.97-5.03) | Non-saline to moderately saline (1.85-4.17) |

| Characteristics | Land unit | | | | |
|---|---|---|---|---|---|
| **Organic carbon (%)** | 0.05-2.4% (extremely low to high) | 0.33-1.35 (extremely low – moderate) | Low to moderate (0.69-1.17) | 0.21-1.48 (extremely low – moderate) | Low (0.85-1.01) |
| **Nutrient status** | Very low to low (N, P, K, S) | Very low to low (N, P, S), Elevated levels (K) | Very low to low (N, P, S), Elevated levels (K) | Very low to low (N, P, S), Elevated levels (K) | Very low to low (N, P, S), Elevated levels (K) |
| **Exchangeable sodium percentage** | Non-sodic (~0%) | Non-sodic (0-1.4%) | Non-sodic (0) | Non-sodic (0-1.9) | Non-sodic (0) |
| **Metals** | Very high (As,Cr,Pb), moderate (Co, Mo,Se) and low (Cd) | Very high (As,Cr,Pb), moderate (Co, Mo,Se) and low (Cd) | Very high (As,Cr,Pb), moderate (Co, Mo,Se) and low (Cd) | Very high (As,Cr,Pb), moderate (Co, Mo,Se) and low (Cd) | Very high (Cr, Co), moderate (As, Pb) and low (Cd, Mo,Se) |

# Based on Moore, G.A. (1998) Soil Guide. A Handbook for Understanding and Managing Agricultural Soils. Bulletin 4343. Agriculture Western Australia, Perth. March 1998
* BDL – Below Detection Limits

## 8.2.3 Geology

### Local geology

The general characteristics of the Eliwana geology are presented in Table 16 and is illustrated with a conceptual cross section through the planned mine area in Figure 8. The dominant lithology of the hills at Eliwana is comprised of Brockman Iron Formation (Dales Gorge, Whaleback Shale and Joffre members), a geological unit known to host large iron ore deposits in the Hamersley Ranges. Iron ore is will also be mined from the Mount Newman member of the Marra Mamba Formation.

**Table 16. Key geological units in the Eliwana mine area.**

| Geology | | Description | Erodibility[#] |
|---|---|---|---|
| Tertiary alluvial / colluvial and detrital | | Valley fill sequence consisting of interbedded clay, silt and gravel. | High |
| Brockman Iron Formation | Joffre Member | BIF with minor thin shale horizons | Low |
| | Whaleback Shale Member | Interlayered chert and shale with layers of BIF near the base | Moderate |
| | Dales Gorge Member* | Alternating sequences of BIF and argillite macrobands. | Moderate |
| Mount McRae Shale* | | Interlayered shale, dolomitic shale, chert and minor BIF | Moderate |
| Mount Silvia Formation | | Banded iron formation separated by layers of mudstone, minor chert and dolomite | Moderate |
| Wittenoom Formation | Bee Gorge Member | Thinly laminated argillite with subordinate thickness of carbonate, chert, volcaniclastics and iron formation | High |
| | Paraburdoo Member | Bedded dolomite with some chert and argillite | High |
| | West Angela Member* | Massive and laminated dolomite interbedded while shaley dolomite with pyrite and chert | High |
| Marra Mamba Formation | Mount Newman Member | Integrated thin shale, chert and banded iron formation with thin shale intervals. | Low |
| | McLeod Member | Integrated thin shale, chert and banded iron formation. | Low |
| | Nammuldi Member | Alternating yellow/brown chert and iron formation mesobands | Low |
| Jeerinah Formation | | Shale commonly associated with pyrite concretions | High |
| Calcrete* | | Calcium-rich hardened material | Low |
| Dolerite | | Extremely hard volcanic rock | Low |

[#]Potential to generate an erodible waste rock with respect to other waste material types in the Pilbara, based on general geological characteristics. Site specific test work required after blasting and material handling to validate categories and establish properties.

* Potential for dissolution or chemical hazard. Pit specific test work is required.

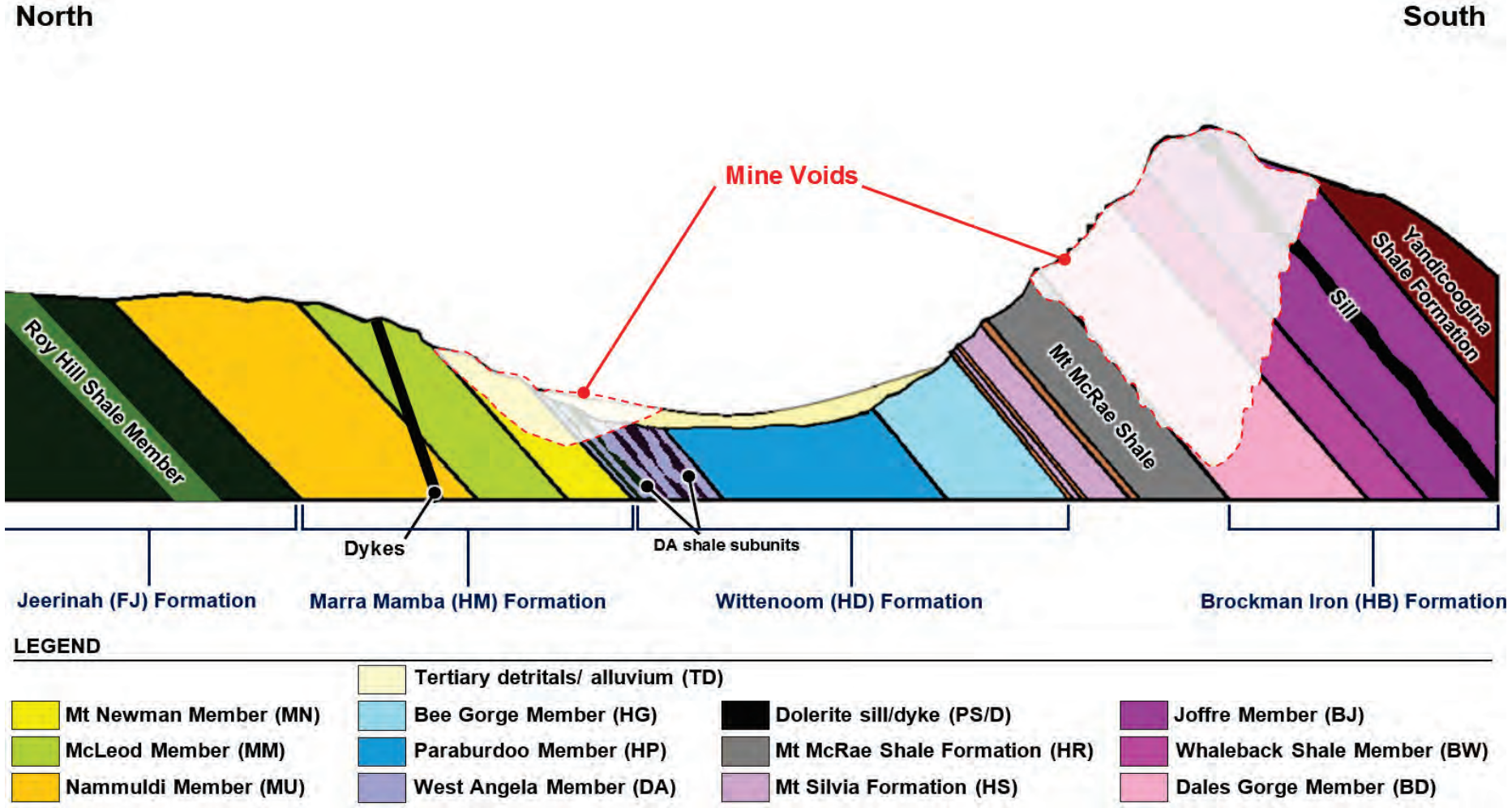



Figure 8. Conceptual geological profile of the Eliwana mine valley (vertically exaggerated, not to scale)

The erosion-resistant nature of the local geology is reflected in the topographical slope angles (Table 17), which range from almost flat along the valley floor to 45 degrees and steeper along the ridges.

**Table 17. Slope relation to Land Units**

| Land unit | Ave slope angle | Description |
|---|---|---|
| Stony Plain | 0-10 degrees | Flat lower slopes and U-shaped valley floor |
| Ridgeline | 15-45 degrees | Concave slopes increasing to very steep slopes and break-aways |
| Low rise | 11-20 degrees | Intermediate undulating slopes |

## Fibrous geology

Asbestos is a naturally occurring potentially hazardous fibrous material, common in the Pilbara, which when inhaled can impact human health. Asbestos is the fibrous form of mineral silicates belonging to the serpentine and amphibole groups of rock forming minerals. Chrysotile (white asbestos), crocidolite (blue asbestos) and amosite (brown asbestos) are the most commonly encountered asbestiform minerals associated with the local geology. These materials may be encountered when drilling and / or excavating unmineralised Banded Iron Formation (notable within the Dales Gorge Member) in the Brockman Iron Formation and in the Marra Mamba Formation. Asbestiform materials also erode naturally from cliffs and hills in Pilbara, and have been observed in Pilbara creek beds, pools and floodplains, although no specific sightings have occurred at Eliwana.

Drilling activities have intercepted asbestiform materials in several drill holes, and it is possible that fibrous materials will be excavated during mining. The *Fibrous Materials Management* plan will be implemented at Eliwana to identify and manage asbestiform materials during the operation of the mine. When encountered, asbestiform materials (greater than 5 µm in length and 1 µm or less in width), and any contaminated personal protection equipment, are kept wet and permanently encapsulated in an area that is subsequently signposted (designated) to indicate the presence of the materials.

## Geochemistry

The geochemical properties of the local geology have been established through a series of static and kinetic chemical tests. Static tests have been used to identify elements and conditions of possible concern; while kinetic tests are being conducted to determine the long-term weathering risk.

Analysis of the results from the net acid generation oxidation testing and total and leachable element analyses, has shown the majority of material is non-acid forming and unlikely to generate saline drainage. However, three deleterious rock units, that is problematic rock units with the potential to generate acid, alkaline and / or metalliferous drainage (AMD), were identified:

- Brockman Formation Dales Gorge Member units, particularly the basal unit (D1), and the basal units of the Joffre Member (J1 and J2) have the highest likelihood of generating acid drainage based on the assay results. However additional, more detailed testing within the J1 and J2 and concluded the material will not generate acid.
- Mount McRae Shale has the potential to generate acid and neutral or alkaline metalliferous drainage. However, while Mount McRae Shale is known to contain some pyritic, black shale, the assays sampled do not have a large number of high sulfur analyses. (Only 1.7% of Mount McRae Shale has sulfur greater than 0.5%.)
- Wittenoom Formation West Angela Member shale subunits are pyritic at the base of the unit, just above the Mount Newman ore, and may result in acidic or metalliferous (likely containing elevated manganese) drainage. However the volumes of this material is likely to be encountered is low.

In order to determine the potential for elevated concentrations of elements (metals, metalloids, non-metals) to impact the environment, finely milled rock samples are tested by leaching with water, to simulate a flood event. The water samples are analysed to determine which elements have become mobile, and the concentrations are compared to natural groundwater, surface water and ANZECC 95% of species limit of protection guideline values in order to determine which are elevated above what might be expected in natural conditions, without disturbance by mining. This testing provides an estimate of what the soluble load of metals may be if excavated rock produced drainage.

The results are summarised as follows:

- Leached elements that show a significant correlation (>50%) with total composition are: chloride, cobalt, caesium, potassium, sodium, rubidium and selenium, while arsenic, strontium and vanadium showing a low correlation (40-50%).
- There is an unlikely chance (3-30%) that aluminium, chromium, copper, selenium, thallium, vanadium and zinc will occur above the ANZECC 95% of species limit of protection in any drainage from waste rock.
- There is a rare chance (0-3%) that arsenic, cadmium, cobalt, iron, manganese and nickel will occur above the ANZECC 95% of species limit of protection in any drainage from waste rock.
- Arsenic is a human carcinogen while selenium is a human endocrine disruptor that affects the respiration of fish and exhibits a tendency to bioaccumulate. While, as a whole for all units, the risk from arsenic and selenium does not appear great, the majority of samples in which these elements are detected are the Mount McRae Shale Formation and West Angela Member shale.

- There is minor concern that chromium, copper and nickel may also be present at elevated concentrations, however elevated water hardness reduces the impact of these elements.

The primary contributing factor to the generation of AMD is the exposure of reactive, acid generating minerals to oxygen and water. As a basic principle the generation of AMD can be avoided by excluding oxygen and/or water from contact with deleterious rock units through, for example, encapsulation. Consequently, segregation and encapsulation of the deleterious rock units will be required as part of the Eliwana mineral waste management process.

The geochemical properties, while related to geological stratigraphy, are variable within each unit. Geochemical properties can also be influenced by excavation and processing methods, in that the availability of certain elements may change as the size of particles changes and environmental conditions (e.g. water pH) change. Consequently geochemical sampling and analysis is conducted regularly, in accordance with the *Life of Mine Geochemistry Programme - Acid and/or Metalliferous Drainage Sampling Plan*. As sulfur concentrations are generally low, and thus acid production is expected to be low, geochemical test work is currently focused on the potential for neutral, metalliferous drainage during leach testing work.

### 8.2.4 Waste rock

Geologically derived waste (**waste rock**) at Eliwana originates from hard rock and sediment that is mined to facilitate access to the targeted iron ore deposits (**overburden**) and zones within the targeted deposit that have a low iron content or impurities (**interburden**). Excavation and disposal practices combine the waste rock, sometimes from multiple pits, resulting in a heterogeneous waste rock mix.

Table 18 lists the approximate volumes of waste rock and proportion of total volume that may be mined, and lists whether the material is deleterious and / or erodible. The table shows:

- There are six dominant geological sources of waste rock (from largest to smallest) Dales Gorge Member, Joffre Member, Tertiary materials, Whaleback Shale Formation, Mount Newman Member and Wittenoom Formation.
- Most of the material (~60%) is likely to be of moderate erodibility. Consequently a relatively conservative approach to waste dump design will be required to manage erosion. Around 20% of the waste rock, however, is likely to be of low erodibility and suitable for rock armouring, should it be required.
- A maximum of 8% of all waste rock is currently defined as deleterious. This estimate is may reduce with more targeted definition of the waste rock units. The deleterious units will need to be encapsulated within benign material.

Table 18. Combined geological composition of waste rock (estimate, PER scenario)

| Geology | | Volume | Percentage of all waste | Erodibility | Deleterious |
|---|---|---|---|---|---|
| Tertiary alluvial / colluvial and detrital | | 90Mt | 16% | High | No |
| Brockman Iron Formation | Joffre Member | 110Mt | 19% | Low | No |
| | Whaleback Shale Member | 40Mt | 6% | Moderate | No |
| | Dales Gorge Member | 200Mt | 35% | Moderate | No |
| | *D1* | *(20Mt)* | *(3%)* | *Moderate* | *Yes* |
| Mount McRae Shale | | 10Mt | 1% | Moderate | Yes |
| Wittenoom Formation | | 50Mt | 9% | High | No |
| | *West Angela Member* | *(40Mt)* | *(6%)* | *High* | *Yes* |
| Marra Mamba Formation | Mount Newman Member | 50Mt | 9% | Low | No |
| Other minor contributors | | | <5% | - | No |

An average waste rock geochemical profile is provide in Table 19. When compared against the generalised soil chemistry, the waste rock data suggests the mean composition is similar to soil with respect to cobalt, chromium, lead and selenium, however arsenic and molybdenum are likely to be elevated in the waste rock. However, as the soil and waste rock are not significantly dissimilar, it is likely that the waste rock will provide a suitable growth medium for native plants.

Table 19. Generalised geochemical composition of waste rock.

| (n = 270) | Elements of potential concern (mg/kg) | | | | | | |
|---|---|---|---|---|---|---|---|
| | As | Cd | Co | Cr | Mo | Pb | Se |
| Min | 0.7 | *<0.1* | *<1* | 1.0 | *<0.05* | *<1* | *<0.1* |
| 25th % | 5.6 | *<0.1* | 1.4 | 20 | 0.71 | 4.1 | 0.17 |
| Mean | 32 | *<0.1* | 7.1 | 46 | 2.1 | 13 | 1.1 |
| 75th% | 25 | *<0.1* | 6.7 | 59 | 2.5 | 15 | 1.0 |
| 80th % | 32 | *<0.1* | 8.0 | 65 | 3.0 | 19 | 1.2 |
| 90th % | 100 | *<0.1* | 17 | 89 | 4.5 | 34 | 2.5 |
| Max | 480 | 4.3 | 150 | 340 | 14 | 120 | 52 |

## 8.3 Water

### 8.3.1 Surface water

**Catchments**

Eliwana is located within the Duck Creek catchment, within the regional Ashburton River basin. The Duck Creek catchment area covers approximately 6,800 km$^2$ at the confluence with the Ashburton River. The Ashburton River basin has a total area of 78,777 km$^2$.

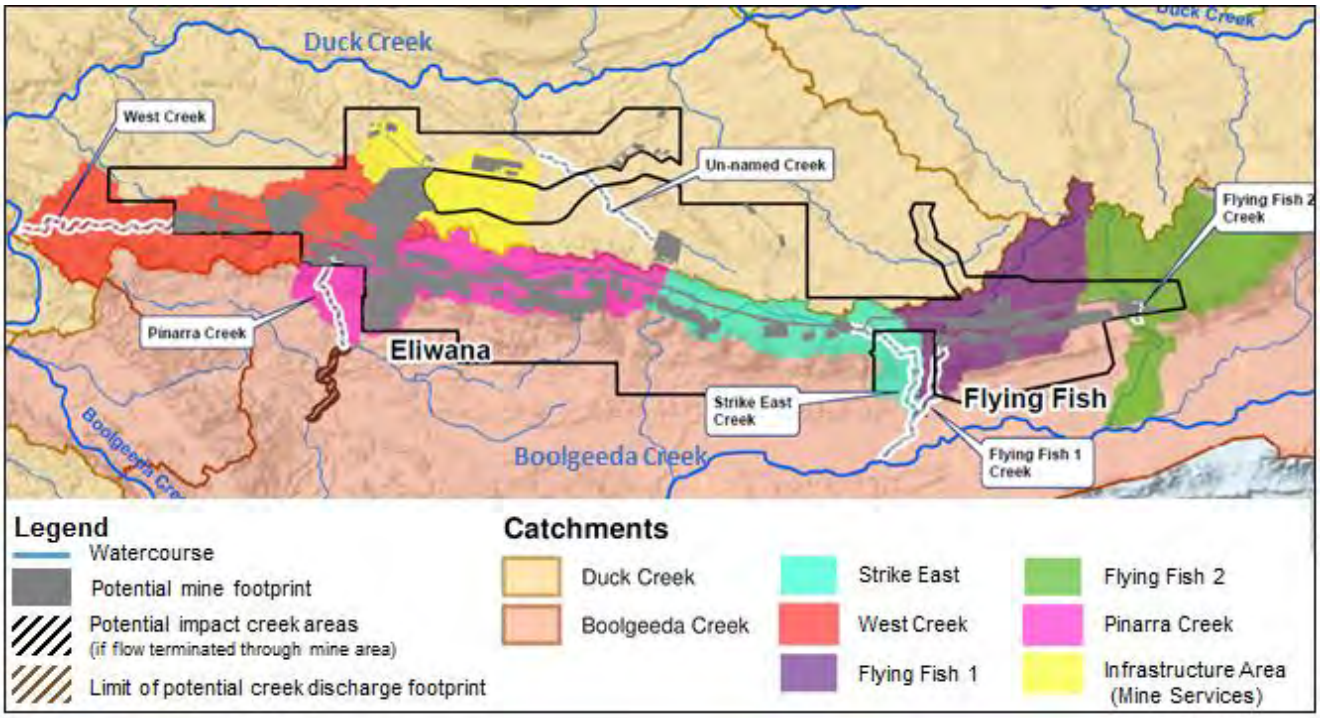



Figure 9. Surface water catchments of the Eliwana area

Creeks in Duck Creek catchment are ephemeral, that is they generally only flow in direct response to rainfall. As the local soils typically have high infiltration rates, it may take several days of rain to saturate the ground before catchment runoff commences and creeks start to flow. As a result, the majority of creek flow occurs from November to March when tropical lows and cyclones bring heavy rain.

If there is a large low from a tropical cyclone, or if multiple tropical lows occur within a few weeks of each other regional flooding may occur. These events can be large enough individually and cumulatively to significantly reshaped drainage channels. Isolated thunderstorms have the potential to create fast and localised flooding, referred to as flash flooding. These events generally have a lower potential for widespread damage as the extent and magnitude of flooding is much smaller than cyclonic events.

Major creeks within the Duck Creek catchment (Figure 9) include Duck Creek (proper), Boolgeeda Creek (catchment 1,660 km$^2$) and Caves Creek (catchment 1,535 km$^2$), all of which are located outside the mine area, although they may be traversed to access the site. The majority of the pits will be developed within the Boolgeeda Creek subcatchment, with only the Broadway West pits located in the informally named West catchment contributing flows directly to Duck Creek, upstream from the Duck – Boolgeeda Creek confluence. Similarly the majority of the mine services activities will be undertaken north of the Boolgeeda Creek subcatchment, in the Duck Creek subcatchment, upstream of the Duck – Boolgeeda Creek confluence.

The only formally named tributary that winds through the site is Pinarra Creek (catchment 60 km$^2$), a contributor to the Boolgeeda Creek subcatchment, which flows from the proposed mine services area, through the mine valley, then south to Boolgeeda Creek. Other similar sized unnamed creeks / subcatchments intercepted by the mine include (from west to east) the informally named West (catchment 69 km$^2$), Strike East (catchment 46 km$^2$), Flying Fish 1 (catchment 60 km$^2$) and Flying Fish 2 (catchment 60 km$^2$) areas. Within these catchments water flows similar to Pinarra Creek, such that water flows from north of the ridge, along the floor of the mine valley, before flowing into Boolgeeda or Duck Creek.

It is possible that the surface water flowing along these tributaries may be terminated within a mine void during mining and remain so on closure. In which case flow along the tributaries may be permanently reduced or cease flow along some sections of the creek. The potentially terminated catchment areas equate to <15 percent of the Boolgeeda Creek catchment and <2 percent of Duck Creek catchment.

Modelling based on the termination of these catchments suggests that flow along sections of Boolgeeda Creek and within Pinarra Creek could be reduced by less than 25 cm during regular (2% AEP) flood events. These reductions are relatively low and within the natural variability of flood events; such that little to no impact on the hydrological regimes is predicted to occur in Boolgeeda or Duck Creek. The hydrological regimes that may be permanently changed are illustrated in Figure 9 and include tributaries in all catchments except the infrastructure area. Vegetation communities along these impacted tributaries may require assistance to transition to the changed hydrological regime.

## Water quality

The streamflow in the ephemeral creeks in the subcatchments (and wider Pilbara) are typically fresh, but is generally highly turbid due to the rapid rise of creek levels in response to rainfall, when flooding occurs. Typical values for the Ashburton River basin and the broader Pilbara region from the DoW's *Water Information Reporting* database are presented in Table 20, and for water measured flowing into Pinarra Creek at Eliwana in Table 21. The surface water generally has low salinity, is fresh, and meets most drinking water limits, although there is abundant

aluminium and iron exceeding the aesthetic taste values with minor concentrations of boron, barium and manganese.

Water quality in naturally occurring pools can be highly variable, in part due to the individual characteristics of each pool, its water supply(rainfall, creek flow, alluvial groundwater or groundwater structure), the preceding climate (drought/flood history, recent groundwater recharge etc.), and interaction with livestock. The high turbidity levels indicate that the ephemeral creeks have high bed loads in their natural state with many instances of significant erosion on existing stream banks and notable areas of instability in the natural environment, highlighting that erosion is a naturally occurring process.

**Table 20: Regional surface water quality data (sourced from DWER)**

| Parameter | Pilbara Wide | | Ashburton | |
|---|---|---|---|---|
| | Minimum | Maximum | Minimum | Maximum |
| pH (pH units) | 5.2 | 9.4 | 6.7 | 8.8 |
| EC (µS/cm) | 3 | 6,090 | 83 | 6,090 |
| Turbidity (NTU) | 0.1 | 3,200 | 0.5 | 3,200 |
| Alkalinity (mg/L) | 3.6 | 420 | 35 | 274 |
| TDS (mg/L) | 22 | 3,932 | 70 | 2,618 |
| Nitrate as N (mg/L) | 0.05 | 32 | 1 | 3 |
| Hardness (mg/L) | 3.6 | 1,538 | 48.9 | 1,539 |
| Dissolved Silica (mg/L) | 1 | 68 | 7.7 | 22 |

**Table 21: Range of surface water major ion concentrations (mg/L) for water flowing into Pinarra Creek**

| Range | pH | EC µS/cm | Tot Alk as $CaCO_3$ | Hardness as $CaCO_3$ | Ca | Mg | Na | K | $HCO_3$ as $CaCO_3$ | Cl | $SO_4$ | F | NOx as N | $NH_4^+$ as N |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Min | 7.3 | 44 | 2.0 | 12 | 3.0 | 0.5 | 2.0 | 2.0 | 2.0 | 4.0 | 2.0 | <0.01 | 0.1 | 0.020 |
| 25th % | 7.4 | 101 | 6.5 | 43 | 14 | 2.0 | 3.3 | 3.0 | 6.5 | 4.5 | 5.3 | <0.01 | 0.3 | 0.040 |
| Mean | 7.6 | 144 | 26 | 59 | 18 | 3.6 | 7.6 | 3.9 | 26 | 11 | 10 | 0.07 | 0.5 | 0.08 |
| 75th % | 7.8 | 182 | 48 | 72 | 22 | 4.8 | 11 | 4.0 | 48 | 14 | 14 | 0.1 | 0.6 | 0.07 |
| 80th % | 7.9 | 188 | 49 | 75 | 22 | 5.0 | 11 | 4.4 | 49 | 16 | 15 | 0.1 | 0.6 | 0.09 |
| 90th % | 8.0 | 196 | 52 | 82 | 24 | 5.7 | 13 | 5.0 | 52 | 17 | 18 | 0.1 | 0.8 | 0.21 |
| Max | 8.1 | 322 | 58 | 147 | 42 | 10 | 17 | 8.0 | 58 | 28 | 25 | 0.2 | 1.3 | 0.25 |
| <LOR | - | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 9 | 0 | 10 |

## 8.3.2 Groundwater

### Aquifers

Groundwater in the local area occurs in two dominant hydrogeological environments: in surficial (Tertiary Detrital) aquifers hosting relatively 'young' water associated with the major creek systems, and 'older' weathered and fractured aquifers.

Older aquifers in the area are associated with mineralised bedrock of the Marra Mamba and Brockman Iron Formations and weathering of the Wittenoom Formation, particularly where dolomite is predominant. These aquifers are considered to be largely unconfined, but are compartmentalised by steeply dipping shale lithologies and cross-cutting dolerite dykes. As a consequence, each compartment can be dewatered (for water supply or to facilitate mine access to ore) with limited impact on its neighbouring compartment. Figure 10 shows a conceptual long section through the valley, within the Wittenoom Formation aquifer, identifying several unconfined groundwater compartments, separated by dolerite dykes. The data suggests there is no hydraulic gradient within each compartment, and groundwater flow appears limited to leakage between compartments.

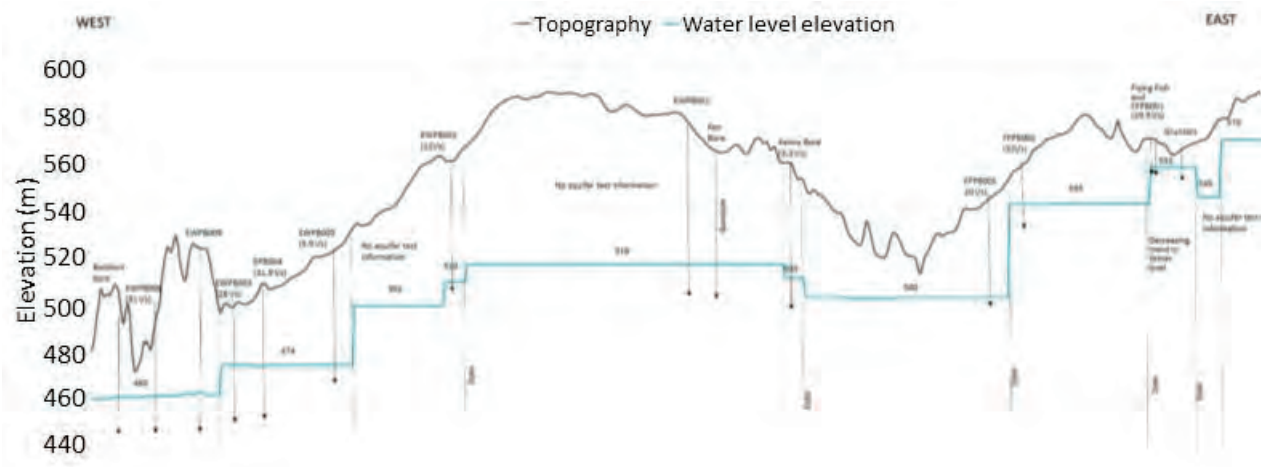



**Figure 10 Long section (50km) through Wittenoom Aquifer illustrating groundwater compartmentalisation.**

This local pattern of flat hydraulic gradients is overprinted on a regional pattern of groundwater flow from 574 m AHD in the east to 459 m AHD in the west. Groundwater levels at the base of the valley vary from 5 m below ground level (bgl) to 80 m bgl, with the shallower depths usually associated with incised topography near surface water drainage features.

Analysis of groundwater monitoring data suggests that rainfall of at least 20 mm / day is required before sufficient infiltration is generated to recharge shallow (<30m depth to groundwater) aquifers.

## Groundwater quality

Table 22 summarises the groundwater parameters and major ion concentrations from bores in the local area. Groundwater in the area is generally described as fresh, with total dissolved solids between 500-800 mg/L. Groundwater quality in the Eliwana mine area is evenly split between being a calcium and magnesium-bicarbonate type; while Flying Fish groundwater contains significant bicarbonate but is dominated by magnesium and sodium-chloride type water. Salinity ranges from 400-2,500 µS/cm.

From a regional perspective, groundwater in the Turee Creek Group (to the south of the project area) have the freshest groundwater with a salinity of ~500 µS/cm, followed by bores in the Bee Gorge and Paraburdoo Members of the Wittenoom Formation, and the Brockman Formation located in the Eliwana area with 900 – 1,000 µS/cm. Bores in the Paraburdoo Member in the Flying Fish Mining area have markedly higher salinity of between 1,900 – 2,500 µS/cm. Common minor elements present in groundwater are boron, barium, copper, manganese, strontium and zinc.

**Table 22. Range of groundwater parameters and major ion concentrations (mg/L)**

| Range | pH | EC µS/cm | Tot Alk as $CaCO_3$ | Hardness as $CaCO_3$ | Ca | K | Mg | Na | Cl | $SO_4$ | Tot N | Si |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Min | 7.1 | 404 | 7.0 | 112 | 18 | 6.0 | 16 | 37 | 70 | 17 | <0.01 | 7 |
| 25th % | 7.7 | 920 | 275 | 359 | 70 | 8.0 | 43 | 58 | 100 | 73 | 0.020 | 9 |
| Mean | 7.9 | 1,330 | 288 | 488 | 87 | 13 | 65 | 106 | 210 | 162 | 0.34 | 12 |
| 75th % | 8.0 | 1,950 | 336 | 662 | 107 | 20 | 90 | 169 | 353 | 301 | 0.39 | 14 |
| 80th % | 8.1 | 2,030 | 340 | 678 | 114 | 20 | 90 | 175 | 374 | 314 | 0.52 | 15 |
| 90th % | 8.1 | 2,302 | 350 | 790 | 125 | 24 | 121 | 196 | 445 | 344 | 1.0 | 15 |
| Max | 8.5 | 2,480 | 405 | 905 | 136 | 26 | 138 | 232 | 503 | 373 | 1.9 | 34 |
| <LOR | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 0 |

### 8.3.3 Pools

Due to the ephemeral nature of the creeks, permanent and semi-permanent water sources including pools and soaks provide an important ecosystem service.

There are a number of permanent and semi-permanent pools located outside of the mined area, including Donkey Pool and Jeriwah Rock Hole (12 km north of the pits) and numerous local pools within Duck Creek including those located 7km east of the mine, at the junction of the West catchment and Duck Creek. These pools, and most other pools in the area, are

associated with the Tertiary Detrital aquifer, and areas where shallow water levels exist within the Wittenoom Formation. These pools are located outside the mined area are not expected to be impacted by mining activities.

Pools that may be impacted by mining activities have been identified in the West Creek catchment, upstream of the Duck Creek pools. These pools are associated with groundwater dependent vegetation, suggesting the pools may be semi-permanent.

Small, ephemeral rock pools can be found within the mine area. These rock pools are filled when the creeks flow, and are sheltered from the high evaporation rates by the steep gully and rugged overhanging topography. The pools allow water to persist in the area after rainfall, but do not support appear to support aquatic fauna or vegetation as they usually dissipate before the next wet season. Some of these rock pools may be mined through as part of the pit development, e.g. in Talisman pit.

## 8.4 Biodiversity

### 8.4.1 Plants

**Dominant vegetation communities**

Multiple field surveys have been undertaken over to time to map local flora and vegetation units. The field studies have included more than 500 quadrats, many sampled 2-3 times, and over 100 releves.

During the field surveys more than 700 taxa were identified in the local area, representing over 130 genera and 46 families. No declared rare or threatened flora have been recorded in the Part IV proposal area; however a number of Priority Flora species have been identified. Some of these species may be disturbed as part of mining activities. As mining activities are not expected to impact on the conservation significance of the Priority species, there is no intention to return Priority Flora species as part of rehabilitation activities.

More than 90 vegetation types, ranging from *Eucalyptus victrix* open woodlands to *Triodia* hummock grasslands, were mapped across the area; although not all will be disturbed as part of the mine development. Five mosaic units incorporating at least two vegetation types were also noted. The vegetation cover can range to 80% projected foliar cover.

Vegetation condition ranged from Excellent to Poor. The areas of poorer conditions were largely confined to drainage lines and associated floodplains, with some degradation in areas of Mulga and clay plains. The cause of the degradation is mostly due to higher abundances of weed

species (e.g. **Cenchrus* species) and evidence of moderate to heavy grazing, which is not unusual given the dominant pastoral land use is rangeland cattle grazing.

In general, Eliwana is characterised by a mosaic of open hummock grasslands and shrublands of Triodia, Acacia and Eucalypt species. Dominant vegetation communities include (by associated land unit):

- Ridgeline land unit: ElAmTw - *Eucalyptus leucophloia* subsp. *leucophloia* and/ or *Corymbia hamersleyana* mid open woodland over *Acacia maitlandii* mid sparse shrubland over *Triodia wiseana* low hummock grassland.
- Low Rise land unit: ChAiTw/ElAbTlo - The vegetation associations of this mosaic is described by *Corymbia hamersleyana* and/or *E. leucophloia* subsp. *leucophloia* low open woodland over *Acacia inaequilatera* and/or *A.bivenosa* mid sparse shrubland over *Triodia wiseana* low open hummock grassland and *Eucalyptus leucophloia* subsp. *leucophloia* low open woodland over *Acacia bivenosa* mid open shrubland over *Triodia longiceps, T.wiseana* low open hummock grassland.
- Stony Plain land unit: EgAatTe - *Eucalyptus gamophylla* mid sparse mallee shrubland over *Acacia atkinsiana, A. bivenosa, A. exigua* tall sparse shrubland over *Triodia epactia, T. wiseana* mid hummock grassland.
- Drainage line land units
    - ExAcTHtTe - *Eucalyptus xerothermica* low open woodland over *Acacia citrinoviridis*, *A. bivenosa*, *A. pyrifolia* tall sparse shrubland over *Themeda triandra*, *Chrysopogon fallax* mid tussock grassland over *Triodia epactia* mid hummock grassland in low water availability areas; or
    - EvAcCcErIt - *Eucalyptus victrix* low-mid open woodland over *Acacia citrinoviridis* and/ or *Melaleuca glomerata* tall open shrubland over **Cenchrus ciliaris*, *Eriachne tenuiculmis* mid open tussock grassland when groundwater is present.

### Conservation significant vegetation communities

Four vegetation types of conservation significance were observed in the area and have the potential to or will be disturbed by mining activities. These vegetation types group into two significance classes:

1. Priority Ecological Communities: Priority 3 "*Triodia* sp. Robe River assemblages of mesas of the West Pilbara":
    - ElApTspr - *Eucalyptus leucophloia* subsp. *leucophloia* low open woodland over *Acacia pruinocarpa* tall sparse shrubland over *Triodia* sp. Robe River (M.E. Trudgen et al. MET 12367) low hummock grassland

- ElAcAarTwTspr - *Eucalyptus leucophloia subsp. leucophloia* isolated low trees-low open woodland over *Acacia citrinoviridis*, *A. pruinocarpa* low open woodland over *Acacia arida*, *A. maitlandii* mid sparse-mid open shrubland over *Triodia wiseana*, *T.* sp. Robe River (M.E. Trudgen et al. MET 12367) low hummock grassland

These communities are located north of the mine valley, near and within the planned mine services areas on a specific geological mesa formation, and may be directly and indirectly impacted. A vegetation community of a similar composition may be returned, where practicable, in areas subject to light disturbance as part of rehabilitation activities.

2. Groundwater Dependent Ecosystems (**GDE**): Vegetation communities containing known obligate or facultative phreatophytic vegetation species identified in the area include:

    - Potential GDEs

        - EvAcCcERIt - *Eucalyptus victrix* low-mid open woodland over *Acacia citrinoviridis* and / or *Melaleuca glomerata* tall open shrubland over **Cenchrus ciliaris*, *Eriachne tenuiculmis* mid open tussock grassland.

        - EvAcMgERIt - *Eucalyptus victrix* low-mid open woodland over *Acacia citrinoviridis*, *Melaleuca glomerata* tall sparse shrubland over *Eriachne tenuiculmis* mid sparse tussock grassland.

    - GDEs

        - EcAcEUaTe - *Eucalyptus camaldulensis* subsp. *refulgens*, *E. victrix* mid woodland over *Acacia citrinoviridis*, *Melaleuca glomerata* tall open shrubland over *Eulalia aurea* mid sparse tussock grassland over *Triodia epactia* low sparse hummock grassland.

        - MaMgCYPv - *Melaleuca argentea* (*Eucalyptus camaldulensis* subsp. *refulgens*) mid open forest over *Melaleuca glomerata*, *Acacia coriacea* subsp. *pendens* tall sparse shrubland over *Cyperus vaginatus* mid sparse sedgeland over *Eriachne tenuiculmis* low sparse tussock grassland.

    Associated with drainage lines, these communities may be directly or indirectly disturbed through mining activities. Remnants communities will only receive incident rainfall once surface water flows are truncated from upstream. These remnants will likely experience changes in vegetation structure and species composition as a result of receiving significantly reduced surface water flows, leading to a decline in vegetation health followed by a loss of biomass, before the community recalibrates to the reduced water availability and establishes a new equilibrium. In some instances support, including increased weed management and erosion controls, may be required to minimise impacts to adjacent vegetation communities during this transition.

Where direct disturbance of these communities is required it is likely that the hydrological regime associated with the creek will also have been altered. Consequently it is unlikely that these communities can be returned on closure.

## Culturally significant vegetation

Table 23 lists the local flora species of significance to some Aboriginal People, identified from published literature (e.g. Charles & Ellery (Coppin) (2015), Hayes & Hayes (2007), Vitenbergs & Brehaut (2001)). Further consultation with Traditional Owners will be undertaken during the life of the mine to identify opportunities to incorporate plants of cultural value into rehabilitation where appropriate.

**Table 23. Flora species of general significance to Aboriginal People**

| Botanical name | Common name | Use |
|---|---|---|
| *Acacia ampliceps* | Salt wattle | For healing and ceremony |
| *Acacia ancistrocarpa* | Fitzroy wattle | Edible seeds, for healing and ceremony |
| *Acacia aneura* | Mulga | Edible galls, used for making spears, woomeras, clubs, digging sticks, sandals |
| *Acacia arida* | Arid wattle | For healing and ceremony |
| *Acacia atkinsiana* | Atkin's wattle | Edible galls, good for finding edible grubs |
| *Acacia bivenosa* | Two-nerved wattle | Good for finding edible grubs, used for making houses, brooms |
| *Acacia citrinoviridis* | Jam tree | Used for making spears, woomeras |
| *Acacia colei* | Cole's Wattle | Edible gum, used for making hunting spears |
| *Acacia coriacea* subsp. *pendens* | Leather-leaved wattle | Edible seed, used for making spears and boomerangs |
| *Acacia dictyophleba* | Sandpaper wattle | Used to make houses, brooms, |
| *Acacia exilis (exigua)* | | Edible seeds |
| *Acacia inaequilatera* | Camel bush | Edible seeds, seeds burnt and used to make body paint, used for healing and ceremony |
| *Acacia maitlandii* | Spiky wattle | Edible gum |
| *Acacia monticola* | Gawar | Used for making spear points |
| *Acacia pruinocarpa* | Gidgee | Edible gum |
| *Acacia pyrifolia* | Kanji | Edible gum, edible seeds |
| *Acacia synchronicia* | Barbi bush | Used for making spears, clubs, axe handles, fence posts |
| *Acacia tenuissima* | | Edible seeds |
| *Acacia tetragonophylla* | curara | Edible seeds, used for making boomerangs |
| *Acacia tumida* var. *pilbarensis* | Pindan wattle | Used for making hunting spears |
| *Acacia xiphophylla* | Snakewood | Edible seeds, gum, roots, good for finding edible grubs, used for making boomerangs |

| Botanical name | Common name | Use |
|---|---|---|
| **Aerva javanica* | Kapok bush | Seed heads used for pillow stuffing |
| *Aristida contorta* | Bunched kerosene grass | Used to start fires, hair lotion |
| *Calandrinia* sp. | Parakeelya | Edible root |
| *Capparis lasiantha* | Wild passionfruit, Split jack | Edible Plant, |
| *Capparis spinosa* | Caper bush | Edible Plant, for healing and ceremony |
| *Capparis umbonata* | Wild orange | Edible plant |
| **Cenchrus ciliaris* | Buffel grass | Eaten by kangaroos |
| **Cenchrus setigerus* | Birdwood grass | Fire starter |
| *Cleome viscosa* | Tickweed | For healing and ceremony |
| *Codonocarpus cotinifolius* | Cork hopbush, Native poplar | For healing and ceremony |
| *Cucumis* sp. | Wild melon | Edible plant |
| *Cucumis melo* | Wild cucumber | Edible plant |
| *Cullen leucanthum* | | Used for making hunting spears |
| *Cymbopogon ambiguus* | Scent grass | For healing and ceremony |
| *Cyperus vaginatus* | Stiffleaf sedge | Used to make fishing nests, baskets |
| *Dysphania rhadinostachya* | Crumbweed | Edible seeds |
| *Dysphania kalpari* | Rats tail | Seeds ground to make damper |
| *Enchylaena tomentosa* | Ruby saltbush | Edible Plant, |
| *Eucalyptus camaldulensis* | River gum | Good for finding edible grubs, for healing and ceremony |
| *Eucalyptus deserticola / Corymbia deserticola* | Desert bloodwood | Good for finding honey |
| *Eucalyptus gamophylla* | Twin-leaf mallee | Good for finding honey |
| *Eucalyptus hamersleyana / Corymbia hamersleyana* | Bloodwood | Edible galls, good for finding honey, lerp or honeydew, for healing and ceremony |
| *Eucalyptus leucophloia* | Snappy gum | Good for finding honey, lerp or honeydew, used to make spears, shields, hitting sticks |
| *Eucalyptus victrix* | Blackheart gum | Good for finding edible grubs, lerp |
| *Eucalyptus xerothermica* | Pilbara box | Lerp or honeydew |
| *Erempphila cuneifolia* | Emu Bush | For healing and ceremony |
| *Eremophila fraseri* | Turpentine bush, emu bush | For healing and ceremony |
| *Eremophila longifolia* | Berrigan | For healing and ceremony, edible nectar |
| *Ficus brachypoda* | Rock Fig, Wild fig | Edible plant |
| *Gossypium robinsonii* | Desert rose, wild cotton | Used for making spears, dancing sticks, sandals |
| *Grevillea pyramidalis* | Caustic bush | Yellow paint from bark, edible nectar |
| *Grevillea wickhamii* | Wickham's grevillea | Edible nectar, edible gum, edible fruit |

| Botanical name | Common name | Use |
|---|---|---|
| *Hakea lorea* | Honey hakea | Edible flower or nectar, for healing and ceremony |
| *Ipomoea muelleri* | Morning glory | Edible root |
| *Lepidium platypetalum* | Native mustard bush | For healing and ceremony |
| *Melaleuca argentea* | Cadjeput, paperbark | Water, good for finding honey, used for making yandies, shields, spears, houses, firesticks |
| *Melaleuca eleuterostachya* | Desert paperbark | Lerp or honeydew |
| *Melaleuca glomerata* | Tea-tree | Used to make shade houses, brooms |
| *Petalostylis labicheoides* | Cassia | Used for making hunting spears |
| *Porana commixta (Duperreya commixta)* | Bush bean | Edible plant |
| *Portulaca oleracea* | Pigweed | Ground to make damper |
| *Psydrax latifolia* | Conkleberry, native plum | Edible plant |
| *Psydrax suaveolens* | Wild currant | Edible plant |
| *Pterocaulon sphaeranthoides* | | For healing and ceremony |
| *Ptilotus exaltatus (nobilis)* | Mulla mulla | For healing and ceremony |
| *Ptilotus obovatus* | Cotton bush | For healing and ceremony |
| *Rhyncharrhena linearis* | Bush bean | Edible plant, |
| *Santalum lanceolatum* | Northern Sandalwood | Edible plant, |
| *Santalum spicatum* | Sandalwood | Edible plant, |
| *Sarcostemma vimonale* subsp. *Austral (Cynanchum viminale* subsp. *australe)* | Caustic vine | For healing and ceremony |
| *Scaevola spinescens* | Currant Bush | Edible plant |
| *Senna notabilis* | Cockroach bush | Good place to find grubs |
| *Sesbania cannabina* | Sesbania pea | Used for making shields, yandies |
| *Solanum horridum* | Wild gooseberry | Edible plant, use the leaves for washing |
| *Solanum phlomoides* | Wild tomato | Edible plant |
| *Solanum diversiflorum* | Bush tomato | Edible plant |
| *Solanum lasiophyllum* | Flannel bush/bush tomato | Edible plant, |
| *Stemodia grossa* | Vicks Bush | For healing and ceremony, fish poison |
| *Tinospora smilacina* | Snakevine | Edible tuber |
| *Trachymene oleracea* | Lace flower | Used for making drinking straws |
| *Trichodesma zeylanicum* | Northern bluebell | Used to make firesticks |
| *Triodia epactia* and *Triodia pungens* | Soft spinifex | Used to make wax, fishing nets, houses, seeds ground to make damper |
| *Typha* sp. | Bulrush | Edible root |

### 8.4.2 Seed

The seed bank in the topsoil stockpiles is expected to persist for a limited number of years. As a general guide grasses are expected to persist for less than 18 months and most plant species less than 5 years, while acacias and eucalypts may persist for up to 10 years.

When rehabilitation activities are undertaken within 2 years of the initial disturbance, the seed bank within the topsoil stockpile is generally considered to be adequate to return vegetation species diversity. For example, rehabilitation commenced following construction disturbance along linear corridors, or following exploration drilling programs.

Most mine disturbance, however, is not expected to be rehabilitated within 2 years. As a consequence the topsoil seed bank may need to be supplemented with additional seed, or ancillary seeding may be required after the initial rehabilitation to return specific missing plant species, or, where quality topsoil is not available, native seed may be sown directly into the ground to establish a native ecosystem.

The seed used in rehabilitation activities is selected based on those dominant species of the surrounding communities. Table 24 lists the common vegetation species by land unit that will be considered as part of the seed selection process.

**Table 24. Common species found in each Land Unit for use in seed selection.**

| Land Unit | Overstorey | Mid-storey | Understorey |
|---|---|---|---|
| Ridgeline | *Corymbia hamersleyana*<br>*Eucalyptus leucophloia* subsp. *leucophloia*<br>*Hakea chordophylla* | *Acacia maitlandii*<br>*Acacia pyrifolia* var. *pyrifolia*<br>*Acacia arida*<br>*Acacia marramamba*<br>*Acacia pruinocarpa*<br>*Senna glutinosa subsp. glutinosa*<br>*Senna glutinosa* subsp. *pruinosa* | *Aristida holathera*<br>*Cymbopogon ambiguus*<br>*Eriachne mucronata*<br>*Paraneurachne muelleri*<br>*Triodia wiseana*<br>*Triodia* sp. Robe River M.E. Trudgen et al. MET 12367) (P3) |
| Low Rise | *Corymbia hamersleyana*<br>*Eucalyptus leucophloia* subsp. *leucophloia* | *Acacia bivenosa*<br>*Acacia inequilateral*<br>*Senna artemisioides* subsp. *oligophylla*<br>*Senna glutinosa subsp. glutinosa*<br>*Senna glutinosa* subsp. *pruinosa* | *Aristida holathera*<br>*Themeda triandra*<br>*Triodia angusta*<br>*Triodia longiceps*<br>*Triodia wiseana* |
| Stony Plain | *Eucalyptus gamophylla*<br>*Corymbia hamersleyana* | *Acacia atkinsiana*<br>*Acacia bivenosa*<br>*Acacia exigua*<br>*Acacia monticola*<br>*Acacia pyrifolia*<br>*Senna glutinosa* subsp. *glutinosa* | *Paraneurachne muelleri*<br>*Themeda triandra*<br>*Triodia epactia*<br>*Triodia wiseana* |

| Land Unit | Overstorey | Mid-storey | Understorey |
|---|---|---|---|
| | | *Indigofera monophylla* | |
| Drainage Line | *Corymbia hamersleyana*<br>*Eucalyptus xerothermica* | *Acacia bivenosa*<br>*Acacia citrinoviridis*<br>*Acacia pyrifolia*<br>*Acacia tumida* var. *pilbarensis*<br>*Tephrosia rosea* | *Aristida pruinosa*<br>*Chrysopogon fallax*<br>*Cymbopogon ambiguous*<br>*Eriachne tenuiculmis*<br>*Themeda triandra*<br>*Triodia epactia* |

Fortescue opportunistically collect and store local provenance seed for use in progressive rehabilitation activities, in accordance with *Seed Collection and Management Guidelines*. This guideline addresses issues related to timing of seed collection, quality and viability of seed, seed dormancy release and seed storage including:

- Options to burn or dry capsules, pods and cones to release seeds and, when required, treating seed with insecticide and fungicide prior to storage;
- Storing clean seed in dry, insect and vermin proof containers, labelled with details of the species, date collected and collection location; and
- Applying pre-sowing treatment, including scarification, heat and / or smoke.

Pilbara plants have evolved to thrive under the extreme climatic variability experienced in the Pilbara. However, seed germination rates are expected to decline with extended storage. Thus continuous seed collection and storage over the life of the mine is not considered to be an effective management strategy. Local provenance seed, however, is not commercially available in sufficient quantities to support large scale rehabilitation activities. Consequently, adequate seed supply is a consideration for the MCP.

### 8.4.3 Weeds

Weeds pose a threat to natural ecosystems and the native species they support predominantly through the loss of biodiversity as a consequence of species competition. The *Weed Management Plan* is used to identify weed management and monitoring measures to minimise the introduction and spread of weeds established within and adjacent to Fortescue controlled sites, in accordance with the Biosecurity and Agriculture Management Act 2007 (**BAM Act**).

The *Weed Management Plan* targets priority weed species, such as:

- Weeds of National Significance listed by DEE;

- Declared Pests that require management listed by Department of Primary Industries and Regional Development; and
- Environmental weeds listed by DBCA as requiring eradication or control.

The list of priority weed species is reviewed and revised regularly, in line with external guidance. This review process will be continued over the life of the mine and through closure as part of closure weed monitoring / maintenance activities.

A total of 13 introduced or weed species have been recorded in the local region. None of the species are listed as Weeds of National Significance, although several species are listed as environmental weeds. Introduced flora species include:

- **Aerva javanica* (Kapok Bush)
- **Argemone ochroleuca subsp. ochroleuca* (Mexican Poppy)
- **Bidens bipinnata* (Beggartick)
- **Bothriochloa pertusa* (Indian Bluegrass)
- **Cenchrus ciliaris* (Buffel Grass)
- **Cenchrus setiger* (Birdwood Grass)
- **Datura leichhardtii* (Native Thornapple)
- **Euphorbia hirta* (Asthma Plant)
- **Malvastrum americanum* (Spiked Malvastrum)
- **Setaria verticillata* (Whorled Pigeon Grass)
- **Solanum nigrum* (Blackberry Nightshade)
- **Sonchus oleraceus* (Common Sowthistle)
- **Vachellia farnesiana* (Mimosa Bush)

### 8.4.4 Fauna

#### Vertebrate Terrestrial Fauna

Multiple baseline and specific fauna surveys have been completed identifying more than 20 mammal species, 80 bird species, 70 reptile species, 3 amphibian species and 6 introduced fauna species. Of these recorded species a total of 12 are considered to have conservation significance (Table 25), another 24 are considered significant that could occur in the area. However, as development of Eliwana will not impact the conservation significance of any fauna species, restoration of habitat associated with vertebrate terrestrial fauna species is not an objective of the MCP.

Gorges and gullies across the area provide important habitat for EPBC Act listed species including the Northern Quoll, Pilbara Leaf-nosed Bat and Pilbara Olive Python.

**Table 25. Significant fauna species recorded in the local area.**

| Name | Conservation status | | DBCA Priority Status | Noted habitat and implications for closure |
|---|---|---|---|---|
| | Federal | State | | |
| Northern Quoll (*Dasyurus hallucatus*) | Endangered | Schedule 2 – Endangered | | All – favours gorge/gullies<br>Inconclusive scat record, photographic records suggest foraging use only. |
| Olive Python (*Liasis olivaceus barroni*) | Vulnerable | Schedule 1 – Vulnerable | | Ridgeline, Low Rise and Stony Plain units |
| Pilbara Leaf-nosed Bat (*Rhinonicteris aurantius*) | Vulnerable | Schedule 1 – Vulnerable | | Ridgeline, Low Rise and Stony Plain units |
| Rainbow Bee-eater (*Merops ornatus*) | Migrant | Schedule 3 – Migrant | | Low Rise, Stony Plain and Drainage Line units |
| Fork-tailed Swift (*Apus pacificus*) | Migrant | Schedule 3 – Migrant | | Whole area |
| Peregrine Falcon (*Falco peregrinus*) | | Schedule 7 – Other Specially protected fauna | | Whole area. |
| Australian Bustard (*Ardeotis australis*) | | | Priority 4 | Low Rise, Stony Plain and Drainage Line units |
| Western Pebble-mound Mouse (*Pseudomys chapmani*). | | | Priority 4 | Resident. Ridgeline, Low Rise and Stony Plain units |
| Ghost Bat (*Macroderma gigas*) | | | Priority 4 | Ridgeline, Low Rise and Stony Plain units |
| Long-tailed Dunnart (*Sminthopsis longicauda*) | | | Priority 4 | Low Rise and Stony Plain |
| Lined soil-crevice skink (*Notoscincus butleri*) | | | Priority 4 | Low Rise and Stony Plain |
| Bush Stone-curlew (*Burhnius grallarius*) | | | Locally significant | Low Rise and Stony Plain<br>Listed as P4 until recently, it has been included since it is uncommon and patchily distributed. |

## Short Range Endemic Species

Twenty-two short range endemic (**SRE**) species have been identified in the local area, located in gorges/gullies, in woodland adjacent to drainage lines, and on south-facing rockface/ridgelines. Only seven of these were restricted to the survey area. Through the use of biological and habitat surrogates, three of these seven species are considered to be unlikely to be restricted to the mine development envelope. The remaining four species were considered to be either potential SRE or confirmed SRE, namely:

- Confirmed SRE: Antichiropus 1021DNA02 This keeled millipede was located in woodland in a drainage line.
- Potential SREs: Conothele 1021DNA02 and Synothele 1021DNA02 Both these invertebrate species are trapdoor spiders.
- Dampetrus 1021DNA02

Habitat restoration targeting SREs is not proposed as part of this MCP.

## Aquatic Fauna

Permanent waterholes along Caves Creek and Duck Creek provide a dry season refugia for fish, reptiles and amphibious species. One species of fish has been recorded in the survey area (the Spangled Perch - *Leiopotherapon unicolour*). However it is likely that other species recorded in the region may also be present in any permanent waterholes, including Bony Bream (*Nematalosa erebi*), Western Rainbowfish (*Melanotaenia australis*), Hyrtl's Tandan (*Neosilurus hyrtlii*), Barred Grunter (*Amniataba percoids*) and Fortescue Grunter (*Leiopotherapon aheneus*) (a Priority 4 listed species).

While permanent waterholes along Caves Creek or Duck Creek are not expected to be directly impacted by mining activities, indirect impacts to aquatic fauna can occur through changes to water quality or hydrological regimes. These impacts include, but are not limited to: water toxicity / bioaccumulation / biomagnification etc., changes that influence the type of plants growing in the waterholes thereby modifying / interrupting the food web, and changes that alter fauna abundance (higher or lower) thereby influencing food webs. Further studies are required to demonstrate the proposed closure strategies will not indirectly impact or otherwise degrade the hydrological regimes or water quality, to achieve the closure objectives.

## Subterranean Fauna

Nine stygofauna species and 17 troglofauna have been identified within the planned disturbance footprint, suggesting a moderate species richness. Subterranean fauna habitat will

be removed during mining. Populations of subterranean fauna outside the impact area will not be affected and therefore the species will survive beyond the impact area. Habitat restoration targeting subterranean fauna is not proposed as part of this MCP.

### 8.4.5 Pests

Like weeds, pest animals pose a threat to natural ecosystems and the native species they support. Of the six introduced terrestrial fauna species, *Mus musculus* (house mouse), *Felis catus* (feral cat), *Bos taurus* (European cattle), *Equus asinus* (donkey), *Equus caballus* (horse), and *Canis lupus* (dog), cattle are likely to influence closure the most. This concern is due to flora biodiversity being influenced by overgrazing which could compromise vegetation and restoration outcomes, as well as cattle and other ungulate (hoofed) mammals traversing areas for grazing purposes are also known to increase landform instability and erosion rates.

Pest animals also have the capacity to carry and transmit diseases to native flora (plant pathogens). Management of feral herbivores is a consideration for monitoring and maintenance activities.

## 8.5 Contamination

For the purpose of this MCP, contamination relates to any substance that is present in or on land or water at above background concentrations and presents, or has the potential to present, a risk of harm to human health or any environmental value. For a contamination risk to exist there must be a contaminant source, a receptor (human health or environmental value) and a pathway connecting them.

During operations, potential contaminant sources are identified and minimised through implementation of the various management plans including: *Chemical and Hydrocarbon Management Plan*, *Life of Mine Geochemistry Programme Acid and/or Metalliferous Drainage Sampling Plan, Asbestos Management* and *Waste Management Plan*.

### AMD risks

The potential for geologically derived contamination of water bodies has been reviewed as part of the *Conceptual Site Model and Operational Risk Assessment*, and after closure as part of the *Geochemistry Risk Assessment for Closure* (Appendix 4). The review demonstrated AMD risks may be present, related to:

- Deleterious waste rock and sub-grade ore (which may remain on closure) with the potential to contaminate local soils, local creek tributaries and associated surficial groundwater aquifers, and Boolgeeda Creek;
- Tailings with the potential to contaminate the Wittenoom aquifer; and
- Deleterious geology left in situ (unmined) in the pit walls, especially when combined with exposed groundwater tables (creating permanent pit lakes) and / or connected to the major creek tributaries.

Further risks to the ecosystem are also possible through the food web, linked to direct ingestion, bioaccumulation and biomagnification of potentially toxic metals if present in soil or water. The presence of toxic metals may also conflict with post-closure and adjacent beef cattle production pastoral land use.

### Hydrocarbon and other chemical risks

Contaminated soil, sediment and water will be contained, captured and treated onsite through bioremediation. It is recognised, however, that there is the potential for contaminants to remain unidentified during the life of the operation. Consequently, contaminated sites assessment and associated clean-up is a consideration for decommissioning activities.

# 9. SUPPORT SERVICES AREA CLOSURE STRATEGY AND ANALYSIS

The mine support service area encompass all of the mining related activities undertaken outside the primary pit and waste dumping areas (the mine valley), including disturbance performed as part of the Minor and Preliminary Work development stage. Land uses in this area during mining include administration areas, workshops, camps and airstrips. The OPF, tailings storage facility and train load out are also located in this area.

Once infrastructure is removed via the decommissioning, dismantling, demolition and disposal process, the land is rehabilitated according to the relative condition of the ground (e.g. light disturbance or heavy disturbance).

Additional management is also required for areas that may not have been directly impacted by the operation but have the potential to be indirectly impacted. This includes areas managed and / or monitored during the life of the mine to mitigate or minimise indirect impacts.

## 9.1 Decommissioning, dismantling, demolition and disposal

### 9.1.1 Retained infrastructure

Fortescue will seek to retain and repurpose infrastructure where a new owner can identify an alternate public good or alternate use for infrastructure. Opportunities to retain infrastructure identified to date are listed in Table 26. Discussions with stakeholders are ongoing, and are unlikely to be resolved until closure activities are due to commence. Discussion will include condition of the asset on transfer, transfer of liability, and other legal requirements necessary to support a transfer ownership.

**Table 26. Retained infrastructure opportunities**

| Asset | Opportunity | Future owners |
|---|---|---|
| Airstrip | Retain for other land user purposes, e.g. other mining activities, or emergency services | Fortescue, other mining company, community, local government |
| Access roads | Retain for access management and monitoring, community land access | Fortescue, community |
| Rail and rail loop | Retain as State Asset, in accordance with State Agreement | State of Western Australia |
| Groundwater bores | Retain for other land user purposes, e.g. water supply | Community |

A list of existing assets has been compiled for the purpose of cost estimation, but is not discussed or presented in this MCP.

### 9.1.2 During operations

During the life of the operations infrastructure will be decommissioned, dismantled / demolished and / or disposed in accordance with applicable health, safety and environment approvals, permits and protocols.

Potential contamination identified during operational phase decommissioning activities will be managed and / or ameliorated in accordance with the relevant environmental conditions.

### 9.1.3 End of mine life

Approximately two years prior to mine closure, a Decommissioning and Demolition Study will commence. The Study will ensure decommissioning, dismantling, demolition and disposal activities are undertaken in a safe, co-ordinated, efficient and cost effective manner at the end of the mine life. The Study will consider:

- Re-deployment and sale of mobile fleet and equipment and other transportable assets, i.e. salvageable equipment, demountable buildings, scrap metal etc.;
- Decommissioning, dismantling and demolition management and schedule, including:
    - delineation of preparatory activities to be undertaken (e.g. isolation and clean-up) prior to closure;
    - activities requiring expert contractors, i.e. demolition;
    - workforce management and transition;
- Specific work methods and waste management, including:
    - Landfill and associated waste management facility requirements;
    - On-site or off-site decontamination, bioremediation and other disposal options;
- Quality controls, environmental management, workplace health & safety, including:
    - licenses, permits and approvals;
    - monitoring activities and key performance indicators;
- Stakeholder / regulatory interface.

Specific work methods and waste management will be developed to include the following activities:

- Clean, prepare and remove saleable assets.
- Construct / expand landfill site and associated waste management and recycling facilities.
- Purge, clean and decontaminate ore processing facilities, chemical storage including gas and liquids (including diesel, oils, processing facility chemicals etc.), waste storage water storage and any associated service infrastructure.
- Isolate and terminate power, gas, compressed air etc. to all buildings, structures requiring demolition. Provide temporary service connection points at the proposed demolition site boundary where required.
- Demolish / dismantle structures:
    (i) Fence all structures requiring demolition, to control access.
    (ii) Separate and stockpile scrap materials and dispose of waste as appropriate.
    (iii) Remove in-ground foundations (i.e. concrete footings, slabs, piles etc.) to 1m below ground level, dispose of waste and backfill with waste rock, or alternatively brake-up and cover with 1m of waste rock.
    (iv) Bioremediate hydrocarbon contaminated soil, if encountered.
- Remove and dispose of other service related infrastructure located on the surface (e.g. water pipelines). Buried service related infrastructure (e.g. pipelines, power cabling, sump liners) to be left in situ, unless excavation and removal is required to manage a specific risk.
- Complete contaminated site assessment.

## 9.2 Light Disturbance closure domain

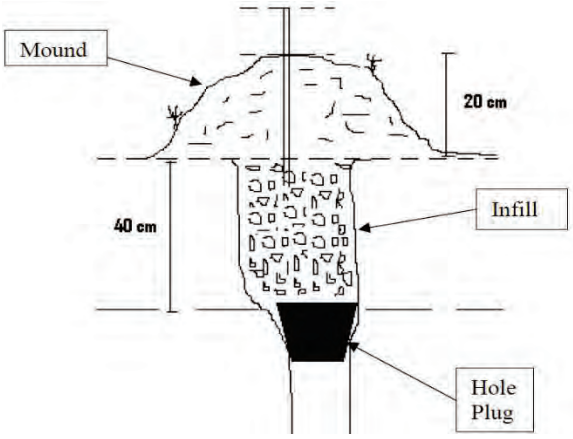
Light Disturbance areas are defined as locations that retain their original topography and connectivity to undisturbed vegetation. As part of the disturbance activities soil and vegetation have (usually) been removed and stockpiled adjacent to the area prior to disturbance.

Areas classified as light disturbance include drill holes, drill pads tracks, access roads, shallow free-draining borrow areas, some laydown areas and linear infrastructure disturbance. Areas of

light disturbance are often required for a limited time and provide opportunities for progressive re-vegetation during the mine life.

### 9.2.1 Light Disturbance closure strategy

Closure landform and vegetation strategies in light disturbance areas include:




- Cut and remove drill collars to a minimum depth of 400 mm below the surface. Insert appropriately sized conical concrete plug to achieve tight fit, then mound dirt over hole such that water drains away.
- Remove any plastic liners from sump and dispose of appropriately. Place sample piles and cyclone spoil into the sump, or otherwise blend with surface materials
- Knock windrows down, level / contour blend area to a free draining surface to match surrounding topography.
- Distribute stockpiled topsoil and vegetation, where available, across surface, then lightly rip area perpendicular to the slope of the ground to minimise erosion by surface water.

**Figure 11. Examples of light disturbance rehabilitation. Left: Track scarification (ripped). Centre: Contour blending. Right: Topsoil and vegetation return on drill pad.**

## 9.2.2 Current performance of Light Disturbance rehabilitation

The following case example illustrates the successful rehabilitation of light disturbance areas at Fortescue managed operations.

### Case Example: Fortescue's Shallow Borrow Pit Rehabilitation

Shallow borrow pits are rehabilitated to the Fortescue's *Borrow Pit Management Procedure* (45-PL-EN-0018). Rehabilitated in 2015, Borrow Pit A (Figure 12) was rehabilitated by reshaping the landscape to minimise ponding within the rehabilitated area. Topsoil was replaced and the land was subsequently contour ripped.


**2016** **2017**

**Figure 12. Case example of self-draining borrow pit rehabilitation at a Fortescue managed operation.**

In 2016, the site was recorded on having vegetation cover of 13%, with a number of juvenile *Triodia* individuals recorded and a few *Acacia* individuals. The site has been assessed as continuing to develop successfully, with over 40% of perennial plant species coverage recorded in 2017, with approximately 25% of this cover being *Triodia* species (primarily *Triodia wiseana*). The development of perennial shrubs and grasses can be seen in Figure 13. Some minor soil movement has occurred and flattening of the troughs was observed, but overall the borrow pit is stable.

2016

2017

Figure 13. Re-establishment of perennial vegetation at Borrow Pit A.

### 9.2.3 Knowledge gaps and further work

A summary of the planned Light Disturbance domain closure strategy and further studies required to the support the strategy are described in Table 28. This list will be updated as further information on the design and performance of the rehabilitation is realised.

Table 27. Light Disturbance closure domain tasks and further studies.

| Tasks | Further studies required |
|---|---|
| Cut and remove drill collars to 40 cm, insert lug and backfill with mound. | No further studies |
| Dispose of plastic sump liners, culverts or other infrastructure. | |

| Tasks | Further studies required |
|---|---|
| Knock down windrows, reshape pads etc. to create free draining surface blended into natural topography. | |
| Redistribute topsoil, rip / scarify area then return vegetation stockpiles. | • Review rehabilitation performance. Identify potential issues and develop solutions if required. |

## 9.3 Heavy Disturbance closure domain

Heavy Disturbance areas are characterised by heavily altered or compacted soils, relatively small (usually less than 5m high) modifications to the pre-mining topography and blocked or diverted minor water courses, resulting from the construction of landforms to accommodate mine infrastructure.

Areas classified as Heavy Disturbance include, but are not limited to:

- Borrow pits;
- Significant infrastructure: including the ore processing facilities (**OPF**), administration and workshop areas and water storage structures;
- Footprints of waste rock dumps that are reclaimed on closure (also known as temporary waste dumps) leaving less than 5m of waste rock above the pre-mining topography; and
- Land bridges constructed from waste rock that rise up to 5 m above the local terrain.

### 9.3.1 Heavy Disturbance closure strategy

The closure strategies for reshaping the land and returning vegetation for areas identified as Heavy Disturbance are as follows.

#### Landform

Area specific landform rehabilitation plans will be developed to guide earthworks, using the following strategies.

- Heavy Disturbance areas will be reshaped using dozers to create a self-draining landform, then ripped to a depth of 50 cm, perpendicular to the slope direction, to remove compaction and encourage water infiltration.

- Culverts will be removed (if present) and, based on an assessment of the post-closure flow volume, an appropriately sized gap will be cut into the landform to facilitate surface water flow. On the edges of the gap, the banks will be sloped to less than 1V:10H, or otherwise cut back to the pre-mining geometry.
- Where the heavy disturbance area is more than 1,000 $m^2$ with a slope of more than 5 degrees, shallow windrows (<20cm) will be constructed / pushed up on the contour approximately every 50 m to reduce sheet flows and the associated erosion while vegetation is establishing. The shallow windrows are expected to trap leaf litter, nutrients and seeds, to encourage vegetation growth adjacent to the shallow windrows.

Erosion modelling of the waste rock and / or construction materials that have been used to build up areas will be required to establish the appropriate limits for landform slopes.

### Vegetation

Heavy Disturbance areas will be comprised of large flat areas, built up from the original topography using waste rock. As most of the waste rock types are conducive to plant growth, the waste rock creates a deep growth media, similar to the Stony Plain land unit. Thus Heavy Disturbance area are expected to be capable of supporting vegetation communities similar to those observed on the Stony Plain land unit.

Revegetation will be promoted through natural recolonisation from the surrounding vegetated area and by application of seedbank bearing materials such as stockpiled topsoil and vegetation.

- Soil stockpiles that support significant weed populations will be treated prior to use.
- Soil will be placed to an average depth of 100 mm across the surface of the landform. The soil will be lightly ripped into the surface materials, parallel to the slope, using a grader, to create a micro-topography that will trap leaf litter and seeds. Stockpiled vegetation will be pushed across areas where it is available.
- Approximately three years after the topsoil has been returned, when the plants are of a suitable size for authentication, the area will be audited to identify gaps in targeted vegetation community and the appropriate seed mix of local provenance will be developed and applied to encourage gap species to establish.

Further work required to validate this closure strategy includes:

- Commence trials to identify vegetation species emerging from topsoil of different ages on flat to low slopes, waste rock recolonised without topsoil, and identify associated species gaps.

- Develop seed mix and associated seeding regimes necessary to reach desired vegetation community outcomes.

### 9.3.2 Knowledge gaps and further work

A summary of the planned Heavy Disturbance domain closure strategy and further studies required to the support the strategy are described in Table 28. This list will be updated as further information on the design and performance of the rehabilitation is realised.

**Table 28. Heavy Disturbance closure domain tasks and further studies.**

| Tasks | Further studies required |
|---|---|
| Clear pipelines, tanks, sumps. | • Undertake Study to developed Decommissioning, Dismantling, Demolition and Decommissioning Plan. |
| Remove and dispose of mobile equipment and transportable / reusable infrastructure | |
| Remove services to a depth of 0.5m or bury if below. | |
| Remove buildings and footings to a depth of 0.5m. Bury if below. | |
| Remove or remediate any hydrocarbon stained soils. | • Review the site before / after undertaking demolition activities for any areas that may have been subject to unknown spills. |
| Remove culverts and added fill, and return drainage line shape. | No further studies |
| Reshape the landform such that it ties into the surrounding landscape and manages drainage appropriately. | • Undertake erosion modelling of waste rock and construction materials to establish acceptable limits for landform slopes.<br>• Develop an integrated rehabilitation plan that describes how each landform should be shaped to integrate drainage and achieve an acceptable closure outcome.<br>• Design appropriate surface water management structures (if required). |
| Apply stockpiled topsoil and rip, with consideration to slopes, to a depth of 0.5 m. | • Review topsoil inventory to confirm availability and source of topsoil.<br>• Undertake trial to confirm closure strategy achieves expected outcome. |
| Review performance of rehabilitation, identify gap species and undertake ancillary seeding for gap species 3 years after initial works | • Develop seed mix and application plan. |

## 9.4 Tailings Storage Facility closure domain

The Tailings Storage Facility closure domain represents the above ground, valley fill TSF that may or may not be constructed at Eliwana. The domain will be comprised of two subdomains, a

surface subdomain and embankment subdomain, reflecting the different types of closure activities that will be required to rehabilitate the landform. These strategies will be refined in conjunction with detailed design of the TSF.

### 9.4.1 TSF surface subdomain closure strategy

#### Tailings surface

During operation of the facility, waste fines will be managed so as to create a topographic low adjacent to the natural topography, away from the embankment. At the cessation of the operating life the surface is likely to retain a shallow grade, sloping towards the natural topography. The TSF is likely to be positioned towards the top of the local catchment, thus surface water run-on will be limited.

Experience in the Pilbara suggests that the surface of the waste fines may be trafficable, i.e. sufficiently dry so as to facilitate truck movements without causing the truck to bog or the land to subside, approximately 1 to 2 years post-deposition.

Testing completed to date suggests the tailings will not pose a contamination risk. However, further work will be undertaken to validate this assumption once tailings deposition commences. If the potential for groundwater contamination is indicated during the operational testing programme, options to minimise surface water infiltration will be investigated. These options include the use of shedding covers and / or spillways to drain surface water runoff and incident rainfall off the surface and into the local environment.

If tailings materials are benign and unlikely to inhibit plant growth, the surface will be inspected and the susceptibility to erosion will be evaluated. It is possible, due to the gravity-driven deposition method likely to be employed, that coarse particulates will dominate near the embankment outlets with finer, erodible clays being concentrated towards the topographic low. Areas confirmed as being susceptible to wind erosion and likely to create dust will be covered with 10 cm of benign waste rock. No further cover material will be applied if benign.

Assuming the surface topography slopes away from the embankment, and can contain a Probable Maximum Precipitation (**PMP**) event, it is likely that no further physical landscaping or surface water controls will be required.

#### Vegetation

Options to revegetate the surface will differ depending on the surface water treatment required to manage contamination risks. If the tailing proves benign, the surface may be revegetated with

clay and water logging tolerant species often found in drainage lines in the local area. If a cover is required the vegetation may need to be selected based on the type of cover and level of contamination risk, depending on whether plants roots can safely interact with the tailings and whether specific evapotranspiration rates need to be achieved to reduce infiltration. In all cases, due to the significantly changes soil profile and water storage capacity, it is unlikely that the rehabilitated surface will sustain a vegetation community of similar composition to the adjacent undisturbed hills.

### 9.4.2 TSF embankment subdomain closure strategy

#### Embankment stability and rehabilitation

Embankment stability and an associated rehabilitation strategy will be developed as part of the detailed design of the TSF. Long term geotechnical and erosional stability will need to meet the minimum standard recommended by the Australian National Committee on Large Dams (**ANCOLD**) and other specifications as described in the *Tailings storage facilities in Western Australia – code of practice* published by the Resources Safety and Environment Divisions, Department of Mines and Petroleum, Western Australia (2013).

### 9.4.3 Knowledge gaps and further work

A summary of the planned Tailings Storage Facilities domain closure strategy and further studies required to the support the strategy are described in Table 29.

**Table 29. Tailings Storage Facilities closure domain tasks and further studies.**

| Tasks | Further studies required |
|---|---|
| Decommission, remove and dispose of mechanical infrastructure and pipework. | • Undertake Study to developed Decommissioning, Dismantling, Demolition and Decommissioning Plan. |
| Confirm tailings physical and chemical properties are within expected range. | • Undertake test work to establish physical and chemical properties of tailings.<br>• Confirm if ongoing saturation / drainage of tailings will increase contamination risk (potential for contamination of Wittenoom aquifer). |
| Construct surface water control features on fines surface. Cover areas susceptible to dust erosion with more competent materials | • Establish surface water management requirement, in consideration of contamination risk<br>• Review conceptual design options, confirm PMP capacity and undertake detailed design of surface water management.<br>• Identify material sources for controls, i.e. rock for armour, rock mulches etc. |

| Tasks | Further studies required |
|---|---|
| Stabilise embankment | • Review conceptual design options and undertake detailed design of embankment rehabilitation.<br>• Undertake field trials to establish if rock mulch is required to prevent gully erosion.<br>• Confirm volumes, size / grade and source of rock for rock mulch, if required. |
| Rip topsoil and rock (if required), and seed areas as required, excluding berms. | • Undertake research to confirm clay pan communities can be established on TSF surface.<br>• Establish seed mixes for surface and WRL slopes. |
| Review performance of rehabilitation, identify gap species and undertake ancillary seeding for gap species 3 years after initial works | • Undertake rehabilitation trials to identify likely gap species.<br>• Identify opportunities to reduce the number of gaps species as part of initial rehabilitation activities. |

## 9.5 Indirect Impact closure domain

The Indirect Impact closure domain will be used to identify and manage key stakeholder values located downstream of or immediately adjacent to disturbed areas that must be retained or returned on closure. This domain will include site specific locations of environmental and heritage value, as discussed in Section 5.3 *Stakeholder values*.

### 9.5.1 Indirect Impact closure strategies

During the operation of the mine, Fortescue will employ a range of management measures to reduce the potential for sites and places of value to be indirectly impacted. Where there is high risk for potential impact to a specific site or place of value specific management plans may be developed in consultation with key stakeholders. These site / place specific management plans are reviewed and revised throughout the mine life, to reflect the changing values and sources of potential impact. Plans in force at the end of the mine life will continue to be implemented, where relevant, in order to maintain the values beyond closure.

Heritage places will be managed in accordance with Fortescue's *Guideline for the Management of Aboriginal Cultural Heritage* to minimise the potential for indirect impacts. Heritage places will be audited to ensure no impact has occurred as a result of operational or closure activities.

Safe access routes to the heritage places will also be reviewed with Traditional Owners. Where required, safe access routes will be demarcated in a culturally appropriate manner.

### 9.5.2 Knowledge gaps and further work

A summary of the planned Indirect Impact closure strategies and further studies required to the support the strategy are described in Table 30.

**Table 30. Indirect Impact closure domain tasks and further studies.**

| Tasks | Further studies required |
|---|---|
| Confirm no indirect impacts to nominated environmental value monitoring sites | • Review and revise plans in consideration of closure strategies, manning levels and site support for post-closure monitoring and maintenance. |
| Confirm no indirect impact to heritage places | |

# 10. MINE VALLEY CLOSURE STRATEGY AND ANALYSIS

The mine valley comprises the primary pit and waste dumping areas, located south of the mine services areas. Land uses in the area are expected to include pits, waste dumps, ore stockpiles, low grade (uneconomic) ore stockpiles, haul roads, land bridges, Run-of-Mine (**ROM**) pad and heavy vehicle laydown areas.

### Managing mine development and closure planning uncertainty at Eliwana

The layout of the mine valley will evolve over the life of the mine, such that the end of mine life layout for Eliwana is difficult to predict with accuracy at this stage of the mine development. The layout of the mine will be developed in response to future activities, including but not limited to:

1. Future detailed geological and geotechnical infill drilling programs. These programs cannot be undertaken until after permission to mine is received due to the ground disturbance created. These programs confirm the ore grades, which are used to differentiate economic ore from waste rock / sub-economic ore. They are also used to refine the wall angles to ensure the pits are suitably stable. The results from these programs influence the location, number and size of the pits, and subsequently the geological make-up and size of the waste dumps and position of haul roads.
2. Reconciliation and mine safety reviews. Reconciliation activities are undertaken as the rock is excavated and actual conditions are revealed in full. Changes to the pit and haul roads, for example, will be made based on the observed geological and geotechnical conditions to ensure the mine provides a suitably safe workplace.
3. Product strategy, future approvals and other stakeholder negotiations. Fortescue intends to undertake a staged mining approach, whereby areas within Eliwana will be developed progressively, or not at all, in response to market demands for iron ore. Changes to the product strategy, that is the grade of iron mined, and other ongoing stakeholder negotiations will influence the development sequence of the pits. These changes, in turn, will influence waste dump development, opportunities for backfill and subsequently the haul road network.

Figure 14 is provided to illustrate how an individual pit at Eliwana, developed in slightly different ways in response to the above activities, may act on the environment, the ecosystem and human health in different ways, and therefore require different closure management.

A. In Figure 14 scenario A, only ore from above the water table is excavated. Salt / metal accumulation on the pit floor, derived from wall and floor exposures of deleterious geology, and minor leakage (including very low volumes of AMD) to the groundwater table were identified as potential pathways for environmental impact. However, the groundwater is not expect to move far, due to compartmentalised nature of the aquifer.

Closure management in this scenario might therefore seek to minimise vegetation growth within the pit, to avoid or minimise the potential for biological uptake of toxic metals, once it can be confirmed that leakage into the watertable will not adversely impact downstream groundwater dependent environmental or heritage values.

B. In Figure 14 scenario B, ore is also excavated from below the watertable. Exposure of the watertable allows evaporation to occur, changing the flow direction of the groundwater, creating a groundwater 'sink'. The sink keeps salt/metals in the groundwater from leaving the pit. However the presence of a permanent water body has greater potential to attract animals, including cattle associated with the local beef production industry.

   Closure management in this scenario might therefore seek to deter larger animals from accessing the pit. If lake water quality deterioration proves to have the potential to impact smaller birds and reptiles (that cannot be excluded from the area), the closure management might also consider introducing harvestable vegetation that scavenges toxic metals to remove those metals from the system.

C. In Figure 14 scenario C, ore is also excavated from below the adjacent creek. As the creek cannot be diverted around the pit, water flowing into the pit causes the lake water level to rise. Under this scenario the lake water again leaks into the compartmentalised watertable. During very large rainfall events the pit fills to the brim, and lake water flows away from the pit and into the downstream environment; and again with every smaller subsequent rainfall event until sufficient storage returns to the pit to capture the creek inflow.
   The creek water carries nutrients, seeds and animals in the pit, creating a food web that interacts directly with the lake water. This introduces the potential for bioaccumulation and biomagnification of toxic elements, but also introduces the potential for beneficial habitat and beneficial land uses.

   Closure management in this scenario might therefore seek to manage the deleterious materials and associated problematic salts / metals, to minimise the potential for bioaccumulation or biomagnification, allowing for a beneficial post-closure land use. Or alternatively, a creek diversion channel may need to be cut through the local hills, to prevent the creek water from ever interacting with the pit.

D. In Figure 14 scenario D, additional benign waste rock is mined in order to access a deeper ore body. The benign waste rock is placed (as 'backfill') into the void, covering the deleterious geology and parts of the watertable. The storage volume within the void is reduced, such that the lake water regularly overtops the pit, restoring surface water

flow to the downstream creek system. With regular outflow and by covering the deleterious geology and watertable, salt and metal accumulation within the lake water is very low, within the range observed in local pools.

Closure management in this scenario might therefore seek to stabilise a portion of the pit edge, to establish and facilitate safe access to healthy wetland ecosystem. Beneficial land uses including camping, hunting and fishing may be discussed with stakeholders, and supporting infrastructure including the provision of safe access to the lake would need to be considered.

This example illustrates four different outcomes that may result within just one pit. Alternative outcomes can be identified for all features within the mine valley. Consequently, for any mine feature located within the mine valley, at each stage of the mine development, there is a range of potential environmental outcomes for which several closure management options may be available.

Feature specific closure strategies will be developed on a stage by stage basis. Where environmental or heritage values may affected, key stakeholders will need to be consulted in order to identify the most appropriate closure solution for that mining stage; necessitating an adaptive management approach to closure planning.

### Adaptive management approach to closure planning

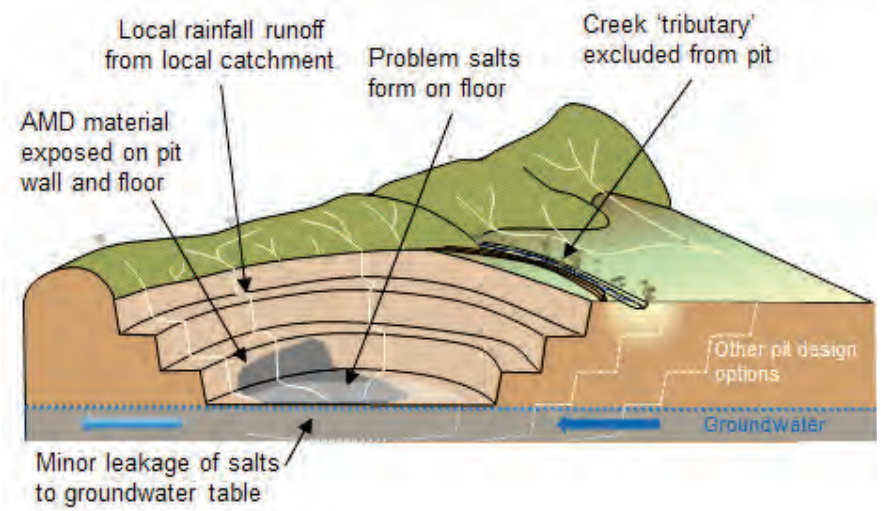
Fortescue recognises that management of Eliwana to achieve the closure objectives will require a proactive approach to closure management. To demonstrate how uncertainty associated with the mine staging will be managed as part of closure planning during the mine life, Fortescue has compiled the *Closure-related Management Plan* (**CMP**) in Appendix 5. The CMP describes the adaptive management-based processes and provisions that will be used for the key closure-related disciplines of rehabilitation, surface water management and landform management, to develop and update future editions of the Eliwana Mine Closure Plan, based on the conditions present at the end of each mining stage.

The closure plan will need to be regularly reviewed and changed in response to changes in the mine plan and planned mine staging. These changes may need to be supported by further, additional technical studies, to guide the management changes and to ensure the closure objectives will be met.

It is envisaged that each stage of the mine development and any changes to the MCP will be developed in consultation with the relevant key stakeholders and approved under the Mining Act.

In order to facilitate this proactive management approach, Fortescue has already integrated the closure planning function into the Mine Planning team. This integration ensures that changes to the mine plans are reflected in the closure plan before the mine plans are executed on the ground. The integration also enables closure risks, including risks that the closure objectives may no longer be met, to be identified early in the mine planning process so that effective management and mitigation strategies can be integrated into the mine plan to achieve successful mine closure.

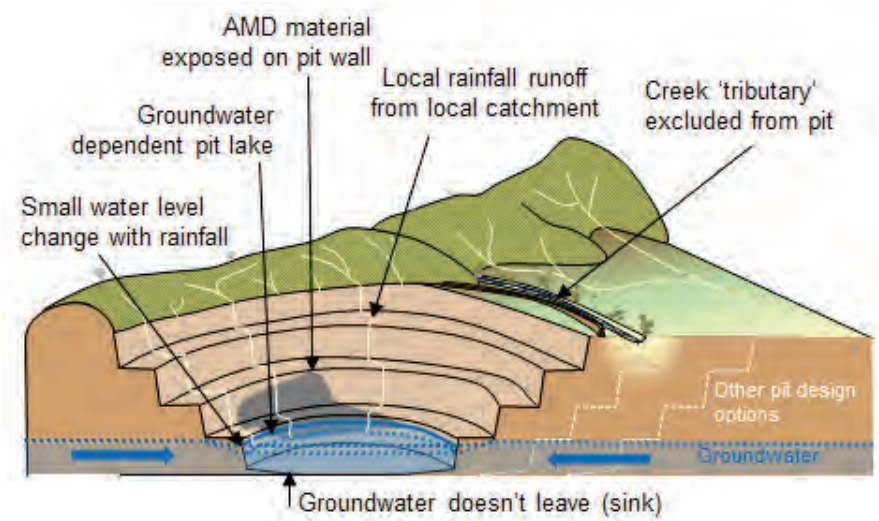
**A) Ore above water table**




Potential environmental outcome:

- Catchment runoff flows over deleterious material exposures, eroding and exposing fresh deleterious materials. Water ponds on pit floor, above water table, intermittently generating very small volumes of AMD. Potential animal interaction for limited periods during ponding.
- Water dissipation via infiltration allows salts / metals to leave via groundwater.
- Water dissipation via evaporation leaves salts / metals to build up in soil, potential plant uptake.
- Local creek tributaries excluded from pit. No pathway for AMD to contaminate land / vegetation outside pit or compartmentalised aquifer.

**B) Ore below watertable**

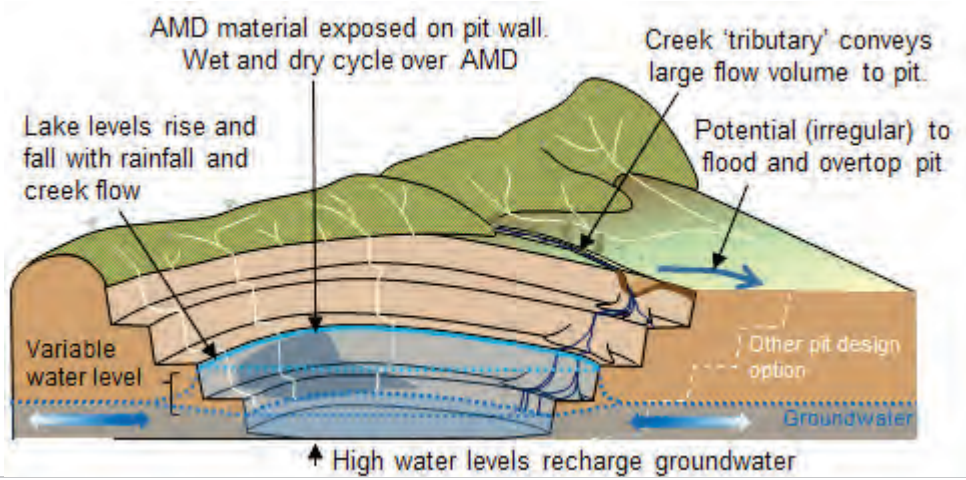



Potential environmental outcome:

- Permanent groundwater dependent lake develops. Permanent water attracts animals, including beef cattle (post-closure land use). Potential for animals to ingest lake water.
- Catchment runoff flows over deleterious materials, eroding and exposing fresh deleterious materials. Lake water levels fluctuate with rainfall, draining and re-saturating deleterious materials, increasing potential for AMD production.
- Evaporation exceeds combined groundwater inflow rates and rainfall. Lake acts as groundwater sink, prevents water from moving away from lake, but results in progressively more saline / polluted lake water.

**Figure 14. Different potential closure conditions arising as a result of the mine development process. Based on studied conditions at Eliwana.**

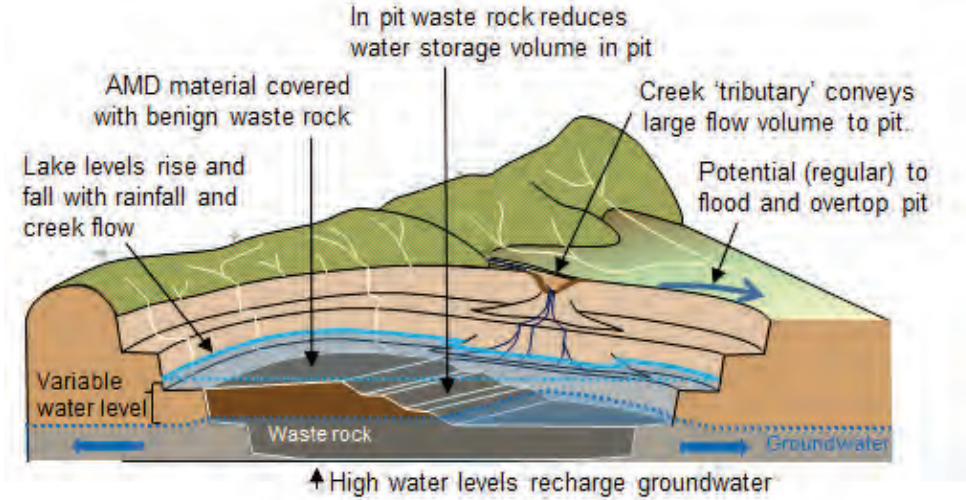
**C) Ore under creek**




Potential environmental outcome:

- Permanent groundwater dependent lake develops. Permanent water attracts animals and people. Potential for animals to ingest lake water.
- Creek flow into the pit conveys large volume of water, contributes seed / soil / nutrients to lake, facilitates plant growth in lake and on fringe. Water can bring fish into lake. Full food-web connection established.
- Creek flow causes rapid water level rise and slow drain. Wetting-drying cycle over deleterious materials flushes salts / metals built up during dry into lake water during wet. Increase in total salt / metal load offset by significantly increased water volume.
- High lake water levels recharge groundwater, allow salts / metals to leave via groundwater; trapped in compartmentalised aquifer. Creek flow into pit causes irregular outflow, allowing water to be released to creeks / soils, to interact with downstream vegetation and animals.

**D) High strip ratio ore (increased volume of waste rock produced)**




Potential environmental outcome:

- Benign waste rock generated during mining is used to cover deleterious materials, minimises oxygen supply to minimise AMD generation.
- Creek flow into pit causes rapid water level rise and slow drain. Permanent lake forms dominated by fresh water, but supported by groundwater.
- Permanent water attracts animals and people. Creek flow brings seed / soil / nutrients to lake, facilitates plant growth in lake and on fringe. Water can bring fish into lake. Full food-web connection established.
- High lake water levels recharge groundwater, allow water to leave via groundwater; trapped in compartmentalised aquifer.
- Water storage capacity in pit reduced due to backfill, results in more frequent outflow. More frequent release of lake water reduces salt / metals build up, leads to better lake water quality, maintains downstream creek flood regime.

**Figure 14 cont'd. Different potential closure conditions arising as a result of the mine development process. Based on studied conditions at Eliwana.**

## 10.1 Pit closure domains

### 10.1.1 Pit closure strategy

As illustrated in Figure 15, upwards of 25 pits could be developed in the local hills, on the ridgelines or on the valley floor of the mine valley. Technical studies completed to date have been based on the PER scenario. The results from these studies are intended to indicate magnitude of the issue(s) if no closure management is applied; and subsequently do not represent a conclusive prediction of environmental conditions on closure. In future updates to the MCP Pit closure domains will be established for each pit group of the planned mine stage. (These may differ significantly from the PER scenario.)

Individual pits within the PER scenario ranged in size from <10 Ha to >200 Ha, a combined area of over 1,400 Ha of the mine valley. Some of the pits within the PER scenario intersect and mine below the watertable, some mine through local creek tributaries, some mine through both or intersect neither. Table 31 summarises the hydrological interactions that have been assessed for each pit group. Table 31 also lists the potential for a pit lake to form based on the modelled groundwater recovery without closure management, and the potential for water to leave the pit (outflow) following rainfall.

**Table 31. Main pits (>30Ha footprint) and their interactions with groundwater and surface water (without closure management).**

| Pit group name | | Planned depth (mAHD) | Groundwater inflow | Position in floodplain | Potential for pit lake | Surface water outflow[#] |
|---|---|---|---|---|---|---|
| Eliwana | Broadway West | 363 | Likely | Within | Likely | Frequent - Rare |
| | Broadway East | 435 | Likely | Within | Likely | Very Rare – Extreme |
| | Broadway South | 444 | Remote | Potentially within | Remote | Very Rare – Extreme |
| | Swan | 543 | Remote | Above | Remote | None |
| | Piccadilly | 543 | Remote | Above | Remote | None |
| | Talisman East | 489 | Remote | Above | Remote | None |
| | M6 | 450 | Likely | Within | Likely | Very Rare – Extreme |
| | P Tenement 3 (P3) | 423 | Remote | Above | Remote | None |
| | P Tenement 4 (P4) | 417 | Remote | Above | Remote | None |
| | Talisman | 426 | Likely | Within | Likely | Very Rare – Extreme |
| | West End | 310 | Likely | Above | Likely | None |
| | West Side | 456 | Likely | Above | Likely | None |

| Pit group name | Planned depth (mAHD) | Groundwater inflow | Position in floodplain | Potential for pit lake | Surface water outflow# |
|---|---|---|---|---|---|
| Flying Fish 1 | N/A | Remote | Within | Remote | Rare |
| Flying Fish 2 | N/A | Remote | Potentially within | Remote | None |

# Rating system based on size of event required to fill mine void, using Australian Rainfall and Run-off classification Frequent – More than once every 10 years, Rare – Between 10 and 50 years, Very Rare –100 years or more, Extreme – up to PMP.

Following rainfall all of the mine voids will temporarily contain water from direct precipitation and runoff. This water is likely to dissipate quickly via infiltration and evaporation. As a result, salt build-up on the pit floor is expected to be low and in most cases would not pose a risk of contamination in the event of a rare, very large rainfall event occurring which could flush salts down into the ground or out into the environment via overflow.

The water quality in the permanent pit lakes that form on the southern ridge is the most susceptible to deterioration, as a result of evaporation and runoff from Mount McRae Shale Formation exposed in the wall rock. Over time, and without further closure management, there is the potential for these pits to contain high salinity and dissolved metals. Where these pits are disconnected from the creek systems, the pits are likely to form terminal, evaporative sinks. The compartmentalised groundwater aquifer limits even density driven groundwater flow, such that there would be no transport pathways for the degraded water to leave the void.

The water quality in the pits connected to creeks is more complex to assess at this stage of the mine development. In pits connected to creek systems inflow from both fresher surface water will combine with the more saline groundwater, if present. Under the PER scenario, the Talisman and Broadway East, for example, are predicted to have large, deep pits that are capable of storing rainfall from all but very rare (100+ year) storm events. As a result, water quality may deteriorate slowly, due to evaporation / evapoconcentration of salts and metals linked to potential exposure of West Angela Member shale in the footwall rock. Again, compartmentalisation of the groundwater aquifer would limit groundwater movement; although, without closure management, there is the potential for salts and metals to be flushed from the void during larger storm events.

However further assessment of the water quality leaving the pit during such events is difficult to establish at this stage of the project, as assessment of post-closure water quality is sensitive to pit specific conditions including pit geometry and geology, which will change over the life of the mine.

Wherever there is the potential for water to leave the pit, detailed studies of the geological units left exposed in each pit will be required to validate the metalliferous drainage potential. This is because the geology exposed in individual pits has the potential to be less reactive than the

regional sampling indicates. Stochastic water balance modelling is also required, to provide a probabilistic assessment of the overflow and the potential concentration of salts and metals in that water. Then, as with all of the closure options, the outcomes would need to be discussed with stakeholders, to ensure the predicted outcomes align with local environmental and heritage values.

In all likelihood, studies to date indicate that without management the large volume of water required to fill Talisman and Broadway East, for example, will dilute the salts and metals to background levels, such that the overflow is unlikely to pose a risk to the environment. While in Broadway West the small pit storage capacity and large upper catchment area is likely to result in more frequent pit flushing, which would limit the deteriorating effects of evapoconcentration on the water quality. As a consequence, outflow water quality from Broadway West, without management, may be unchanged or only slightly altered from upstream conditions, depending on the final analysis of the pit wall geochemistry.

A preliminary assessment of the geotechnical zone of instability based on the PER scenario pit shells has also been completed (Figure 15). The zones of instability were developed in accordance with the DMP Guideline on *Safety bund walls around abandoned open pit mines* for weathered material. Where the pit wall is considered to be stable, for example due to the type of geology and angle of the pit wall, the zone of instability aligns with the edge of the pit.

Due to the complexity of the pit and water interactions, management of the zones of instability and the placement of pit abandonment bunds will be discussed with stakeholders at each stage of the mine development, in consideration of safety, environmental and heritage values, and future land use.

Future closure activities associated with this domain may include, but are not limited to:

- Analysis of the geotechnical zone of instability, influence of groundwater recovery on wall stability, inflow wall stability / erosion head cut, and subsequent abandonment bund position in consideration of the local topographical constraints and surface water flow;
- Mapping and associated geochemical tests of the pit geology, to quantify the exposure of deleterious (AMD producing) materials;
- Review of the pit water balance for low to extreme rainfall events, to establish the frequency of outflow and AMD exposure contact residence time;
- Review of the contributing catchment, to evaluate the potential for the flows to convey seed, nutrients, sediment, aquatic fauna etc. to the pit and thereby sustain a food-web;

- Review of the pit lake water quality, including temporal variability as water levels rise and fall, in consideration of climate variability and bio-geochemical reactions, to establish potential to sustain a healthy ecosystem; and
- Review opportunities for post-closure beneficial land-use with stakeholders, to establish re- vegetation plans where appropriate.

### 10.1.2 Knowledge gaps and further work

A summary of the planned Pit domain closure strategy and further studies required to the support the strategy are described in Table 32.

**Table 32. Pit closure domain tasks and further studies.**

| Tasks | Further studies required |
|---|---|
| Consult with stakeholders on proposed closure strategies. | • Establish list of key environmental and heritage values for each pit.<br>• Review closure options with relevant key stakeholders to identify preferred closure strategy. |
| Review geotechnical zone of instability and establish appropriate ground control management for unstable areas | • Update of geotechnical zone of instability based on end of mine stage pit geometry / as-built slope profile, reconciled material parameters and weathering profile, if applicable. This may include detailed geotechnical stability analysis for critical sections.<br>• Quantify impact of creek / catchment inflow on wall stability, creek head cut (upstream erosion propagation), and subsequent abandonment bund design and placement.<br>• Establish likely mechanisms for interactions of public & fauna with pit water body, where present. Incorporate appropriate management controls to deter or accommodate interactions.<br>• Progress discussion on abandonment bund requirements with DMIRS safety representatives, in consideration of common law requirements. |
| Confirm volumes of deleterious materials exposed on wall / floors and geochemical behaviour of those materials over the long term | • Complete in pit geological mapping of deleterious material exposures.<br>• Undertake kinetic geochemical testing to confirm leaching reaction times. |
| Predict long-term water conditions (probability model) for pit, in consideration of climate variability, stratification, water chemistry and biogeochemical aspects where appropriate | • Establish pit lake water model appropriate to magnitude of in pit water volumes and catchment connectivity. |
| Confirm downstream environmental and heritage value interactions | • Review the environmental and heritage values linked to water and associated ecosystem services.<br>• Establish or otherwise prove disconnection between pit water bodies and downstream receptors. Undertake monitoring where required to confirm predictions.<br>• Assess and confirm the changes to the hydrological regimes will not impact the downstream receptors / values |

| Tasks | Further studies required |
|---|---|
| Construct and vegetate, where appropriate, closure landform | • Design landform in consideration of upstream changes, downstream receptors and planned / modelled closure strategy.<br>• Establish (re)vegetation strategy including seed/planting selection and establishment, and research appropriate implementation techniques when littoral and riparian vegetation is required. |
| Review weed abundance within the pit post-closure, and manage appropriately if required | • Establish protocols for weed management adjacent to open water bodies, in consideration of unstable ground, frequency of weed control (expected abundance due to regular water supply), control methods etc. |

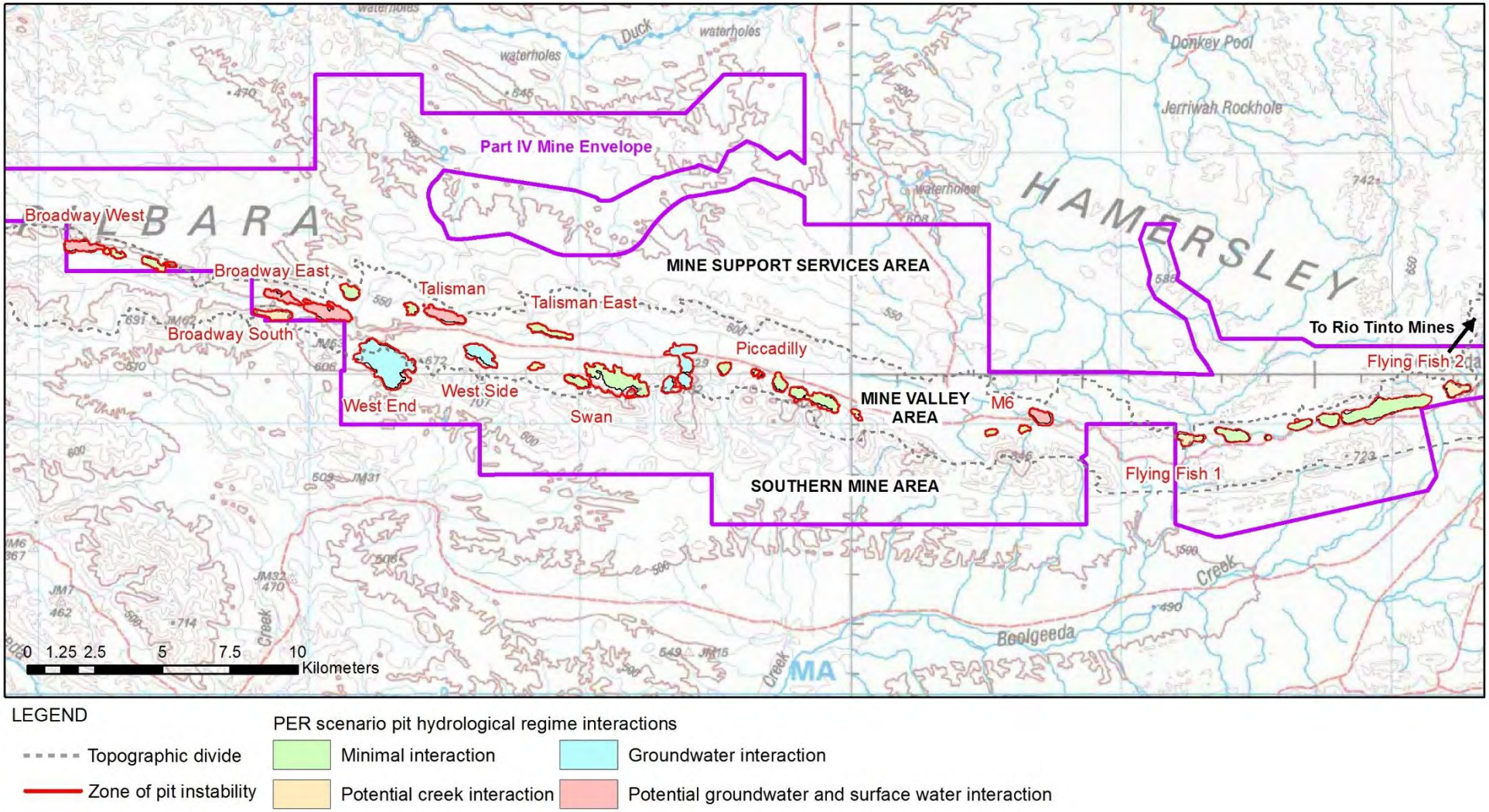



**Figure 15. Pit distribution and zones of instability. Pits are colour coded to represent the potential interaction with groundwater and surface water systems.**

## 10.2 Waste Rock Landform closure domains

Waste rock landforms (**WRL**s) that may be constructed include waste dumps, long-term low grade stockpiles, elevated haul roads and land bridges, and elevated work areas e.g. ROM pads. Some of the waste rock generated on the site may be problematic, including the potential for fibrous and deleterious materials, both of which require encapsulation or other appropriate management. Deleterious materials will only be stored in the waste dumps.

More than six waste dumps could be developed in and external to the mine valley (Figure 16). Table 33 lists the potential waste dump sites and their key characteristics in terms of height, percentage of low erodibility material and percentage of potentially deleterious materials.

**Table 33. Waste dump summary table (PER scenario)**

| Waste rock landform | Height (lowest lift to upper lift) | Percentage low erodibility material | Percentage potential deleterious material |
|---|---|---|---|
| Broadway West | 90 m | 22 % | <1 % |
| Broadway | 60 m | To be developed | To be developed |
| West End | 130 m | 46 % | 7 % |
| Long Term Low Grade 1 | 65 m | 36 % | <1 % |
| West Side | 95 m | 17 % | 24 % |
| Swan | 60 m | 0 % | 5 % |
| Piccadilly | 75 m | 8 % | 13 % |
| Flying Fish 1 | 70 m | To be developed | To be developed |
| Flying Fish 2 | 55 m | To be developed | To be developed |

The process by which the waste dumps will be designed is described in the *Closure Management Plan* (Appendix 5). Possible waste dump locations, e.g. Figure 16, have been selected in areas adjacent to the pits where economic ore has not been identified. Further drilling and studies will be undertaken to ensure the ground is sterile (contains no ore of economic value), to evaluate the foundations conditions and to improve our understanding of the waste rock characteristics. The waste dump design will then be refined based on these conditions and characteristics, in consideration of the volume and type of waste rock estimated to be produced from each pit.

The waste dumps will generally be constructed to fill in the valleys adjacent to the pit. Waste dump construction is typically undertaken by loose dumping successive lifts (Figure 17). The height of the lift is determined based on the ongoing geotechnical evaluation of the waste rock properties after drill and blasting, in accordance with applicable mine regulations. As the face of lift reaches the closure designed horizontal extent for each lift, the height of the advancing face is reduced.

Closure designs will be updated throughout the mine life, to reflect the outcomes from ongoing geotechnical evaluation of the waste rock and to ensure the closure designs reflect the as-built conditions. Further updates to the waste dump closure designs will be required as, over the life of the mine, the closure strategies for the Pit closure domains are progressed. For example, if waste rock is used to backfill or stabilise pit areas as part of the future closure strategy, or as part of a change to the waste dump locations, the waste dump designs will need to be adjusted accordingly to accommodate for the lower volume of waste rock reporting to each waste dump and new closure designs will need to be introduced for the additional waste rock landform feature.

### 10.2.1 Waste rock landform closure strategy

#### Deleterious material encapsulation

Table 34 lists the acid classification of the waste rock by pit of origin. For the majority of the site the waste rock will be acid consuming (AC) or non-acid forming (NAF) and will be suitable to use to encapsulate deleterious materials. There is no waste rock block that contains an average, total sulfur concentration of greater than 0.5 % (a very conservative measure of high acid risk), which therefore means that no waste rock will be classified as high capacity potentially acid forming (PAF-HC). As a consequence, in general the risk of acid generation has been assessed as low.

**Table 34. Percentage of waste rock by acid classification by pit (PER scenario).**

| Pits | Waste rock acid classification percentage | | | | | | |
|---|---|---|---|---|---|---|---|
| | Unknown | Benign | | | Potentially acid generating | | |
| | | AC | NAF | UCU | UCL | PAF-LC | PAF-HC |
| Broadway East | <1 | 50 | 31 | 14 | 1.1 | 2.6 | 0 |
| Broadway South | <1 | 29 | 52 | 17 | <1 | 1.3 | 0 |
| Broadway West | 0 | 43 | 29 | 18 | 0 | 8.9 | 0 |
| Broadway | 0 | 55 | 35 | 10 | <1 | <1 | 0 |
| East 4 | 0 | 66 | 28 | 4.7 | 0 | 1.0 | 0 |
| Eagles Nest | 0 | 16 | 25 | 23 | 0 | 36 | 0 |
| MM6 | 0 | 95 | 4.2 | <1 | <1 | <1 | 0 |
| P Tenement 1 | 24 | <1 | <1 | 55 | 0 | 20 | 0 |
| P Tenement 3 | 0 | 2.0 | 16 | 43 | <1 | 39 | 0 |
| Piccadilly | <1 | 12 | 27 | 30 | 1.9 | 29 | 0 |
| Swan | 0 | 6.1 | 20 | 33 | 2.0 | 38 | 0 |
| Talisman | 0 | 58 | 33 | 8.4 | <1 | <1 | 0 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Talisman East | 0 | 79 | 21 | <1 | 0 | 0 | 0 |
| West End | 0 | 65 | 17 | 11 | 1.5 | 5 | 0 |
| West Side | 0 | 11 | 35 | 32 | 4.8 | 17 | 0 |
| % of Total Waste | <1 | 43 | 23 | 19 | 1.3 | 14 | 0 |

**Acid classification**: PAF-HC: Potentially acid forming – high capacity; PAF-LC: Potentially acid forming – low capacity; UCL: Uncertain – Likely to be potentially acid generating; UC: Uncertain – Unlikely to be potentially acid generating; NAF: Non-acid forming; AC: Acid consuming; Unknown: unable to be classified, further samples required.

Across the site, the percentage of waste rock with a low potential capacity to generate acid and / or metalliferous drainage is estimated between 7 and 10 percent of all waste rock generated. However, as illustrated in Table 35, the distribution of this deleterious waste rock across the waste dumps is highly variable, and could range from less than 1 percent up to ~25 percent of the waste rock in any one waste dump. The West Angela Member percentages may include the benign chert which is interbedded with potentially acid forming shale units, and these volumes could potentially be reduced if subunits are sufficiently thick to distinguish and separate while excavating.

**Table 35. Deleterious waste rock contribution to waste dumps (PER scenario)**

| Deleterious units for encapsulation | Potential waste dumps and stockpiles | | | | | | Overall |
|---|---|---|---|---|---|---|---|
| | Broadway West | West End | West Side | Swan | Piccadilly | Long term low grade | |
| D1 of Dales Gorge Member | 0.9% | 0.0% | 3.7% | 2.9% | 2.9% | 0.6% | 1.2 - 1.5% |
| Mount McRae Shale | 0.0% | 1.7% | 3.1% | 2.2% | 0.2% | 0.0% | 1.1 - 1.6% |
| West Angela Member | 0.0% | 5.0% | 16.8% | 0.0% | 10.3% | 0.0% | 4.2 - 6.3% |
| **Combined** | **0.9%** | **6.8%** | **23.6%** | **5.1%** | **13.3%** | **0.6%** | **6.5 - 9.5%** |

Preliminary transient water and geochemical modelling has been completed to estimate the quality and volume of water that may leak from the waste dumps. The preliminary modelling has been based of a 'worst-case' waste dump scenario, which assumes that the waste dump is comprised solely of deleterious West Angela Member material, the most abundantly available deleterious material with the longest water retention characteristic, encapsulated by 10m of high permeability benign material. The preliminary model results suggest that the volume of leakage from the waste dumps is likely to be relatively low (maximum modelled rate of 1 mm/m$^2$ per day) and, as a result of to dilution effects, it is therefore unlikely that the interaction of the leakage with the surface or groundwater systems would result in an environmental impact.

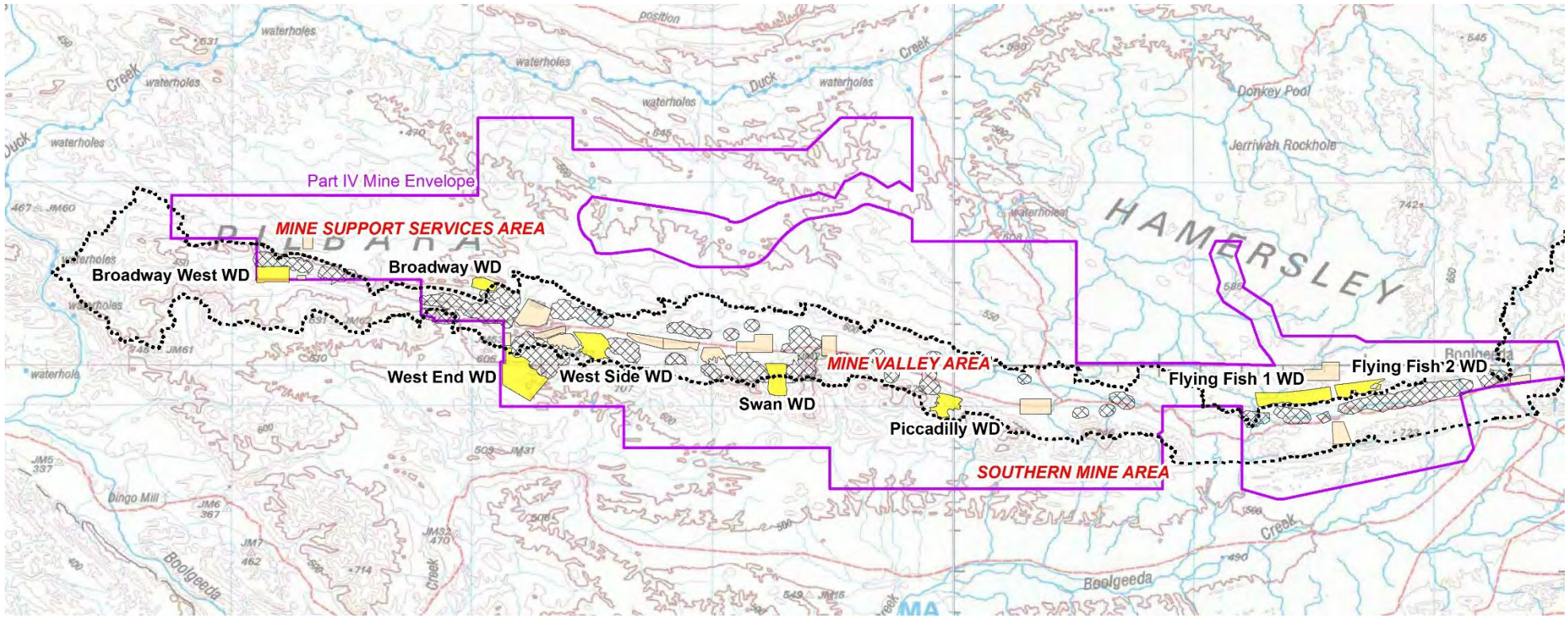



**Figure 16. Waste dump siting options (PER scenario). Waste dumps shown in yellow. Other WRLs shown in buff. Pits shown in hatching.**

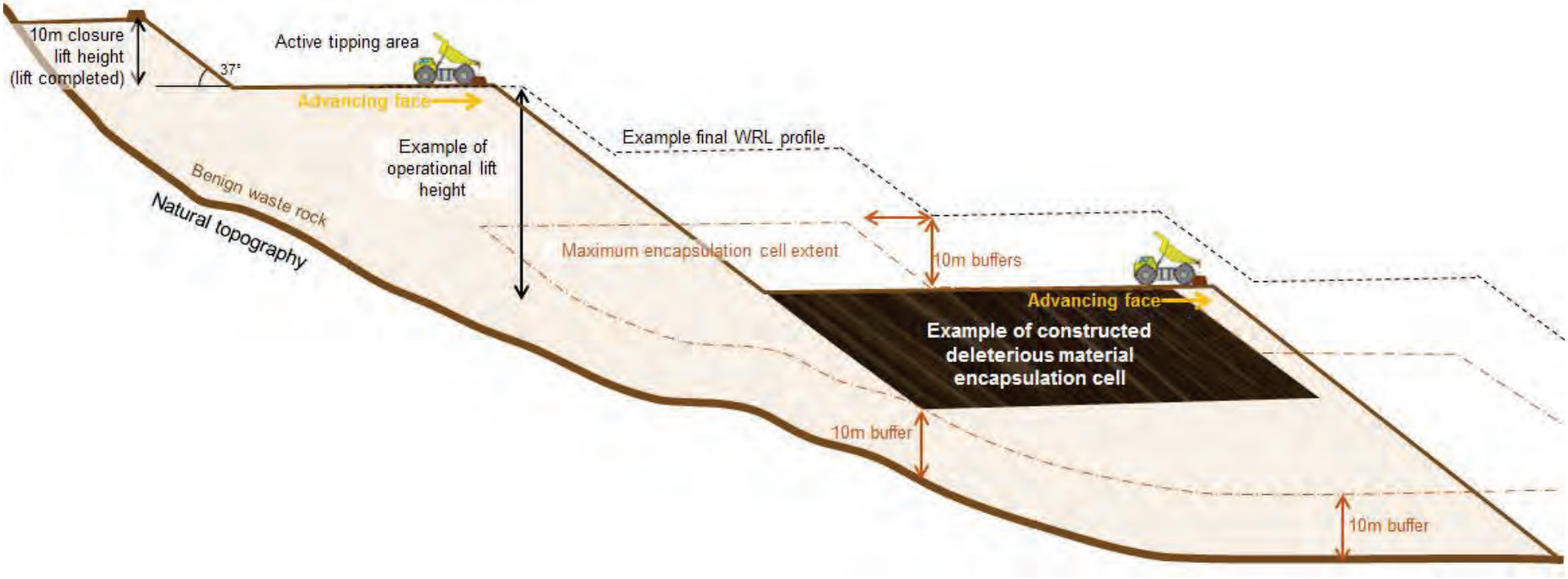



**Figure 17. Simplified waste dump operational cross section, showing completed upper lift and progressing lower lifts with deleterious material encapsulation cell.**

As the benign waste rock is expected to also provide a suitable growth medium for Pilbara plants, the 10 m buffer (Figure 17) will also enable deep rooted Pilbara species to be used in rehabilitation activities. By using deep rooted plant species, i.e. acacias and eucalypts, the plants will be able to intercept infiltration for longer periods of the year, increasing the annual evapotranspiration rates on the waste dump. This will serve to further reduce the volume of water passing through the dump prior to its contact with any encapsulated deleterious materials.

Further geochemical kinetic tests and waste dump models are required to ensure the water quality exiting the waste dump, on interacting with the local environment, meets the closure objectives. These studies will subsequently support further field trials to validate the rates of infiltration, soil evaporation and vegetation transpiration assumptions.

## Erosion potential

The dominant waste rock materials, comprising more than 95% of the waste rock that will be generated, are Dales Gorge Member, Joffre Member, Tertiary materials, Whaleback Shale Member, Mount Newman Member and Wittenoom Formation. The distribution and proportion of this material will vary between waste dumps. Table 36 illustrates the possible range of contributions to the waste dumps. The majority of the waste rock is of moderate to low erodibility; however, there are scenarios where more highly erodible material could be generated than low erodibility material. Consequently a relatively conservative approach to landform design is required.

**Table 36. Geological source rock contribution to waste dumps**

| Geological source | Percentage contribution to waste dumps | | | Erodibility |
|---|---|---|---|---|
| | Minimum | Average | Maximum | |
| Dales Gorge Member | 25% | 42% | 60% | Moderate |
| Joffre Member | 0% | 14% | 40% | Low |
| Tertiary materials | 5% | 12% | 20% | High |
| Whaleback Shale Member | 4% | 11% | 20% | High |
| Mount Newman Member | 0% | 10% | 25% | Low |
| Wittenoom Formation | 0% | 9% | 20% | High |

Fortescue are currently considering two waste dump design options (Figure 18) based on the management of similar moderately erodible waste rock at its nearby Solomon mine site.

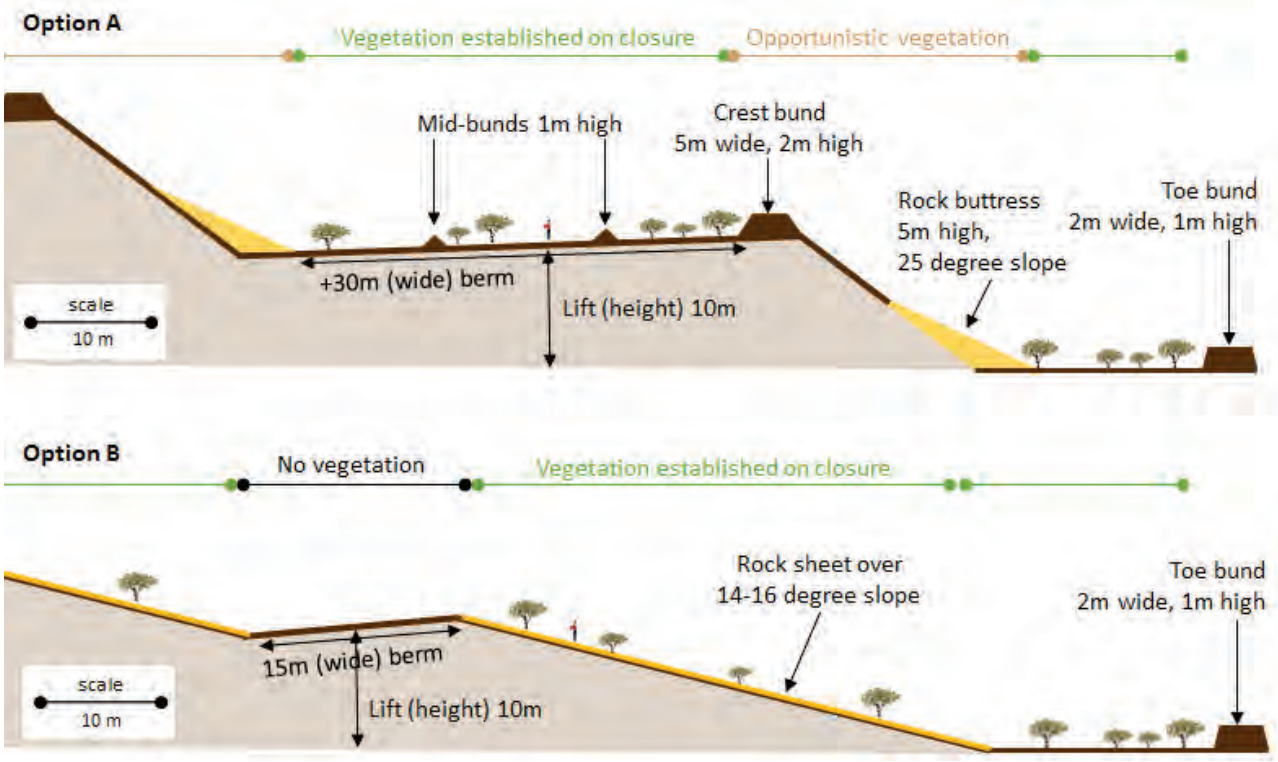



**Figure 18. Rehabilitation design Option A: Stepped landform, Option B: Batter-berm landform.**

Option A

Option A (Figure 18 top), the 'stepped landform', resembles the characteristic stepped landforms associated with the iconic local banded iron formation geology. The stepped landform utilises large berms and bunds to control surface water and contain sediment on the berm, to prevent the release of water or sediment to the environment even during extremely rare rainfall events (>10,000 year events).

In Option A, the slopes would be constructed by leaving the waste rock at the tipped angle of repose, and introducing additional low erodibility waste rock in the form of a 'rock buttress' at the base of the slope, sloped at 25°. The buttress would be pushed into place using dozers, creating a concave slope with a geometry similar to the landforms observed in the adjacent ridgelines. Because the waste dump itself is not reshaped on closure, the low erodibility waste rock required for the rock buttress can be stockpile on waste dump, segregated from the general waste rock, ready for use. Similarly, as the waste dump is not reshaped, there is little to no risk of exposing encapsulated deleterious or fibrous materials.

The berms and the upper surfaces would be backsloped by around 2 degrees. Small bunds or windrows would be constructed on the berms parallel to the toe of the slope

and crest bund, to minimise surface water movement across the +30m wide berm during large storm events; and a large crest bund 2m high and 5 m wide would be constructed to minimise personnel exposure to the steep slope.

Vegetation is subsequently established on the 'flat' berms areas, where water, sediment and seed naturally accumulate. Vegetation would be established by placing a 10cm layer of topsoil over the berm. The +30m wide berms can be easily trafficked to undertake rehabilitation monitoring and maintenance activities.

Option B

Option B (Figure 18 bottom), the 'batter-berm landform', resembles the typical Pilbara waste dump. Dozers are used to completely reshape the landform, cutting into the waste dump to creating +30m long slopes of 14 to 16 degrees. The 10 m encapsulation zone around the deleterious material ensures it is unlikely that the material will be excavated during reshaping.

In Option B the berms are short, less than 15m wide, and capable of storing large (100 year) but not extreme rainfall events. As a consequence, a sufficiently large rainfall event can fill the berms to the top and then water can cascade down the slopes.

As the slopes are comprised of moderately erodible material, in Option B a sheet of rock must be placed over the slopes to protect from excessive erosion during these large events. The rock required to armour the slopes can be sourced from the low erodibility portion of the waste rock. However, as the rock must be placed on the landform after reshaping, additional ground disturbance is required to store the segregated low erodibility waste rock to the side of the waste dump.

In Option B vegetation is established on the rock sheeted slopes. The rock is placed over the topsoil and the two materials are mixed together by ripping the ground. The rip lines must the constructed with precision, perpendicular to the dump slope to prevent further erosion issues.

Further physical characterisation including erosion related testwork will be completed following drill and blasting of the waste rock. This test work will be used to quantify the likely erosion rates that may result from different landform designs. Based on these physical and computer modelling results, as per the process described in the *Closure-related Management Plan* (Appendix 5), the waste dump designs may be reviewed and / or refined, and field trials would be established to test the design performance prior to rehabilitation implementation.

### 10.2.2 Knowledge gaps and further work

A summary of the planned Waste Rock Landform domain closure strategy and further studies required to the support the strategy are described in Table 37.

**Table 37. Waste Rock Landform closure domain tasks and further studies.**

| Tasks | Further studies required |
|---|---|
| Confirm waste rock chemical and physical properties within expected range. Review design if waste rock is more / less erodible than predicted. | • Confirm physical property attributes of waste rock presenting on the waste dumps.<br>• Complete geochemical kinetic testwork to inform geochemical modelling.<br>• Confirm proposed closure landform design in consideration of local surface water catchment runoff, creeks, pit development etc.<br>• Undertake erosion modelling to predict landform performance and test for design flaws. Revise design if environmental impact is possible. |
| Review waste rock handling schedule and undertake randomised field sampling to confirm deleterious materials are encapsulated in 10m of benign waste rock | • Undertake geochemical modelling to predict chemistry of water leaving dump via subsurface systems based on planned rehabilitation design. Revise design if environmental impact is possible. |
| Complete earthwork to achieve closure design | • Undertake field trials to confirm design performance and optimise procedure for constructing. |
| Apply minimum of 5cm topsoil (target 10 cm) and other treatments as required to stimulate vegetation growth. | • Undertake field trials to ascertain vegetation recruitment from topsoil. |
| Review performance of rehabilitation, identify gap species and undertake ancillary seeding for gap species 3 years after initial works | No further studies identified at this stage. |

# 11. CLOSURE ISSUES

## 11.1 Risk assessment process

Closure related risks are managed in accordance with Fortescue's *Risk Management Framework (2016)*. The aims of the closure risk assessment process are to:

- Identify potential hazards that could influence successful closure of the mine;
- Evaluate the risks to people, property and the environment given the management controls / strategies described in the MCP; and
- Identify actions to reduce the risk to as low as reasonably practicable (ALARP), preferably to a Low or Very Low risk.

Risks within the closure risk register are reviewed and updated as conditions change. The closure risk register is also systematically reviewed and updated at least every three years with a panel of multi-disciplinary subject matter experts.

### 11.1.1 Identification of closure hazards

A closure issues identification session for Eliwana was held in October 2017. Successful closure was defined as demonstrating the Eliwana closure objectives have been achieved.

Table 38 summarises the key hazards that were identified for Eliwana. Hazards discussed included common closure issues observed at other operations, knowledge / baseline data gaps, unverified design and performance assumptions, and results from recent closure-related studies at other mines in the Pilbara region.

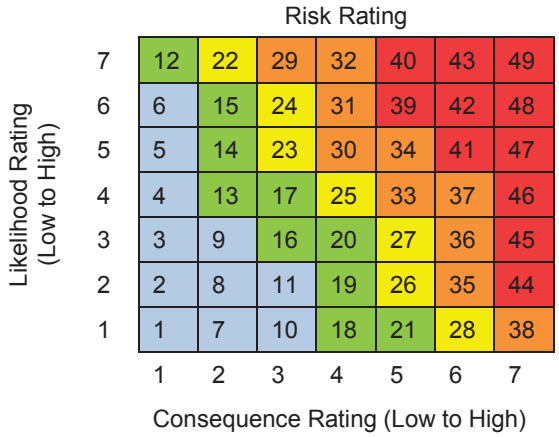
**Table 38. Key hazards for closure consideration.**

| Aspect | Potential hazard | Concern for Eliwana |
|---|---|---|
| Decommission | Contamination | Hydrocarbon spills, asbestos materials |
| | Disposal of waste | Adequate disposal facilities |
| Landform | Safe landforms | Open edges on pits and waste dumps<br>Pit wall failure<br>Encapsulation of fibrous waste rock<br>Development of sinkholes<br>Presence of open water bodies |
| | Stable landforms | Wind erosion / dust generation from waste fines<br>Erosion management and landform design consistent with waste rock characteristics<br>Rock armour stockpiles / use of capping materials to stabilise<br>Integrated creek and mine void management |

| Aspect | Potential hazard | Concern for Eliwana |
|---|---|---|
| | | Water / wave erosion in open water bodies |
| | Contamination | Segregation and management of deleterious waste rock<br>Potential for acid drainage<br>Leaching / metal enrichment through waste rock<br>Use of 'store and release' vegetation covers to minimise leachate |
| Water | Pit lakes | Uncertainty of groundwater recovery<br>Recharge influence on groundwater from creeks<br>Long term water balance(s)<br>Water quality, chemistry and biological influences on chemistry<br>Climate change influences<br>Cumulative influence of multiple (regional) pit lakes |
| | Creek behaviour | Erosion management / sediment control<br>Flow volume return to downstream ecosystem |
| Vegetation | Plants | Suitable growth media<br>Viability of seedbank<br>Ability to obtain seed and germinate gap species<br>Seasonal and climate influence on growth<br>Vegetation communities to minimise rainfall infiltration on waste dumps |
| | Resilience | Development of soil nutrients<br>Return of soil micro-organisms and other fauna<br>Plant fertility and seedbank development |

### 11.1.2 Evaluation of closure hazards

This closure risk assessment employed a 7x7 risk matrix to evaluate risk (Figure 19). The criteria used for this evaluation is provided in the *Mine Closure Risk Assessment* report presented in Appendix 3.




| Risk Rating | Risk Level Description |
|---|---|
| 1 to 11 | 1- Very Low |
| 12 to 21 | 2 - Low |
| 22 to 28 | 3 - Moderate |
| 29 to 38 | 4 - High |
| 39 to 49 | 5 - Extreme |

**Figure 19. Fortescue risk rating matrix**

The *inherent or raw risks* represent the conditions that may result without implementing controls during operations or on closure. The inherent risks were defined by considering the likelihood of different outcomes occurring at Eliwana given the nature of the local environment as established through the baseline data collation. The most significant negative outcomes (or hazards) were then rated with respect to health and safety, natural environment, social and reputation, and / or compliance factors. The hazard rating system descriptions for these factors is provided in Appendix 3.

The *current risk status* was determined by establishing the likelihood of the consequence occurring after the nominated controls are implemented. When establishing the likelihood, panel members were also asked to take into account the current performance of the controls at the site and at other sites, and confidence, based on professional experience and expertise, that the required success could be achieved if the designs and plans available today were implemented.

The current risk status also includes an assessment of the cost to implement the planned controls. By considering the costs, the panel were encouraged to identify innovative, low cost solutions in alignment with Fortescue's Corporate Values, with the projected cost to implement the controls flowing through to the financial provision (refer to Chapter 14 *Financial provisioning for closure*).

The *final or treated environmental risk* represent the anticipated outcome assuming successful implementation of all of the controls and completion of the further work.

## 11.2 Risk profile

Figure 20 illustrates the results of the risk assessment, with the assessment report presented in full in Appendix 3. As all risk assessment processes differ, Table 39 describes how the ratings should be interpreted with respect to this closure plan.

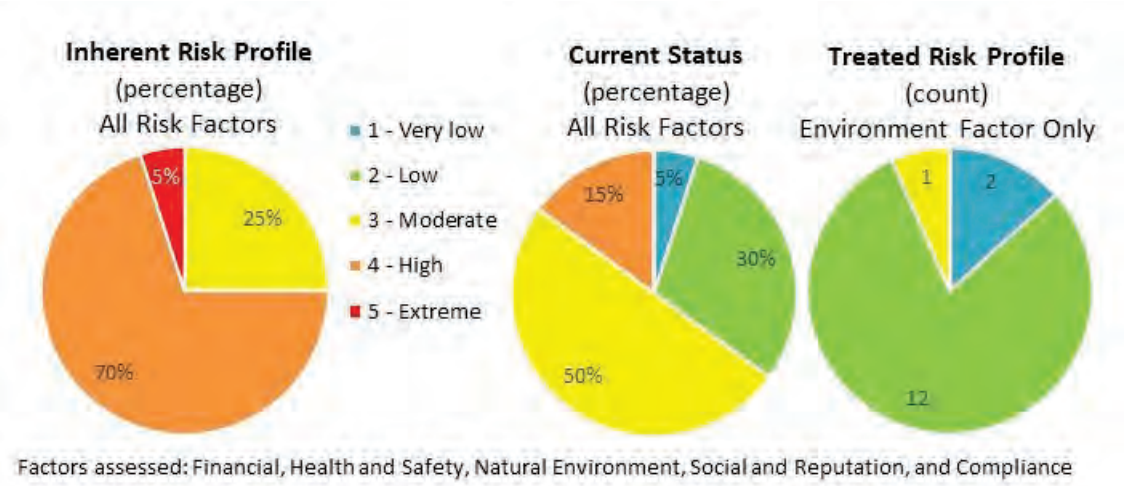



**Figure 20. Eliwana closure risk profile. Inherent (raw) risk (left), current status (middle) based on the studies completed to date and anticipated final / treated environmental risk profile (right).**

Due to the nature of the mining activity, presence of local creeks and likely extraction of deleterious waste rock that may generate AMD, Eliwana's inherent closure risks are high to extreme.

Based on the planned operational controls and closure strategies proven to date, 85 percent of the risks can be reduced to moderate risks or lower. Further work will be required to reduce the risks to ALARP. This work, as described in the *Closure Strategies* sections and reported in the risk assessment outcomes (Appendix 3), includes further study of:

- Management of deleterious material to minimise AMD;
- Management of mine voids and associated pit lakes;
- Prevention of impairment to downstream ecosystems, for example, as a consequence of changes to hydrological regimes;
- Return of vegetation communities suited to the changed landform and water conditions; and
- Post-closure land use within the mine valley, given the extensive landform changes.

Due to the nature of the operation and level of closure risk, active management will be required to review, revise, update and review again the closure strategies throughout the mine life. To

this end Fortescue has developed the CMP (Appendix 4) to describe the adaptive management processes that will be used to drive further work.

On implementing the planned controls and successfully completing the future work programs, Fortescue expect to reduce 14 of the 15 environmental related risks to low or very low risk ratings.

A moderate environmental risk, rated as remote (not expected to occur) but with the potential to cause serious, long-term impairment of habitat or ecosystem function, has been identified relating to degraded pit lake water. Lake water may become degraded and cause ecosystem issues when released to the environment if, for example, biological and biological-geological reactions create eutrophic (oxygen deprived) water conditions or if the lake water hosts / breeds pest and weed species. Without release to the environment, lake water may also pose a risk if the water hosts pathogenic bacteria / microorganisms etc. that may affect fauna or human health.

This risk will be reviewed following the development of individual pit closure strategies, when local pit water balance and pit - creek interactions can be better understood and evaluated.

**Table 39. Risk rating interpretation**

| Risk rating | Inherent (raw) risk conclusion | Current risk status | Treated risk |
|---|---|---|---|
| 1 - Very Low | Physical evidence is available to demonstrate this hazard is not present at this site. | Physical evidence is available to demonstrate this hazard has been eliminated as a threat. | Risk reduced to as low as reasonably practicable (ALARP) |
| 2 - Low | Physical evidence suggests this hazard is not a threat to successful closure at this site. | Physical evidence is available to demonstrate the proposed management will successfully control the threat.<br>Ongoing review of this threat is recommended lest site conditions change. | |
| 3 - Moderate | Evidence suggests this hazard could pose a threat to successful closure at this site. | There is (some) evidence or widely accepted professional opinion that the proposed management will successfully control the threat.<br>Further action and/or monitoring is required to validate success of the proposed management. | Consider if ALARP has been achieved. Discuss residual risk acceptance with stakeholders. |
| 4 - High | Evidence suggests this hazard poses a substantive threat to successful closure of this site.<br>OR<br>Absence of adequate information prevents this threat from being satisfactorily assessed, and professional opinion suggests this hazard would pose a threat to successful closure of this site. | Professional opinion suggests the proposed management is likely to control the threat.<br>Actions have been proposed to validate the threat assessment and to validate the success of the proposed management.<br>Further refinement of the proposed management may be required based on the action outcomes. | Risk is too high. Identify other management strategies to reduce risk. |
| 5 - Extreme | Evidence and / or professional opinion suggests this hazard has the potential for irreversible impairment to a conservation significant ecosystem or site of cultural significance. | A feasible management solution has yet to be determined. | |

# 12. CLOSURE IMPLEMENTATION

## 12.1 Implementation framework

Table 40 lists the mining phases and associated closure planning and implementation stages applied in this closure plan. In this context, progressive rehabilitation of a closure domain is complete when the pre-closure and closure phases are completed while Eliwana remains in an operational mining phase.

**Table 40. Implementation framework nomenclature**

| Mining phases | Closure phases | Closure planning stages | Closure implementation stages | |
|---|---|---|---|---|
| Exploration and Study | Approval | Baselines | Targeted | |
| | | Strategies | | |
| | | Risk identification | | |
| Operational | Pre-closure | Stakeholders | Operation | |
| | | Feature / domain designs | Progressive re-vegetation | Progressive rehabilitation |
| | | Risk and studies | Trials | |
| Closure | Closure | Stakeholders | Decommissioning | |
| | | | Landform shaping | |
| | | | Water management | |
| | | | Vegetation | |
| | Post-closure | | Observational | |

### 12.1.1 Pre-closure phase

During the operation stage, monitoring programs serve to identify potential issues that may not be resolved during the operational pre-closure phase, and will constitute issues or aspects to be resolved or managed during the closure phase.

Progressive re-vegetation is undertaken to restore vegetation in low disturbance level areas (light disturbance closure domains) shortly after disturbance, particularly areas that are not expected to be used again in the next 5 years, i.e. along exploration tracks and drill pads where drilling shows the areas do not contain economic ore. Monitoring requirements for these areas is minimal due to the (usually) high restoration success rates. Due to the low level of disturbance and short timeframe between disturbance and restoration, vegetation performance in progressive re-vegetation areas is generally not indicative of later closure outcomes.

During the pre-closure phase progressive rehabilitation activities focus on studies and field trials, to ensure the strategies proposed for each closure domain can be achieved, and to refine

the techniques associated with the activities to reduce closure costs. Field trials and associated monitoring may also be designed specifically to respond to knowledge gaps. These trials may also include intensive testing of monitoring techniques and success parameters, to refine monitoring approaches for quantifying completion criteria and to minimise post-closure monitoring costs.

### 12.1.2 Closure phase

Fortescue blends ore from multiple pits, across multiple mining operations to generate their ore products. Consequently, most of the pits, waste dumps and other supporting infrastructure remains active until the final years immediately prior to closure of the site. As a consequence, the majority of the bulk earth works and associated closure activities will be undertaken during the closure phase.

During the decommissioning stage, when buildings and other structures are dismantled and demolished, monitoring programs are implemented to ensure that the activities are undertaken and waste materials are disposed in accordance with Australian health, safety and environmental standards, regulations and in line with permits and approvals. The majority of these activity-based monitoring programs will be developed immediately prior to decommissioning, in accordance with operational licenses and statutory obligations.

During the landform shaping and water management closure stages, a reduced, project specific workforce is utilised to reshape the land. Monitoring during for the landform shaping and water management stages focus on conformance to design and health, safety and environmental factors specific to the use of large earth moving machinery.

The workforce and on-site fleet is further reduced during the vegetation closure stage, when the focus shifts to the use of a smaller fleet and manual labour for the application of topsoil, seed and (if required) planting of seedlings.

### 12.1.3 Post-closure phase

The post-closure closure phase is triggered by the completion of on-ground activities. The workforce are likely to have demobilised from the site, returning only to carry out monitoring and site inspections. If conditions deteriorate to level that trigger maintenance, equipment and competent personnel will be re-mobilised to the site to carry out repairs.

During this post-closure phase, monitoring, inspection and maintenance is managed through an adaptive framework. Starting initially with a range of environmental performance indicators and activities required to address various approval, permit and other legal obligations, using the

adaptive framework the frequency and type of monitoring undertaken is rapidly diminished once conformance to plan is demonstrated and approvals / permits are retired.

Eventually only the long-term monitoring associated with completion criteria and enduring environmental and tenure conditions remain. Completion criteria monitoring will continue until stakeholders agree that the closure objectives have been met.

### 12.1.4 Reporting

Performance results including the progress of field trials, studies and other research are reported to relevant regulatory authorities using the established Annual Environmental Reporting and / or Triennial Environmental Reporting processes. These reports will continue to be provided throughout the closure and post-closure phases. When available, progress against completion criteria and other indicators of environmental performance will also be reported.

## 12.2 Implementation schedule

Fortescue propose to develop the Western Hub mining area in stages, slowly opening up new pits and waste dumps over the mine life. The sequence by which the pits and waste dumps will be developed, and subsequently when the features will be ready to close, is not fixed and is likely to change over the life of the mine in response to external factors. Consequently a continuous, proactive approach to closure management will be required.

Fortescue's proactive approach to closure planning has been documented in the CMP presented in Appendix 5. This proactive approach to closure will ensure that closure strategies are continuously adapted and integrated into the mine plan, in response to the changing ground conditions, the increasing knowledge base, and will ensure the evolving closure strategies are informed by ongoing discussions with key stakeholders.

### 12.2.1 Closure domain summary

Table 41 summarises the closure strategies and indicative timing of the closure activities. As mining progresses the end use dates will be reviewed and revised and opportunities to bring closure activities forward, into the operating phase as progressive rehabilitation may be identified.

**Table 41. Eliwana closure domain implementation summary.**

| Domain | End use date | Closure tasks | Progressive rehabilitation |
|---|---|---|---|
| Light Disturbance | End of mine life | Cut and remove drill collars to 40 cm, insert lug and backfill with mound.<br>Dispose of plastic sump liners, culverts or other infrastructure.<br>Knock down windrows, reshape pads etc. to create free draining surface blended into natural topography.<br>Redistribute topsoil, rip / scarify area then return vegetation stockpiles. | ✓<br>Ad hoc areas |
| Heavy Disturbance | End of mine life | Clear pipelines, tanks, sumps.<br>Remove and dispose of mobile equipment and transportable / reusable infrastructure<br>Remove services to a depth of 0.5m or bury if below.<br>Remove buildings and footings to a depth of 0.5m. Bury if below.<br>Remove or remediate any hydrocarbon stained soils.<br>Remove culverts and added fill, and return drainage line shape.<br>Reshape the landform such that it ties into the surrounding landscape and manages drainage appropriately.<br>Apply stockpiled topsoil and rip, with consideration to slopes, to a depth of 0.5 m.<br>Review performance of rehabilitation, identify gap species and undertake ancillary seeding for gap species 3 years after initial works | ✓<br>Ad hoc areas |
| Tailings Storage Facility | End of mine life | Decommission mechanical infrastructure.<br>Remove and dispose of above ground pipework<br>Confirm waste rock properties within expected range.<br>Construct surface water control features on fines surface. Cover areas susceptible to dust erosion with more competent materials<br>Stabilise embankment<br>Rip topsoil and rock (if required), and seed areas as required, excluding berms.<br>Review performance of rehabilitation, identify gap species and undertake ancillary seeding for gap species 3 years after initial works | × |
| Indirect Impact | End of mine | Confirm no indirect impacts to nominated sites<br>Confirm no indirect impact to heritage places | × |
| Pits | End of mine life | Review geotechnical zone of instability and establish appropriate ground control management for unstable areas<br>Confirm volumes of deleterious materials exposed on wall / floors and geochemical behaviour of those materials over the long term<br>Predict long-term water conditions (probability model) for pit, in consideration of climate variability, stratification, water chemistry and biogeochemical aspects where appropriate<br>Confirm downstream environmental and heritage value interactions<br>Construct and vegetate, where appropriate, closure landform<br>Review weed abundance within the pit post-closure, and manage appropriately if required | ✓<br>Ad hoc areas |

| Domain | End use date | Closure tasks | Progressive rehabilitation |
|---|---|---|---|
| Waste Rock Landforms | End of mine life | Confirm waste rock chemical and physical properties within expected range. Review design if waste rock is more erodible than predicted.<br>Review waste rock handling schedule and undertake randomised field sampling to confirm deleterious materials are encapsulated in 10m of benign waste rock.<br>Complete earthwork to achieve closure design.<br>Apply minimum of 5cm topsoil (target 10 cm) and other treatments as required to stimulate vegetation growth.<br>Review performance of rehabilitation, identify gap species and undertake ancillary seeding for gap species 3 years after initial works | ✓ Ad hoc areas |

### 12.2.2 Progressive rehabilitation identification and implementation planning

#### Progressive rehabilitation action plans

Opportunities to undertake progressive rehabilitation are undertaken as part of the regular mine closure plan updates and site's annual environmental review.

Before re-vegetation or rehabilitation or other similar activities commence, action plans need to be developed. The action plans document the reasoning behind the proposed work and the standard the outcome is expected to achieve. This documentation is required to ensure that, in the future, the success or failure of the rehabilitation can be appropriately determined and, where appropriate, future rehabilitation activities can be adapted to capitalise on the success or otherwise be adapted to avoid failure.

The action plans need to consider the specific ground conditions and document:

- **Site description**: a description of the disturbance, condition of the soil, local vegetation and availability / volume of any local stockpiles. Include photos.
- **Method**: earthworks including contour diagrams and machinery recommendations, surface treatment including ripping depths / widths and topsoil requirements, seed requirements including rates and seed mix.
- **Permit and other issues**: ground disturbance (land use certificates), heritage, below ground infrastructure, etc.
- **Timing**: when activities are to be undertaken, in consideration of season, recent weather conditions, and equipment availability.
- **Cost**: estimated cost to implement.

- **Monitoring**: indicators to be used to verify rehabilitation implementation success (performance indicators), i.e. conformance to design, seedling emergence etc. and other project specific environmental monitoring i.e. dust monitoring, weed monitoring etc.
- **Reporting and accountability**: project close out report standards, cost reconciliation, sign posting, GIS records, handover for ongoing rehabilitation performance monitoring. List of responsibility, accountability, consultative, informed persons for the project.

To ensure the rehabilitation activities are set up to achieve the closure objectives or otherwise support the closure planning process, action plans should be reviewed by the Environment and Operations Planning teams. On ground activities may commence once the action plans are agreed and the relevant work instructions are completed and approved by the Mine Manager.

## 12.3 Premature closure and other factors

Sudden changes in commodity pricing and other factors outside of the control of the mine plan can lead to the temporary suspension of operations or unexpected closure. In the event of unexpected closure or suspension of operations, the site will transfer into a care and maintenance regime. Relevant authorities, including DMIRS and DWER, will be notified and a *Care and Maintenance Plan* or equivalent will be developed in accordance with the direction provided by the relevant authorities.

The *Care and Maintenance Plan* will be developed to demonstrate how the safety and environmental obligations will be met during the suspension of operations. Closure-related activities will constitute one of the components of the *Care and Maintenance Plan*.

Closure-related activities that may require management during temporary suspension of operations are listed in Table 42. If closure of the operation is deemed to be permanent (unexpected closure) a new MCP would be developed for the site and submitted to the relevant authorities for approval, prior to the implementation of closure activities.

**Table 42. Closure-related activities for consideration during temporary suspension of operations.**

| Aspect | Hazard | Activity |
|---|---|---|
| Deleterious material encapsulation | Exposure of deleterious materials to oxygen and water | • Cover all deleterious waste rock in at least 5m of benign waste rock. Where additional benign material is available 10m of cover should be used.<br>• Review the WRL drainage management and where required provide appropriate drainage to minimise water ingress.<br>• Consider rehabilitation of WRL where landforms have reached capacity, in accordance with the MCP (including 10m of benign rock encapsulation). |

| Aspect | Hazard | Activity |
|---|---|---|
| WRL landform stability | Potential for sediment to move off site | • Review WRL designs and sediment protection.<br>• Consider rehabilitation of WRL where landforms have reached capacity, in accordance with the MCP.<br>• Construct sediment control structure around WRLs that have yet to reach capacity and are expected to be utilised when operation recommence.<br>• Establish monitoring regime to target high risk areas (where stability failure has potential to impact environment). |
| Groundwater quality | Metal enrichment and salinity | • Establish groundwater monitoring regime to address potential changes in water quality, based on landscape at time of care and maintenance. |
| Below water table pits | Potential for groundwater quality to degrade due to evapoconcentration. | • Model and predict groundwater recovery and potential impact to groundwater quality.<br>• If groundwater quality likely to be impacted in the short term, undertake actions to prevent impact. Consider maintaining water table suppression, backfill with waste (sterilise) and backfill with low grade ore stockpile. |
| Continuity of surface water flows | Potential for surface water flow to creeks to be terminated | • Review surface water management systems and assess long term stability of current (at the point of unexpected closure) management. Consider long term supply of water volumes, peak flows and sediment loads.<br>• If surface water systems are likely to impact to the downstream environment, identify options to prevent or mitigate impacts. Consider in pit backfill and levees to stabilise creek diversions, erosion controls to minimise sediment loads. |
| TSF management | Inappropriate storage of surface water | • Assess remaining storage capacity.<br>• If volume of water that could be stored is likely to compromise storage integrity (e.g. potential for a dam break) identify options to reduce dam storage volume. Consider removing / breaching the dam embankment, backfilling area, redesign of the spillway. |
| | Structural integrity degradation | • Consider license conditions and TSF Operations and Surveillance Manual requirements. Review conditions / requirements appropriate to changed operating conditions. Undertake consultation with appropriate regulators regarding any proposed changes. |
| | Dust generation | • Assess characteristics of waste fines on TSF to determine whether dust production is likely.<br>• If dust production is likely, identify actions to mitigate dust generation. Consider capping of waste fines, maintaining wet surface through water discharge. |

**Table 43. Closure monitoring framework**

| Mining Phases | Exploration & Study | Operational | | | Closure | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Closure Phases | Approval | Pre-closure | | | Closure | | | | Post-closure |
| Closure Stages | Targeted | Operation | Progressive re-vegetation | Trials | Decommissioning | Landform | Water | Vegetation | Observational |
| Monitoring programs | • Vegetation condition<br>• TEC/PEC vegetation health<br>• Groundwater dependent ecosystem health<br>• Flora species<br>• Terrestrial fauna species<br>• Avifauna species<br>• Subterranean fauna species<br>• Fauna habitats<br>• Groundwater movement<br>• Groundwater quality<br>• Mineral waste characteristics<br>• Heritage | • Significant fauna<br>• Riparian vegetation health<br>• TEC/PEC vegetation health<br>• Weeds<br>• Rainfall<br>• Waste water<br>• Waste management<br>• Surface water flow<br>• Groundwater movement<br>• Groundwater quality<br>• Dust<br>• Mineral waste volumes<br>• Ground stability<br>• Areas disturbed<br>• Heritage | • Vegetation community composition, structure and health<br>• Evidence of fauna use<br>• Weeds<br>• Soil / growth media properties<br>• Surface stability | • Germination rates<br>• Vegetation community composition, structure and health<br>• Soil / growth media properties<br>• Topsoil seed bank quality<br>• Topsoil properties<br>• Erosion type and rates<br>• Geomorphology evolution<br>• Infiltration rates<br>• Mineral waste permeability<br>• Mineral waste characteristics | • Significant fauna<br>• Riparian vegetation health<br>• TEC/PEC vegetation health<br>• Weeds<br>• Rainfall<br>• Waste water<br>• Waste management<br>• Groundwater movement<br>• Groundwater quality<br>• Dust<br>• Heritage | • Significant fauna<br>• Riparian vegetation health<br>• Weeds<br>• Rainfall<br>• Waste water<br>• Groundwater movement<br>• Groundwater quality<br>• Dust<br>• Heritage | | • Topsoil application<br>• Seed application rates<br>• Riparian vegetation health<br>• Weeds<br>• Rainfall<br>• Waste water<br>• Groundwater movement<br>• Groundwater quality<br>• Dust<br>• Heritage | • Riparian vegetation health<br>• TEC/PEC vegetation health<br>• Vegetation community composition, structure and health<br>• Weeds<br>• Rainfall<br>• Surface water flow<br>• Surface stability<br>• Groundwater movement<br>• Groundwater quality |
| Reporting mechanism | Public Environmental Review | Current annual / triennial environmental reviews | | | Future annual / triennial environmental reviews | | | | |
| Use in MCP | Baseline and issues identification | | Performance and improvement | | Conformance and issues resolution | | | | Conformance and maintenance |

# 13. MONITORING AND MAINTENANCE PROGRAMS

Table 43 lists the monitoring aspects required or considered at each closure planning and implementation stage. The monitoring programs for the site are still under development and will be developed in consultation with relevant key stakeholders.

## 13.1 Pre-closure monitoring programs and maintenance triggers

Pre-closure monitoring include:

- Operational stage monitoring programs, i.e. vegetation, fauna, weed, water quality etc., which are used to establish baseline conditions and identify potential closure-related issues; and
- Trials and progressive re-vegetation monitoring programs, which are used to gauge and improve closure performance.

Most of the operational stage monitoring programs are designed to alert the site to potential environmental impacts as a consequence of mining or to demonstrate compliance with approval or license conditions. Accordingly, operational stage monitoring programs presented below are managed separately from the closure planning cycle and are subject to regular review and update.

### 13.1.1 Ground stability and waste rock physical characteristics

To ensure potential geotechnical hazards are appropriately identified and addressed, management plans including the *Surface Ground Control Management Plans* and *TSF Operations Surveillance and Monitoring Manual*s will be developed.

Monitoring associated with these plans are expected to include:

- Ongoing development of particle size distribution curves (PSDs) for the waste rock presenting at the waste dumps, to inform waste rock landform design and construction;
- Operational inspections of active mining areas to identify areas of potential dump slope, pit wall and crest instability;
- Groundwater seepage, to verify design assumptions regarding groundwater response to seepage, including pit wall and embankment pore pressure (as required); and
- TSF embankment monitoring to confirm stability and measure performance. Stability of the TSF will be verified each year through annual independent audits.

### 13.1.2 Ore and mineral waste geochemistry

The *Acid and / or Metalliferous Drainage Plan* has been established to evaluate the potential for acid and metalliferous drainage to be generated from ore and mineral waste. The number of samples that are collected is based on the tonnage of material generated, and includes samples from various geological stratigraphies (including waste rock and ore), tailings and tailings supernatant.

The program includes an extensive framework of tiered trigger values, defined within the *Life of Mine Geochemistry Programme Site Specific Trigger Values* report, that prompt further test work and investigation, based on the material's potential to generate acid and the potential toxicity to aquatic ecosystems from soluble / bioavailable elements in the mineral waste. The program includes total element analysis, acid-base accounting, dissolved concentrations from short-term leaching water extracts and longer-term kinetic leaching water extracts when required.

Investigation trigger and response actions may include:

| Trigger | Response actions |
|---|---|
| Low Risk Trigger Values (LRTV) | Monitor next 3 analysis to identify increasing trend (towards ITV). |
| Investigation Trigger Values (ITV) | Review Hardness Modified Trigger Values<br>If unresolved, review analysis to confirm value<br>If unresolved, repeat tests and review analysis<br>If unresolved, communicate results with regulator (if required) and increase sampling interval<br>If unresolved, increase sampling range, up and down gradient, to determine extent of plume and establish source. Determine if it will reach receptors.<br>If unresolved, remove source or remediate. Continue increased sampling, tests and analysis until normal conditions return |

### 13.1.3 Groundwater movement and quality

An extensive network of groundwater monitoring bores will be established across Eliwana to track groundwater levels and changes / variability in groundwater quality, in both undisturbed and mine impacted aquifers. This information is used to inform groundwater movement predictions (e.g. dewatering) and to identify any impacts from mining activities.

Site specific groundwater quality trigger values will be established for Eliwana as part of the *Life of Mine Geochemistry Programme - Site Specific Trigger Values* report. The groundwater quality monitoring program is expected to include the following performance indicators:

- pH, EC, and total dissolved solids;

- Dissolved metals, non-metals and metalloids (i.e. Ag, Al, As, B, Be, Cd, Co, Cr, Cu, Fe, Hg, Mn, Ni, Pb, Se, Tl, V, Zn); and
- Major cations and anions (i.e. Na, K, Ca, Mg, Cl, $SO_4$ and Total Alkalinity).

Investigation trigger and response actions may include:

| Trigger | Response actions |
|---|---|
| Low Risk Trigger Values (LRTV) 80th percentile | Monitor next 3 analysis to identify increasing trend (towards ITV). |
| Investigation Trigger Values (ITV) 95th percentile | Review Hardness Modified Trigger Values<br>If unresolved, review/ repeat analysis to confirm value<br>If unresolved, repeat sampling and review analysis<br>If unresolved, communicate results with regulator (if required) and increase sampling interval<br>If unresolved, increase sampling range, up and down gradient, to determine extent of plume and establish source. Determine if it will reach receptors.<br>If unresolved, remove source or remediate. Continue increased sampling, tests and analysis until normal conditions return |

During the operating life of the mine, additional baseline and control site samples may be collected. The extended sample range will be used to refine and reduce the suit of trigger values, so that on closure, monitoring will focus elements of specific concern to the Eliwana ecosystems.

### 13.1.4 Surface water management

A surface water monitoring program will be developed across the site to track and evaluate the impact of changes to the hydrological regime on downstream sensitive receptors. The Program may include vegetation health monitoring, rainfall monitoring, surface water flow gauging and surface water quality samples.

Site specific trigger values will be established. Investigation trigger and response actions may include:

| Trigger | Response actions |
|---|---|
| Water quality exceedance | Confirm if the exceedance resulted in an impact to flora, fauna or water quality.<br>Identify the cause of the exceedance and take corrective actions to prevent further incidents. |
| Significant erosion | Confirm if the sediment released by the erosion event resulted in an impact to flora, water quality or pool health. Take corrective action to ameliorate where required.<br>Identify if corrective action is required to repair the erosion, or otherwise take corrective actions to prevent further incidents. |

| Trigger | Response actions |
|---|---|
| Flow regime or water levels changes exceed prediction | Confirm if the change resulted in an impact to vegetation. Take corrective action to ameliorate where required.<br>Identify if corrective action is required to return to predicted change levels. |

### 13.1.5 Presence of water in mining pits

When dewatering is temporarily or permanently ceased in inactive mining pits, the reduction in groundwater abstraction rates may allow the watertable to partially or fully recover in the base of some pits. Water may also enter the pits via surface water runoff, and potential via creek flow. When a substantial volume of water accumulates within the pit, the water quality and chemistry will be managed in accordance with the *Operational Mine Void Water Management Plan*.

This monitoring program is expected to include:

- Climate data (e.g. rainfall, evaporation, humidity)
- Water body surface level and aesthetics (e.g. Total Suspended Solids / Turbidity, Colour, Odour);
- Water quality (e.g.pH, EC, TDS (calc), Alkalinity, Cl, F, $PO_4$, $NO_3$/$NH_4$); and
- Water chemistry (e.g. Ag, Al, As, B, Ba, Be, Bi, Ca, Cd, Ce, Co, Total Cr, Cs, Cu, Fe, Hg, K, La, Li, Mg, Mn, Mo, Na, Ni, Pb, Rb, Sb, Sc, Se, Sn, $SO_4$, Sr, Th, Ti, Tl, U, V, W, Zn).

### 13.1.6 Vegetation

Vegetation performance in rehabilitated areas is currently undertaken in accordance with the *Rehabilitation and Revegetation Monitoring Procedure*. This procedure uses a combination of photographic monitoring points and monitoring transects compared against reference site performance. Monitoring transects track the following performance indicators:

- Species diversity, richness and composition, and general vegetation condition;
- Total perennial percentage cover, and overstorey (upper) species density and percentage cover;
- Land Function Analysis (LFA) measures of stability, nutrient cycling and infiltration;
- Erosion as measured by the mean number of rills/gullies per 50 m and average rill/gully width and depth;
- Evidence of feral animals (e.g. grazing, tracks, scats, burrows and/or direct sightings).

Where transects are utilised, data is currently collected on an annual basis for the first three years, to evaluate the success of the initial establishment, then on a biennial basis or other internal depending on the vegetation performance and condition e.g. if vegetation is trajectory towards reference sites monitoring may be reduced.

Maintenance trigger and management actions include:

| Trigger | Management actions |
|---|---|
| Monitoring results show levels of erosion occurring beyond natural geomorphic processes and has impact on rehabilitated landform e.g. compromising geotechnical stability | Review the revegetation process (e.g. timing, techniques) in context of other parameters measured during the monitoring process.<br>Implement maintenance repairs. |
| Unsuccessful planting, seeding or germination rates, or a decline/undesirable level in species diversity, structural complexity and percentage cover | Review and amend rehabilitation methods to address identified faults in the landform design.<br>Adjust monitoring frequency to determine if revised rehabilitation methods are effective and to identify any future revegetation / stability issues |

Progressive revegetation monitoring will be used to observe different aspects of the environment and to test different monitoring techniques during the mine life. Consequently, re-vegetation monitoring is not strictly aligned with completion criteria. Results from these studies will be used to inform completion criteria development and prompt stakeholder discussions.

### 13.1.7 Weeds

Weed monitoring is undertaken throughout the year, in accordance with the *Weed Management Plan*, in order to map and inventory weed populations and, where appropriate, implement appropriate actions to control or eradicate the weeds.

Mapping is undertaken using a targeted approach, where areas are selected to be mapped based on observed / reported weed occurrence and historical occurrence. Weed management currently includes:

- Identifying weed species, stem count, and foliar cover class; and
- Treatment e.g. manual or chemical, when required.

Weed treatments are undertaken in accordance the latest regulatory advice. Selected nuisance weeds may also be treated during some campaigns.

### 13.1.8 Fauna

The *Conservation Significant Fauna Management Plan* aims to determine the presence (or absence) of conservation significant terrestrial vertebrate and avifauna species, those species

listed under the *EPBC Act* as critically endangered, endangered, vulnerable or migratory. Where species are present, the monitoring programs seek to measure direct and indirect impacts to inform adaptive management programs.

Impact trigger and management actions include:

| Trigger | Management actions |
|---|---|
| Conservation significant fauna death | Arrange for the species to be verified by appropriately qualified personnel<br>Enter death in BMS and notify DPaW/DoE.<br>Identify reason for death and where it is caused by site activities, implement/change management measures where possible. |
| Conservation significant fauna injury | Record injury in BMS.<br>Appropriately qualified personnel to treat animals where possible and euthanaze where required.<br>Identify reason for injury and where it is caused by site activities, implement/change management measures. |

## 13.2 Closure monitoring and triggers

Closure monitoring will be established as areas of the mine are rehabilitated in preparation for mine closure. Closure monitoring will include a range of programs designed to:

- Manage health, safety and environmental factors, especially during field implementation;
- Check conformance to design; and
- Identify issues that may negatively influence closure outcomes.

As listed in Table 43, these programs cover aspects associated with decommissioning of infrastructure, construction and reshaping of landforms, construction of waterways and establishment of vegetation.

The performance criteria and measurements, additional controls and change management processes will be developed following an assessment of the implementation risks.

## 13.3 Post-closure monitoring and triggers

Post-closure monitoring will focus on demonstrating that the completion criteria have been achieved and on maintenance triggers. As described in Section 6 *Completion criteria*, post-closure monitoring programs will include aspects relating to landform stability, surface water, groundwater, vegetation health and fauna habitat.

The post-closure observational period is anticipated to span more than 20 years, based on the currently estimated groundwater recovery rates.

Monitoring programs and maintenance triggers are still being developed to address the needs of the post-closure phase. Various gap studies and associated field trials, identified through the risk assessment process, are required to be completed before these programs can be adequately defined and refined.

### 13.3.1 Ongoing management and control measures

Ongoing management and control measures refer to those management activities that will be undertaken to support post-closure monitoring programs, and continue after the closure objectives have been met but before the mine is relinquished to the State.

#### Weed management

Land maintenance and vehicular movement associated with inspections, tours and completion criteria monitoring have the potential to disturb land and influence weed populations. An ongoing weed management program, encompassing weed hygiene, surveys and treatment, is required to ensure that weed populations do not threaten the area's ecological values.

Eliwana's *Weed Management Plan* will be updated in consultation with the next land use managers (DBCA and the Pastoral Station managers), targeting areas of ongoing activity post-closure. It is expected that weed treatments will be undertaken in accordance the latest DBCA *Environmental Weed Ranking* (and control) recommendations for weed control.

#### Road management

Eliwana is located in a remote area of the Pilbara, accessible by unsealed roads and subject to regular flooding. Access to rehabilitated areas for inspections, tours and completion criteria monitoring will be via purpose built unsealed roads, owned and operated by Fortescue. Some roads are also intended to be left after the tenure is relinquished e.g. to ensure Traditional Owners can safely travel through the former mining areas in order to maintain their connections to country.

A *Road Monitoring and Maintenance Program* is required to ensure access roads not managed by Main Roads Western Australia can be traversed safely. The *Road Monitoring and Maintenance Program* will be developed in consultation with the next land user(s).

It is anticipated that inspections will be undertaken on a routine basis, depending on traffic usage rates, and following flood events to identify failure modes e.g. corrugations, potholes, rutting, slippery surfaces, scour, and maintenance requirements, i.e. grading.

## Rail infrastructure management

Eliwana will be serviced by The Pilbara Infrastructure Pty Ltd railway. (The railway is not part of the scope of this MCP.) The railway and associated infrastructure, including access roads and laydown areas, may remain in operation after Eliwana is closed, in accordance with the *Railway and Port (The Pilbara Infrastructure Pty Ltd) Agreement Act 2004*, in order to service other mining operations or other Pilbara industries.

The rail and associated infrastructure, including rail culverts and associated drainage controls, will continue to be managed and maintained by The Pilbara Infrastructure Pty Ltd, a wholly-owned subsidiary of Fortescue, in accordance with established railway operating approval and license conditions.

# 14. FINANCIAL PROVISIONING FOR CLOSURE

Financial provisions for closure are a measure of the best estimate of the expenditure required to close the mine in accordance with the current legal requirements, based on the current disturbance footprint, at the point in time when decommissioning is scheduled to commence.

Financial provisioning for closure is undertaken in accordance with Fortescue's external accounting requirements. The provision includes costs to implement and manage activities during the closure phase of the mining life-cycle, such as:

- Decommissioning, dismantling and removal of infrastructure, and associated disposal costs;
- Remediation of contamination;
- Earthmoving and landscaping;
- Reconstruction and management of surface water drainage;
- Treatments to establish vegetation;
- Maintenance and monitoring programs; and
- Project management and contingency cost.

Direct costs, costs relating to on ground activities, are estimated on a per hectare disturbance basis for each closure domain, factoring for salaries, fuel costs, fuel burn rate and machine maintenance costs. Additional cost elements for specific activities, i.e. grouting groundwater bores, are estimated using current market rates. Indirect costs, cost for project management etc., and contingency are estimated as a proportion of the direct cost.

Closure-related activities undertaken during the operational phase are managed as operational costs. These costs are budgeted and reviewed on an annual basis, and include:

- Decommissioning, dismantling and removal of infrastructure, and associated disposal activities;
- Remediation of spills and contamination activities;
- Progressive rehabilitation, including closure studies, research and trials;
- Operational phase monitoring and maintenance programs;
- Stakeholder engagement and consultation; and
- Project development and management costs.

# 15. MANAGEMENT OF INFORMATION AND DATA

## 15.1 MCP information management system

Mine closure related reports, guidelines, management plans and procedures are coordinated and managed through Fortescue's *Planning For Closure* SharePoint site. Support pages have been established for various aspects of the mine closure including: Landform Design, Water Management, Revegetation, Stakeholders and Financial Provision. The site is owned and managed by Fortescue's Operations Planning team, but includes contact details for the various internal subject matter experts and study owners located in various departments within Fortescue.

All of the documents presented on the *Planning For Closure* SharePoint site are managed in a SharePoint document database, which is supported by internal document control procedures. The database and document control procedures facilitate documents version control and review processes.

## 15.2 Data management

Monitoring data is predominantly stored in *EnviroSys* ™. *EnviroSys* is a database system with a web based interface that manages environmental and water parameters collected in the field and / or analysed under laboratory conditions. Data is exported from *EnviroSys* for analysis and interpretation, and the reports resulting from that interpretation are accessed via the *Planning For Closure* SharePoint site.

Spatial data is managed via Fortescue's Geographic Information Systems department and delivered via across multiple spatial data platforms including ArcGIS and Fortescue Maps. Data currently captured and tracked within the spatial systems include, but are not limited to: flora, fauna and vegetation pre-disturbance conditions, ground disturbance area, disturbance type and associated permits, monitoring locations, heritage places and areas to be avoided / not-disturbed.

## 15.3 Corporate legal and other obligations management

Corporate legal and other obligations are managed through the Land Management System (LMS), which is used to track and manage tenement, State Agreement, environmental, heritage and pastoral obligations.

# 16. REFERENCES

## 16.1 Internal guidelines, procedures and plans

The following tables list the closure-related internal guidelines, procedure and plans. These documents are available for internal staff via PIMS.

**Table 44. Fortescue internal guidance documents.**

| Reference | Title | Author | Date |
|---|---|---|---|
| 100-GU-EN-0018 | Characterisation of Mineral Waste Rock and Soils | Fortescue | 23 November 2011 |
| 100-GU-EN-0042 | Waste Rock Landform (WRL) Design Guidelines | Fortescue | 23 June 2016 |
| 100-PL-EN-0011 | Chemical and Hydrocarbon Management Plan | Fortescue | 18 July 2014 |
| 100-PL-EN-0022 | Conservation Significant Fauna Management Plan | Fortescue | February 2018 |
| 100-PL-EN-1009 | Groundwater Management Plan | Fortescue | February 2018 |
| 100-PL-EN-1014 | Life of Mine Geochemistry Programme AMD Sampling Plan | Tetra Tech Australia | 29 July 2014 |
| 100-PL-EN-1015 | Surface Water Management Plan | Fortescue | February 2018 |
| 100-PL-EN-1016 | Acid and Metalliferous Drainage Management Plan | Fortescue | 3 November 2015 |
| 100-PL-EN-1017 | Weed Management Plan | Fortescue | 19 August 2016 |
| 100-PL-EN-1020 | Vegetation Health Monitoring and Management Plan | Fortescue | February 2018 |
| 100-PR-EN-1017 | Waste Rock Landform (WRL) Design Procedure | Fortescue | 15 August 2012 |
| 100-PR-EN-0024 | Vegetation Clearing and Topsoil Management Procedure | Fortescue | February 2018 |
| 100-SP-CI-0004 | Standard Engineering Specification for Drainage and Flood Protection | Fortescue | 9 May 2012 |
| 45-GU-EN-0007 | Seed Collection and Management Guidelines | Fortescue | 1 July 2014 |
| 45-GU-EN-0010 | Defining Closure Objectives and Completion Criteria | Fortescue | 19 July 2016 |
| 45-PL-EN-0010 | Subterranean Fauna Survey Plan | Fortescue | February 2018 |
| 45-PL-EN-0014 | Waste Management Plan | Fortescue | 8 September 2011 |
| 45-PL-EN-0017 | Significant Flora and Vegetation Management Plan | Fortescue | 20 September 2011 |
| 45-PL-EN-0018 | Borrow Pit Management Plan | Fortescue | 20 October 2009 |
| 45-PR-EN-0006 | Weed Control Procedure | Fortescue | 22 October 2007 |
| 45-PR-EN-0027 | Rehabilitation and Revegetation Monitoring Procedure | Fortescue | 15 April 2016 |
| 45-PR-SA-0024 | Asbestos Management | Fortescue | 19 January 2012 |
| 45-SY-EN-0001 | Life of Mine Geochemistry Programme Site Specific Trigger Values | Fortescue | 12 June 2015 |
| SO-01001-WI-WI-OP-0001 | Collecting and Dispatching AMD Samples | Fortescue | 6 July 2016 |
| SO-PR-EN-0006 | Weed Monitoring and Control Procedure | Fortescue | 1 April 2015 |
| SO-PR-EN-0007 | Weed Hygiene Management Procedure | Fortescue | 11 June 2015 |

## 16.2 Internal and commissioned technical reports

The following tables list the internal reports used to inform this document. These documents are subject to commercial confidentiality and are not available for external release or review. These documents are available for internal staff via PIMS.

**Table 45. Technical reports.**

| Reference | Title | Author | Date |
|---|---|---|---|
| 750-EW-5700-AS-HY-0001 | Eliwana Mine Project - Surface Water Impacts Assessment | Fortescue | December 2017 |
| 750WH-5700RP-HY-0007 | Western Hub Stage 1 - Eliwana and Flying Fish Subsurface Materials Characterisation | Fortescue | December 2017 |
| 750WH-5700-RP-HY-0008 | Western Hub - Stage 1 Eliwana and Flying Fish Conceptual Site Model and Operational Risk Assessment | Fortescue | December 2017 |
| 750WH-5700RP-HY-0009 | Western Hub - Stage 1 Eliwana and Flying Fish Geochemistry Risk Assessment for Closure | Fortescue | December 2017 |
| 750WH-5700-RP-HY-0010 | Western Hub - Stage 1 Eliwana Mining Project: Phase I Mine Void Water and Pit Lake Assessment | Fortescue | December 2017 |
| 750WH-5700-RP-HY-0001 | Eliwana Mining Project Groundwater Impact Assessment | Golder Associates | December 2017 |
| 750WH-5700-RP-HY-0002 | Eliwana Mining Project – Hydrogeological Conceptual Model Report | Golder Associates | December 2017 |
| 750WH-5700-RP-HY-0004 | Eliwana Mining Project – Numerical Groundwater Model Development and Calibration Report | Golder Associates | December 2017 |
| 750WH-5700-RP-HY-0003 | Eliwana Mining Project – Numerical Groundwater Model Development and Calibration Report | Golder Associates | December 2017 |
| TBA | Eliwana Project - Soil Characterisation Study | SoilWater | December 2017 |
| J5437-01_R01-V03a | Eliwana Mine Project Discharge Assessment | Water Technology | January 2018 |
| TBA | Eliwana Project: Consolidated Vertebrate Fauna | Ecoscape | December 2017 |
| TBA | Eliwana and Flying Fish Level 2 Flora and Vegetation Survey (Phase 2) | Ecoscape | December 2017 |
| TBA | Eliwana project Subterranean Fauna Assessment | Biologic | December 2017 |
| TBA | Pilbara Groundwater Dependent Vegetation Literature Review | Astron | December 2017 |

## 16.3 External reference

The following externally published documents were referenced in the production of this report.


Bureau of Meteorology. (2016). Data for Eliwana. Retrieved from 2016 Rainfall IFD Data System: http://www.bom.gov.au/

Bureau of Meteorology. (2017a). Monthly Climate Statistics - Paraburdoo Aero (007185). Retrieved from Climate Statistics for Australian Locations: http://www.bom.gov.au/climate/averages/tables/cw_007185.shtml

Bureau of Meteorology. (2017b). Annual Average Evaporation. Retrieved from Average annual, monthly and seasonal evaporation: http://www.bom.gov.au/jsp/ncc/climate_averages/evaporation/index.jsp

Charles, D. & Ellery (Coppin), G. (2015) Putijarra Plants. South Hedland, WA: Wangka Maya Pilbara Aboriginal Language Centre.

CSIRO/BoM. (2017). Rangelands North. Retrieved from Climate Change in Australia: https://www.climatechangeinaustralia.gov.au/en/climate-projections/future-climate/regional-climate-change-explorer/sub-clusters/?current=RLNC&tooltip=true&popup=true

Department of Environmental Regulation (2010) Assessment levels for Soil, Sediment and Water. https://www.der.wa.gov.au/images/documents/your-environment/contaminated-sites/guidelines/2009641_-_assessment_levels_for_soil_sediment_and_water_-_web.pdf

Hayes, A. & Hayes, S. (2007) Ngambunyjarri: Thalanyjibarndi Yininyjarri: Thalanyji Plant Names and Uses. Onslow, WA: Wangka Maya Pilbara Aboriginal Language Centre.

Johnson, S. L., & Wright, A. H. (2001). Central Pilbara groundwater study. Water and Rivers Commission, Western Australia: Hydrogeological record series: HG 8. Pp 57.

Kendrick, P. (2001). Pilbara 3 (PIL3 - Hamersley Subregion). In D. o. Management, A Biodiversity Audit of Western Australia's 53 Biogeographic Subregions in 2002 (p. 724). Kensington, Western Australia: Dept. of Conservation & Land Management.

MWH. (2011). Central Pilbara 2 – Eliwana Scoping Surface Water Assessment. MWH Global.

Payne A.L., M. A. (1988). An inventory and condition survey of rangelands in the Ashburton River catchment, Western Australia. In W. A. Agriculture, Technical Bulletin No. 62. Perth.

Van Vreeswyck A.M.E, Payne A.L., Leighton K.A., Hennig P. (2004) An inventory and condition survey of the Pilbara region, Western Australia. Technical Bulletin No. 92. Department of Agriculture, South Perth

Vitenbergs, A. & Brehaut, L. (2001) The Guruma Story. Northern Territory: Jukurrpa Books.

**Appendix 1:** Closure obligations and commitments register

Report

# Closure related legal obligations register

## Eliwana

**14 February 2018**
**Appendix to the Eliwana Mine Closure Plan**

Fortescue
The New Force in Iron Ore

| | Closure related legal obligations | | Appendix 1<br>EW-PL-EN-0001 |
|---|---|---|---|
| **Revision Number** | 0 | | **14/02/2018** |
| **Status** | IFI - ISSUED FOR INFO | | |
| **Author** | Kirsty Beckett | Kirsty Beckett<br>Signature | 7/02/2018 |
| **Confidentiality** | FORTESCUE STAFF & CONTRACTORS | **Publish on Extranet** | ☐ Yes<br>☒ No |
| **Review Date** | 30/06/2018 | | |

# TABLE OF CONTENTS

# 1. INTRODUCTION

This document lists closure related obligations from the following instruments:

- *Environmental Protection Act 1986;*
- *Environment Protection and Biodiversity Conservation Act 1999;*
- *Railway and Port (The Pilbara Infrastructure Pty Ltd) Agreement Act 2004*;
- *Mining Act 1978;*
- *Land Administration Act 1997;*
- *Land Access Agreements.*

The register also identifies legislation, standards and guidelines that may not apply to Eliwana specifically, but that may be relevant to closure of mine sites generally.

A comprehensive legal review will be required as closure approaches to ensure that all relevant obligations are identified and actioned.

Note 1: the Eliwana Mine Closure Plan assumes no undisturbed land will be cleared for the purpose of implementing mine closure. Obligations pertaining to future clearing have not been included in this register.

Note 2: The scope of the Eliwana Mine Closure Plan excludes rail and associated infrastructure corridors.

# 2. OBLIGATION EXTRACTS

## 2.1 *Environmental Protection Act 1986*

### Part IV Ministerial Statements

No existing approvals issued under Part IV of the EP Act were identified.

### Part V Licence

No existing licenses issued under Part V of the EP Act were identified.

### Native Vegetation Clearing Permit

| CPS | Condition | Relevant closure condition |
|---|---|---|
| 6818/1 | 1 | Clearing can only occur on Rio Tenement AML70/4. |
| | 2 | To widen the existing road |

| CPS | Condition | Relevant closure condition |
|---|---|---|
| | 3 | The Permit Holder must not clear more than 2 hectares of native vegetation. All clearing must be within the area shaded yellow on attached Plan 6818/1. |
| | 6 | When undertaking any clearing or other activity authorized under this Permit, the Permit holder must take the following steps to minimize the risk of introduction and spread of weeds: i) Clean earth moving machinery of soil and vegetation prior to entering and leaving the area to be cleared; ii) ensure that no weed affected soil, mulch, fill or other material is brought into the area to be cleared; and iii) Restrict the movement of machines or other vehicles to the limits of the areas to be cleared. |
| | 7 | a. Where practicable the Permit holder shall avoid clearing riparian vegetation; and b. Where a watercourse is to be impacted by clearing, the Permit holder shall maintain the existing surface flow |

## 2.2 *Environment Protection and Biodiversity Conservation Act 1999*

### EPBC Decision Notice

No Decision Notices issued under the EPBC Act were identified.

## 2.3 *Mining Act 1978*

| Lease | Condition | Closure condition |
|---|---|---|
| E47/1194 | TC-2778 | All surface holes drilled for the purpose of exploration are to be capped, filled or otherwise made safe after completion. |
| | TC-2779 | All costeans and other disturbances to the surface of the land made as a result of exploration, including drill pads, grid lines and access tracks, being backfilled and rehabilitated to the satisfaction of the Environmental Officer. Backfilling and rehabilitation being required no later than 6 months after excavation unless otherwise approved in writing by the Environmental Officer, Department of Industry and Resources, DOIR. |
| | TC-2780 | All waste materials, rubbish, plastic sample bags, abandoned equipment and temporary buildings being removed from the mining tenement prior to or at the termination of exploration program. |
| | TC-2781 | Unless the written approval of the Environmental Officer, DOIR is first obtained, the use of scrapers, graders, bulldozers, backhoes or other mechanised equipment for surface disturbance or the excavation of costeans is prohibited. Following approval, all topsoil being removed ahead of mining operations and separately stockpiled for replacement after backfilling and/or completion of operations. |
| | TC-2782 | The Licensee notifying the holder of any underlying pastoral or grazing lease by telephone or in person, or by registered post if contact cannot be made, prior to undertaking airborne geophysical surveys or any ground disturbing activities utilising equipment such as scrapers, graders, bulldozers, backhoes, drilling rigs; water carting equipment or other mechanised equipment. |
| | TC-2783 | The Licensee or transferee, as the case may be, shall within thirty (30) days of receiving written notification of:-* the grant of the Licence; and* registration of a transfer introducing a new Licensee.Advise, by registered post, the holder of any underlying pastoral or grazing lease details of the grant or transfer. |
| | TC-2784 | No interference with Geodetic Survey Station SSM-JM60 and mining within 15 metres thereof being confined to below a depth of 15 metres from the natural surface. |
| | TC-2785 | The construction and operation of the project and measures to protect the environment being carried out generally in accordance with the document titled:* "Programme of Work on E47/1194, E47/1195 and E47/1196 for Fortescue Metals Group Limited" (Reg ID 27584) dated 8 July 2010 signed by Sean McGunnigle and |

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| | | retained on Department of Mines and Petroleum File No. T0569/201001;* "Programme of Work on E47/1194 for Fortescue Metals Group Limited" (Reg ID 27860) dated 29 July 2010 signed by Sean McGunnigle and retained on Department of Mines and Petroleum File No. T0569/201001;* "Fortescue Metals Group Limited, Exploration Environmental Management Plan v5" dated September 2010 and signed by Adam Meyer and retained on Department of Mines and Petroleum File No. T0569/201001;* "Programme of Work on E47/1194 and E47/1351 for Fortescue Metals Group Ltd" (Reg. ID 33243) dated 23 November 2011 signed by Matt Dowling and retained on Department of Mines and Petroleum file No. EARS-POW-33243;* (Reg. ID 34237) "Programme of Work on E47/1194, E47/1351, E47/1832 and E47/1988 for Fortescue Metals Group Ltd" dated 22 February 2012 signed by Fiona Rowland and retained on Department of Mines and Petroleum file No. EARS-POW-34237;* "Programme of Work on E47/1191-I and P47/1666-I for Fortescue Metals Group Limited" (Reg ID 41835) dated 21 August 2013 signed by Amy Barker and retained on Department of Mines and Petroleum File No. EARS-POW-41835;* "Programme of Work on E47/1194, E47/1299, E47/1300, E47/1351 and P47/1403 for Fortescue Metals Group Limited" (Reg ID 40650) dated 30 July 2013 signed by Andrew Winzer and retained on Department of Mines and Petroleum File No. EARS-POW-40650Where a difference exists between the above document(s) and the following conditions, then the following conditions shall prevail. |
| | TC-2786 | The development and operation of the project being carried out in such a manner so as to create the minimum practicable disturbance to the existing vegetation and natural landform. |
| | TC-2787 | All topsoil and vegetation being removed ahead of all mining operations and being stockpiled appropriately for later respreading or immediately respread as rehabilitation progresses. |
| E47/1195 | TC-2788 | All surface holes drilled for the purpose of exploration are to be capped, filled or otherwise made safe after completion. |
| | TC-2789 | All costeans and other disturbances to the surface of the land made as a result of exploration, including drill pads, grid lines and access tracks, being backfilled and rehabilitated to the satisfaction of the Environmental Officer. Backfilling and rehabilitation being required no later than 6 months after excavation unless otherwise approved in writing by the Environmental Officer, DOIR. |
| | TC-2790 | All waste materials, rubbish, plastic sample bags, abandoned equipment and temporary buildings being removed from the mining tenement prior to or at the termination of exploration program. |
| | TC-2791 | Unless the written approval of the Environmental Officer, DOIR is first obtained, the use of scrapers, graders, bulldozers, backhoes or other mechanised equipment for surface disturbance or the excavation of costeans is prohibited. Following approval, all topsoil being removed ahead of mining operations and separately stockpiled for replacement after backfilling and/or completion of operations. |
| | TC-2792 | The Licensee notifying the holder of any underlying pastoral or grazing lease by telephone or in person, or by registered post if contact cannot be made, prior to undertaking airborne geophysical surveys or any ground disturbing activities utilising equipment such as scrapers, graders, bulldozers, backhoes, drilling rigs; water carting equipment or other mechanised equipment. |
| | TC-2793 | The Licensee or transferee, as the case may be, shall within thirty (30) days of receiving written notification of:-* the grant of the Licence; and* registration of a transfer introducing a new Licensee.Advise, by registered post, the holder of any underlying pastoral or grazing lease details of the grant or transfer. |
| | TC-2794 | The construction and operation of the project and measures to protect the environment being carried out generally in accordance with the document titled:* "Fortescue Metals Group Limited, Exploration Environmental Management Plan v5" dated September 2010 and signed by Adam Meyer and retained on Department of Mines and Petroleum File No. T0569/201001;* "Programme of Work on E47/1194, E47/1195 and E47/1196 for Fortescue Metals Group Limited" (Reg ID 27584) dated 8 July 2010 signed by Sean McGunnigle and retained on Department of Mines and Petroleum File No. T0569/201001;* "Programme of Work on E47/1195, E47/1196, E47/1300, E47/1301 and P47/1400 for Fortescue Metals Group Ltd" (Reg. ID 32518) dated 15 September 2011 signed by Sean McGunnigle and retained on Department of |

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| | | Mines and Petroleum file No. EARS-POW-32518;* "Programme of Work on E47/1195-I, E47/1302-I, E47/1373-I, E47/1533-I and P47/1270-I for Fortescue Metals Group Ltd" (Reg ID 33376) dated 2 December 2011 signed by Mr Matt Dowling - Senior Environmental Advisor and retained on Department of Mines and Petroleum File No. POW-33376Where a difference exists between the above document(s) and the following conditions, then the following conditions shall prevail. |
| | TC-2795 | The development and operation of the project being carried out in such a manner so as to create the minimum practicable disturbance to the existing vegetation and natural landform. |
| E47/1196 | TC-2796 | All surface holes drilled for the purpose of exploration are to be capped, filled or otherwise made safe after completion. |
| | TC-2797 | All costeans and other disturbances to the surface of the land made as a result of exploration, including drill pads, grid lines and access tracks, being backfilled and rehabilitated to the satisfaction of the Environmental Officer. Backfilling and rehabilitation being required no later than 6 months after excavation unless otherwise approved in writing by the Environmental Officer, DOIR. |
| | TC-2798 | All waste materials, rubbish, plastic sample bags, abandoned equipment and temporary buildings being removed from the mining tenement prior to or at the termination of exploration program. |
| | TC-2799 | Unless the written approval of the Environmental Officer, DOIR is first obtained, the use of scrapers, graders, bulldozers, backhoes or other mechanised equipment for surface disturbance or the excavation of costeans is prohibited. Following approval, all topsoil being removed ahead of mining operations and separately stockpiled for replacement after backfilling and/or completion of operations. |
| | TC-2800 | The Licensee notifying the holder of any underlying pastoral or grazing lease by telephone or in person, or by registered post if contact cannot be made, prior to undertaking airborne geophysical surveys or any ground disturbing activities utilising equipment such as scrapers, graders, bulldozers, backhoes, drilling rigs; water carting equipment or other mechanised equipment. |
| | TC-2801 | The Licensee or transferee, as the case may be, shall within thirty (30) days of receiving written notification of:-* the grant of the Licence; and* registration of a transfer introducing a new Licensee.Advise, by registered post, the holder of any underlying pastoral or grazing lease details of the grant or transfer. |
| | TC-2802 | The construction and operation of the project and measures to protect the environment being carried out generally in accordance with the document titled:* "Proposal of Works for Fortescue Metals Group Ltd on E47/1196 (EXP 5301)" dated 7 September 2006 SIGNED BY Francis Pochettino and retained on Department of Industry and Resources file No. 10201/02 VOL.01;* "Fortescue Metals Group Limited, Exploration Environmental Management Plan v5" dated September 2010 and signed by Adam Meyer and retained on Department of Mines and Petroleum File No. T0569/201001;* "Programme of Work on E47/1194, E47/1195 and E47/1196 for Fortescue Metals Group Limited" (Reg ID 27584) dated 8 July 2010 signed by Sean McGunnigle and retained on Department of Mines and Petroleum File No. T0569/201001;* "Programme of Work on E47/1196, E47/1300, E47/1301 and E47/1302 for Fortescue Metals Group Ltd" (Reg. ID 32513) dated 15 September 2011 signed by Sean McGunnigle and retained on Department of Mines and Petroleum file No. EARS-POW-32513;* "Programme of Work on E47/1195, E47/1196, E47/1300, E47/1301 and P47/1400 for Fortescue Metals Group Ltd" (Reg. ID 32518) dated 15 September 2011 signed by Sean McGunnigle and retained on Department of Mines and Petroleum file No. EARS-POW-32518;* "Programme of Work on E47/1196, E47/1301, E47/1302 and E47/2037 for Fortescue Metals Group Limited" (Reg ID 32579) dated 29 September 2011 signed by Mr Matt Dowling Senior Environmental Advisor and retained on Department of Mines and Petroleum File No. EARS-POW-32579Where a difference exists between the above document(s) and the following conditions, then the following conditions shall prevail. |
| | TC-2803 | The development and operation of the project being carried out in such a manner so as to create the minimum practicable disturbance to the existing vegetation and natural landform. |
| E47/1300 | TC-2845 | All surface holes drilled for the purpose of exploration are to be capped, filled or otherwise made safe after completion. |

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| | TC-2846 | All costeans and other disturbances to the surface of the land made as a result of exploration, including drill pads, grid lines and access tracks, being backfilled and rehabilitated to the satisfaction of the Environmental Officer, Department of Industry and Resources (DoIR). Backfilling and rehabilitation being required no later than 6 months after excavation unless otherwise approved in writing by the Environmental Officer, DoIR. |
| | TC-2847 | All waste materials, rubbish, plastic sample bags, abandoned equipment and temporary buildings being removed from the mining tenement prior to or at the termination of exploration program. |
| | TC-2848 | Unless the written approval of the Environmental Officer, DoIR is first obtained, the use of scrapers, graders, bulldozers, backhoes or other mechanised equipment for surface disturbance or the excavation of costeans is prohibited. Following approval, all topsoil being removed ahead of mining operations and separately stockpiled for replacement after backfilling and/or completion of operations. |
| | TC-2849 | The licensee notifying the holder of any underlying pastoral or grazing lease by telephone or in person, or by registered post if contact cannot be made, prior to undertaking airborne geophysical surveys or any ground disturbing activities utilising equipment such as scrapers, graders, bulldozers, backhoes, drilling rigs; water carting equipment or other mechanised equipment. |
| | TC-2850 | The Licensee or transferee, as the case may be, shall within thirty (30) days of receiving written notification of:-* the grant of the Licence; or* registration of a transfer introducing a new Licensee;advise, by registered post, the holder of any underlying pastoral or grazing lease details of the grant or transfer. |
| | TC-2851 | No interference with Geodetic Survey Station JM 8,9,10,11,11A,12,31,32 & Y9 and mining within 15 metres thereof being confined to below a depth of 15 metres from the natural surface. |
| | TC-2852 | The construction and operation of the project and measures to protect the environment being carried out generally in accordance with the document titled:* "Programme of Work for Fortescue Metals Group Pty Ltd on E47/1300, E47/1301, E47/1302 and P47/1402" (Reg. ID 13120) dated 14 April 2008 signed by Francis Pochettino, and retained on Department of Industry and Resources file No. T1940/200301;* "Programme of Work on E47/1299, E47/1300, E47/1301, E47/1302, P47/1399 and P47/1403 for Fortescue Metals Group Limited" (Reg ID 27451) dated 30 June 2010 signed by Sean McGunnigle and retained on Department of Mines and Petroleum File No. T1938/200301;* "Fortescue Metals Group Limited Exploration Environmental Management Plan version 5" dated September 2010 and signed by Adam Meyer and retained on Department of Mines and Petroleum File No. T1938/200301;* "Programme of Work on E47/1196, E47/1300, E47/1301 and E47/1302 for Fortescue Metals Group Ltd" (Reg. ID 32513) dated 15 September 2011 signed by Sean McGunnigle and retained on Department of Mines and Petroleum file No. EARS-POW-32513;* "Programme of Work on E47/1195, E47/1196, E47/1300, E47/1301 and P47/1400 for Fortescue Metals Group Ltd" (Reg. ID 32518) dated 15 September 2011 signed by Sean McGunnigle and retained on Department of Mines and Petroleum file No. EARS-POW-32518;* (Reg. ID 34241) "Programme of Work on E47/1300, E47/1301, E47/1302, E47/1373, E47/1533 for Fortescue Metals Group Ltd" dated 22 February 2012 signed by Fiona Rowland and retained on Department of Mines and Petroleum file No. EARS-POW-34241;* "Programme of Work on E47/1299 and E47/1300 for Fortescue Metals Group Ltd" (Reg ID 36213) dated 3 September 2012 signed by Fiona Rowland and retained on Department of Mines and Petroleum File No. EARS-POW-36213;* "Programme of Work on E47/1299, E47/1300 and P47/1403 for Fortescue Metals Group Ltd" (Reg ID 36840) dated 11 September 2012 signed by Matt Dowling and retained on Department of Mines and Petroleum File No. EARS-POW-36840;* "Programme of Work on E47/1299, E47/1300, E47/1301 and E47/1302 for Fortescue Metals Group" (Reg ID 40283) dated 29 August 2013 signed by Andrew Winzer and retained on Department of Mines and Petroleum File No. EARS-POW-40283;* "Programme of Work on E47/1194, E47/1299, E47/1300, E47/1351 and P47/1403 for Fortescue Metals Group Limited" (Reg ID 40650) dated 30 July 2013 signed by Andrew Winzer and retained on Department of Mines and Petroleum File No. EARS-POW-40650Where a difference exists between the above document(s) and the following conditions, then the following conditions shall prevail. |

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| | TC-2853 | The development and operation of the project being carried out in such a manner so as to create the minimum practicable disturbance to the existing vegetation and natural landform. |
| | TC-2854 | All topsoil being removed ahead of all mining operations from sites such as pit areas, waste disposal areas, ore stockpile areas, pipeline, haul roads and new access roads and being stockpiled for later respreading or immediately respread as rehabilitation progresses. |
| | TC-2855 | All topsoil and vegetation being removed ahead of all mining operations and being stockpiled appropriately for later respreading or immediately respread as rehabilitation progresses. |
| E47/1301 | TC-2856 | All surface holes drilled for the purpose of exploration are to be capped, filled or otherwise made safe after completion. |
| | TC-2857 | All costeans and other disturbances to the surface of the land made as a result of exploration, including drill pads, grid lines and access tracks, being backfilled and rehabilitated to the satisfaction of the Environmental Officer, Department of Industry and Resources (DoIR). Backfilling and rehabilitation being required no later than 6 months after excavation unless otherwise approved in writing by the Environmental Officer, DoIR. |
| | TC-2858 | All waste materials, rubbish, plastic sample bags, abandoned equipment and temporary buildings being removed from the mining tenement prior to or at the termination of exploration program. |
| | TC-2859 | Unless the written approval of the Environmental Officer, DoIR is first obtained, the use of scrapers, graders, bulldozers, backhoes or other mechanised equipment for surface disturbance or the excavation of costeans is prohibited. Following approval, all topsoil being removed ahead of mining operations and separately stockpiled for replacement after backfilling and/or completion of operations. |
| | TC-2860 | The licensee notifying the holder of any underlying pastoral or grazing lease by telephone or in person, or by registered post if contact cannot be made, prior to undertaking airborne geophysical surveys or any ground disturbing activities utilising equipment such as scrapers, graders, bulldozers, backhoes, drilling rigs; water carting equipment or other mechanised equipment. |
| | TC-2861 | The Licensee or transferee, as the case may be, shall within thirty (30) days of receiving written notification of:-* the grant of the Licence; or* registration of a transfer introducing a new Licensee;advise, by registered post, the holder of any underlying pastoral or grazing lease details of the grant or transfer. |
| | TC-2862 | No interference with Geodetic Survey Station JM 13, 14, 29 & 30 and mining within 15 metres thereof being confined to below a depth of 15 metres from the natural surface. |
| | TC-2863 | No interference with the use of the Aerial Landing Ground and mining thereon being confined to below a depth of 15 metres from the natural surface. |
| | TC-2864 | The construction and operation of the project and measures to protect the environment being carried out generally in accordance with the document titled:* "Programme of Work for Fortescue Metals Group Pty Ltd on E47/1300, E47/1301, E47/1302 and P47/1402" (Reg. ID 13120) dated 14 April 2008 signed by Francis Pochettino, and retained on Department of Industry and Resources file No. T1940/200301;* "Programme of Work on E47/1299, E47/1300, E47/1301, E47/1302, P47/1399 and P47/1403 for Fortescue Metals Group Limited" (Reg ID 27451) dated 30 June 2010 signed by Sean McGunnigle and retained on Department of Mines and Petroleum File No. T1938/200301;* "Fortescue Metals Group Limited Exploration Environmental Management Plan version 5" dated September 2010 and signed by Adam Meyer and retained on Department of Mines and Petroleum File No. T1938/200301;* "Programme of Work on E47/1196, E47/1300, E47/1301 and E47/1302 for Fortescue Metals Group Ltd" (Reg. ID 32513) dated 15 September 2011 signed by Sean McGunnigle and retained on Department of Mines and Petroleum file No. EARS-POW-32513;* "Programme of Work on E47/1195, E47/1196, E47/1300, E47/1301 and P47/1400 for Fortescue Metals Group Ltd" (Reg. ID 32518) dated 15 September 2011 signed by Sean McGunnigle and retained on Department of Mines and Petroleum file No. EARS-POW-32518;* (Reg. ID 34241) "Programme of Work on E47/1300, E47/1301, E47/1302, E47/1373, E47/1533 for Fortescue Metals Group Ltd" dated 22 February 2012 signed by Fiona Rowland and retained on Department of |

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| | | Mines and Petroleum file No. EARS-POW-34241;* (Reg ID 35255) "Programme of Work on E47/1301 and E47/2442 for Fortescue Metals Group Ltd" dated 7 May 2012 signed by Fiona Rowland and retained on Department of Mines and Petroleum File No. EARS-POW-35255;* "Programme of Work on E47/1196, E47/1301, E47/1302 and E47/2037 for Fortescue Metals Group Limited" (Reg ID 32579) dated 29 September 2011 signed by Mr Matt Dowling Senior Environmental Advisor and retained on Department of Mines and Petroleum File No. EARS-POW-32579;* "Programme of Work on E47/1299 and E47/1300 for Fortescue Metals Group Ltd" (Reg ID 36213) dated 3 September 2012 signed by Fiona Rowland and retained on Department of Mines and Petroleum File No. EARS-POW-36213;* "Programme of Work on E47/1299, E47/1300 and P47/1403 for Fortescue Metals Group Ltd" (Reg ID 36840) dated 11 September 2012 signed by Matt Dowling and retained on Department of Mines and Petroleum File No. EARS-POW-36840;* "Programme of Work on E47/1299, E47/1300, E47/1301 and E47/1302 for Fortescue Metals Group" (Reg ID 40283) dated 29 August 2013 signed by Andrew Winzer and retained on Department of Mines and Petroleum File No. EARS-POW-40283Where a difference exists between the above document(s) and the following conditions, then the following conditions shall prevail. |
| | TC-2865 | The development and operation of the project being carried out in such a manner so as to create the minimum practicable disturbance to the existing vegetation and natural landform. |
| | TC-2866 | All topsoil being removed ahead of all mining operations from sites such as pit areas, waste disposal areas, ore stockpile areas, pipeline, haul roads and new access roads and being stockpiled for later respreading or immediately respread as rehabilitation progresses. |
| E47/1302 | TC-2867 | All surface holes drilled for the purpose of exploration are to be capped, filled or otherwise made safe after completion. |
| | TC-2868 | All costeans and other disturbances to the surface of the land made as a result of exploration, including drill pads, grid lines and access tracks, being backfilled and rehabilitated to the satisfaction of the Environmental Officer, Department of Industry and Resources (DoIR). Backfilling and rehabilitation being required no later than 6 months after excavation unless otherwise approved in writing by the Environmental Officer, DoIR. |
| | TC-2869 | All waste materials, rubbish, plastic sample bags, abandoned equipment and temporary buildings being removed from the mining tenement prior to or at the termination of exploration program. |
| | TC-2870 | Unless the written approval of the Environmental Officer, DoIR is first obtained, the use of scrapers, graders, bulldozers, backhoes or other mechanised equipment for surface disturbance or the excavation of costeans is prohibited. Following approval, all topsoil being removed ahead of mining operations and separately stockpiled for replacement after backfilling and/or completion of operations. |
| | TC-2871 | The licensee notifying the holder of any underlying pastoral or grazing lease by telephone or in person, or by registered post if contact cannot be made, prior to undertaking airborne geophysical surveys or any ground disturbing activities utilising equipment such as scrapers, graders, bulldozers, backhoes, drilling rigs; water carting equipment or other mechanised equipment. |
| | TC-2872 | The Licensee or transferee, as the case may be, shall within thirty (30) days of receiving written notification of:-* the grant of the Licence; or* registration of a transfer introducing a new Licensee;advise, by registered post, the holder of any underlying pastoral or grazing lease details of the grant or transfer. |
| | TC-2873 | The prior written consent of the Minister for State Development being obtained before commencing mining on Geodetic Station Reserves 40902, 40903, 40904 & 40906. |
| | TC-2874 | No interference with Geodetic Survey Station JM 16, 27 & 28 and mining within 15 metres thereof being confined to below a depth of 15 metres from the natural surface. |
| | TC-2875 | No interference with the use of the Aerial Landing Ground and mining thereon being confined to below a depth of 15 metres from the natural surface. |
| | TC-2876 | The construction and operation of the project and measures to protect the environment being carried out generally in accordance with the document titled: * ;Programme of Works for Fortescue Metals Group Ltd on E47/1302; (Exp 6504) dated |

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| | | 4 April 2007 signed by Francis Pochettino and retained on Department of Industry and Resources File No. T1941/200301 * ;Programme of Works for Fortescue Metals Group Ltd on E47/1302 (Reg ID 20049); dated 5 August 2008 signed by Francis Pochettino and retained on Department of Industry and Resources File No. T1941/200301. * Email titled ;RE: PoW - FMG, E47/1302 (Reg ID 20049; authored Francis Pochettino, received 2 September 2008, and retained on Department of Industry and Resources file No. T1941/200301. * ;Programme of Work for Fortescue Metals Group Pty Ltd on E47/1300, E47/1301, E47/1302 and P47/1402; (Reg. ID 13120) dated 14 April 2008 signed by Francis Pochettino, and retained on Department of Industry and Resources file No. T1940/200301; * ;Programme of Work on E47/1299, E47/1300, E47/1301, E47/1302, P47/1399 and P47/1403 for Fortescue Metals Group Limited; (Reg ID 27451) dated 30 June 2010 signed by Sean McGunnigle and retained on Department of Mines and Petroleum File No. T1938/200301; * ;Fortescue Metals Group Limited Exploration Environmental Management Plan version 5; dated September 2010 and signed by Adam Meyer and retained on Department of Mines and Petroleum File No. T1938/200301; * ;Programme of Work on E47/1373 for Fortescue Metals Group Limited; (Reg ID 29133) dated 1 December 2010 signed by Sean McGunnigle and letter titled ;Re: Programme of Work Application - E47/1373, Resource Drilling Upon Lines with 50m to 100m Spaced Holes and Infill Drilling Upon Lines with 50m to 100m Spaced Holes; dated 21 December 2010 signed by Ross Doherty both retained on Department of Mines and Petroleum File No. EARS-POW-29131; 29133; * ;Programme of Work on E47/1302 for Fortescue Metals Group Limited; (Reg ID 29080) dated 2 December 2010 signed by Sean McGunnigle and retained on Department of Mines and Petroleum File No. EARS-POW-29080; * ;Programme of Work on E47/1196, E47/1300, E47/1301 and E47/1302 for Fortescue Metals Group Ltd; (Reg. ID 32513) dated 15 September 2011 signed by Sean McGunnigle and retained on Department of Mines and Petroleum file No. EARS-POW-32513; * (Reg. ID 34241) ;Programme of Work on E47/1300, E47/1301, E47/1302, E47/1373, E47/1533 for Fortescue Metals Group Ltd; dated 22 February 2012 signed by Fiona Rowland and retained on Department of Mines and Petroleum file No. EARS-POW-34241; * (Reg ID 34675) ;Programme of Work on E47/1302 for Fortescue Metals Group Ltd; dated 23 March 2012 signed by Fiona Rowland and retained on Department of Mines and Petroleum File No. EARS-POW-34675; * ;Programme of Work on E47/1196, E47/1301, E47/1302 and E47/2037 for Fortescue Metals Group Limited; (Reg ID 32579) dated 29 September 2011 signed by Mr Matt Dowling Senior Environmental Advisor and retained on Department of Mines and Petroleum File No. EARS-POW-32579; * ;Programme of Work on E47/1195-I, E47/1302-I, E47/1373-I, E47/1533-I and P47/1270-I for Fortescue Metals Group Ltd; (Reg ID 33376) dated 2 December 2011 signed by Mr Matt Dowling - Senior Environmental Advisor and retained on Department of Mines and Petroleum File No. POW-33376; * ;Programme of Work on E47/1299 and E47/1300 for Fortescue Metals Group Ltd; (Reg ID 36213) dated 3 September 2012 signed by Fiona Rowland and retained on Department of Mines and Petroleum File No. EARS-POW-36213; * ;Programme of Work on E47/1299, E47/1300 and P47/1403 for Fortescue Metals Group Ltd; (Reg ID 36840) dated 11 September 2012 signed by Matt Dowling and retained on Department of Mines and Petroleum File No. EARS-POW-36840; * ;Programme of Work on E47/1299, E47/1300, E47/1301 and E47/1302 for Fortescue Metals Group; (Reg ID 40283) dated 29 August 2013 signed by Andrew Winzer and retained on Department of Mines and Petroleum File No. EARS-POW-40283 * ;Exploration Environmental Mangagement Plan; dated 25 July 2013 signed by S. Robinson and retained on Department of Mines and Petroleum file no. EARS-POW-62594 as Doc ID 4711671. Where a difference exists between the above document(s) and the following conditions, then the following conditions shall prevail. |
| | TC-2877 | The development and operation of the project being carried out in such a manner so as to create the minimum practicable disturbance to the existing vegetation and natural landform. |
| | TC-2878 | All topsoil and vegetation being removed ahead of all mining operations and being stockpiled for later respreading or immediately respread as rehabilitation progresses. |
| | TC-2879 | No activities being carried out within the proposed railway corridor (designated FNA 8039 ) that interfere with or restrict any rail route investigation activities being undertaken by the rail line proponent. |
| E47/1357 | TC-11974 | The construction and operation of the project and measures to protect the environment to be carried out in accordance with the document titled:* ;Programme of |

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| | | Work on E47/1357-I for Fortescue Metals Group Ltd; (Reg ID 54178) dated 13 March 2015 signed by Shontelle Curtis and retained on Department of Mines and Petroleum File No. EARS-POW-54178 as Doc ID 3469203;* ;Exploration Environmental Management Plan (E-PL-002_Rev 6) by Fortescue Metals Group Ltd (Reg ID 54178) dated August 2013 signed by Stuart Robinson and retained on Department of Mines and Petroleum File No. EARS-POW-54178 as Doc ID 3469202. Where a difference exists between the above document(s) and the following conditions, then the following conditions shall prevail. |
| | TC-11975 | The development and operation of the project being carried out in such a manner so as to create the minimum practicable disturbance to the existing vegetation and natural landform. |
| | TC-11976 | All topsoil and vegetation being removed ahead of all mining operations and being stockpiled appropriately for later respreading or immediately respread as rehabilitation progresses. |
| | TC-3055 | All surface holes drilled for the purpose of exploration are to be capped, filled or otherwise made safe after completion. |
| | TC-3056 | All costeans and other disturbances to the surface of the land made as a result of exploration, including drill pads, grid lines and access tracks, being backfilled and rehabilitated to the satisfaction of the Environmental Officer, Department of Mines and Petroleum (DMP). Backfilling and rehabilitation being required no later than 6 months after excavation unless otherwise approved in writing by the Environmental Officer, DMP. |
| | TC-3057 | All waste materials, rubbish, plastic sample bags, abandoned equipment and temporary buildings being removed from the mining tenement prior to or at the termination of exploration program. |
| | TC-3058 | Unless the written approval of the Environmental Officer, DMP is first obtained, the use of scrapers, graders, bulldozers, backhoes or other mechanised equipment for surface disturbance or the excavation of costeans is prohibited. Following approval, all topsoil being removed ahead of mining operations and separately stockpiled for replacement after backfilling and/or completion of operations. |
| | TC-3059 | The licensee notifying the holder of any underlying pastoral or grazing lease by telephone or in person, or by registered post if contact cannot be made, prior to undertaking airborne geophysical surveys or any ground disturbing activities utilising equipment such as scrapers, graders, bulldozers, backhoes, drilling rigs; water carting equipment or other mechanised equipment. |
| | TC-3060 | The Licensee or transferee, as the case may be, shall within thirty (30) days of receiving written notification of:-* the grant of the Licence; or* registration of a transfer introducing a new Licensee;advise, by registered post, the holder of any underlying pastoral or grazing lease details of the grant or transfer. |
| E47/1373 | TC-3110 | All surface holes drilled for the purpose of exploration are to be capped, filled or otherwise made safe after completion. |
| | TC-3111 | All costeans and other disturbances to the surface of the land made as a result of exploration, including drill pads, grid lines and access tracks, being backfilled and rehabilitated to the satisfaction of the Environmental Officer, Department of Industry and Resources (DoIR). Backfilling and rehabilitation being required no later than 6 months after excavation unless otherwise approved in writing by the Environmental Officer, DoIR. |
| | TC-3112 | All waste materials, rubbish, plastic sample bags, abandoned equipment and temporary buildings being removed from the mining tenement prior to or at the termination of exploration program. |
| | TC-3113 | Unless the written approval of the Environmental Officer, DoIR is first obtained, the use of scrapers, graders, bulldozers, backhoes or other mechanised equipment for surface disturbance or the excavation of costeans is prohibited. Following approval, all topsoil being removed ahead of mining operations and separately stockpiled for replacement after backfilling and/or completion of operations. |
| | TC-3114 | The Licensee notifying the holder of any underlying pastoral or grazing lease by telephone or in person, or by registered post if contact cannot be made, prior to undertaking airborne geophysical surveys or any ground disturbing activities utilising |

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| | | equipment such as scrapers, graders, bulldozers, backhoes, drilling rigs; water carting equipment or other mechanised equipment. |
| | TC-3115 | The Licensee or transferee, as the case may be, shall within thirty (30) days of receiving written notification of:-* the grant of the Licence; or* registration of a transfer introducing a new Licensee;advise, by registered post, the holder of any underlying pastoral or grazing lease details of the grant or transfer. |
| | TC-3116 | No interference with Geodetic Survey Station SSM-JM 26, SSM-JM 72 and mining within 15 metres thereof being confined to below a depth of 15 metres from the natural surface. |
| | TC-3117 | The prior written consent of the Minister for State Development being obtained before commencing mining on Geodetic Station Reserve 40904. |
| | TC-3118 | The construction and operation of the project and measures to protect the environment being carried out generally in accordance with the document titled:* "Proposal of Works for FMG Phibara Pty Ltd on Exploration Licence 47/1373" (EXP 5199) dated 20 August 2006 signed by Francis Pochettino, and retained on Department of Industry and Resources file No. T0579/200401.* Programme of Works for Fortescue Metals Group Ltd on E47/1373 (EXP 5733)" dated 4 December 2006 signed by Stuart Robinson, and retained on Department of Industry and Resources file T0579/200401;* "Programme of Work on E47/1155 and E47/1373 for Fortescue Metals Group Limited" (Reg ID 27986) dated Date on Application signed by Sean McGunnigle and retained on Department of Mines and Petroleum File No. T0579/200402;* "Programme of Work on E47/1373 for Fortescue Metals Group Limited" (Reg ID 29133) dated 1 December 2010 signed by Sean McGunnigle and letter titled "Re: Programme of Work Application - E47/1373, Resource Drilling Upon Lines with 50m to 100m Spaced Holes and Infill Drilling Upon Lines with 50m to 100m Spaced Holes" dated 21 December 2010 signed by Ross Doherty both retained on Department of Mines and Petroleum File No. EARS-POW-29131 & 29133;* "Programme of Work on E47/1373 for Fortescue Metals Group Limited" (Reg ID 29131) dated 1 December 2010 signed by Sean McGunnigle and retained on Department of Mines and Petroleum File No. EARS-POW-29131 & 29133;* (Reg. ID 34241) "Programme of Work on E47/1300, E47/1301, E47/1302, E47/1373, E47/1533 for Fortescue Metals Group Ltd" dated 22 February 2012 signed by Fiona Rowland and retained on Department of Mines and Petroleum file No. EARS-POW-34241* "Programme of Work on E47/1195-I, E47/1302-I, E47/1373-I, E47/1533-I and P47/1270-I for Fortescue Metals Group Ltd" (Reg ID 33376) dated 2 December 2011 signed by Mr Matt Dowling - Senior Environmental Advisor and retained on Department of Mines and Petroleum File No. POW-33376Where a difference exists between the above document(s) and the following conditions, then the following conditions shall prevail. |
| | TC-3119 | The development and operation of the project being carried out in such a manner so as to create the minimum practicable disturbance to the existing vegetation and natural landform. |
| | TC-3121 | All topsoil and vegetation being removed ahead of all mining operations and being stockpiled appropriately for later respreading or immediately respread as rehabilitation progresses. |
| E47/1500 | TC-3501 | All surface holes drilled for the purpose of exploration are to be capped, filled or otherwise made safe immediately after completion. |
| | TC-3502 | All costeans and other disturbances to the surface of the land made as a result of exploration, including drill pads, grid lines and access tracks, being backfilled and rehabilitated to the satisfaction of the Environmental Officer, Department of Mines and Petroleum (DMP). Backfilling and rehabilitation being required no later than 6 months after excavation unless otherwise approved in writing by the Environmental Officer, DMP. |
| | TC-3503 | All waste materials, rubbish, plastic sample bags, abandoned equipment and temporary buildings being removed from the mining tenement prior to or at the termination of exploration program. |
| | TC-3504 | Unless the written approval of the Environmental Officer, DMP is first obtained, the use of drilling rigs, scrapers, graders, bulldozers, backhoes or other mechanised equipment for surface disturbance or the excavation of costeans is prohibited. |

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| | | Following approval, all topsoil being removed ahead of mining operations and separately stockpiled for replacement after backfilling and/or completion of operations. |
| | TC-3505 | The licensee notifying the holder of any underlying pastoral or grazing lease by telephone or in person, or by registered post if contact cannot be made, prior to undertaking airborne geophysical surveys or any ground disturbing activities utilising equipment such as scrapers, graders, bulldozers, backhoes, drilling rigs; water carting equipment or other mechanised equipment. |
| | TC-3506 | The Licensee or transferee, as the case may be, shall within thirty (30) days of receiving written notification of:-* the grant of the Licence; or* registration of a transfer introducing a new Licensee;advise, by registered post, the holder of any underlying pastoral or grazing lease details of the grant or transfer. |
| E47/1533 | TC-3561 | All surface holes drilled for the purpose of exploration are to be capped, filled or otherwise made safe immediately after completion. |
| | TC-3562 | All disturbances to the surface of the land made as a result of exploration, including costeans, drill pads, grid lines and access tracks, being backfilled and rehabilitated to the satisfaction of the Environmental Officer, Department of Mines and Petroleum (DMP). Backfilling and rehabilitation being required no later than 6 months after excavation unless otherwise approved in writing by the Environmental Officer, DMP. |
| | TC-3563 | All waste materials, rubbish, plastic sample bags, abandoned equipment and temporary buildings being removed from the mining tenement prior to or at the termination of exploration program. |
| | TC-3564 | Unless the written approval of the Environmental Officer, DMP is first obtained, the use of drilling rigs, scrapers, graders, bulldozers, backhoes or other mechanised equipment for surface disturbance or the excavation of costeans is prohibited. Following approval, all topsoil being removed ahead of mining operations and separately stockpiled for replacement after backfilling and/or completion of operations. |
| | TC-3565 | The Licensee notifying the holder of any underlying pastoral or grazing lease by telephone or in person, or by registered post if contact cannot be made, prior to undertaking airborne geophysical surveys or any ground disturbing activities utilising equipment such as scrapers, graders, bulldozers, backhoes, drilling rigs; water carting equipment or other mechanised equipment. |
| | TC-3566 | The Licensee or transferee, as the case may be, shall within thirty (30) days of receiving written notification of:-* the grant of the Licence; or* registration of a transfer introducing a new Licensee;advise, by registered post, the holder of any underlying pastoral or grazing lease details of the grant or transfer. |
| | TC-3567 | The rights of ingress to and egress from Miscellaneous Licences 47/143, 47/153, 47/184 and 47/185 being at all times preserved to the licensee and no interference with the purpose or installations connected to the licence. |
| | TC-3568 | No interference with Geodetic Survey Station SSM-JM 25 and mining within 15 metres thereof being confined to below a depth of 15 metres from the natural surface. |
| | TC-3569 | No interference with the use of the Aerial Landing Ground and mining thereon being confined to below a depth of 15 metres from the natural surface. |
| | TC-3570 | The prior written consent of the Minister responsible for the Mining Act 1978 being obtained before commencing any exploration activities on Geodetic Station Reserve 40905. |
| | TC-3571 | The construction and operation of the project and measures to protect the environment being carried out generally in accordance with the document titled:* "(Reg ID: 31530) "Programme of Work on E47/1533 for Fortescue Metals Group Ltd" dated 6 July 2011 signed by Matthew Dowling and retained on Department of Mines and Petroleum File No EARS-POW-31530;* (Reg. ID 34241) "Programme of Work on E47/1300, E47/1301, E47/1302, E47/1373, E47/1533 for Fortescue Metals Group Ltd" dated 22 February 2012 signed by Fiona Rowland and retained on Department of Mines and Petroleum file No. EARS-POW-34241;* (Reg. ID 34390) "Programme of Work on E47/1533 for Fortescue Metals Group Ltd" dated 6 March 2012 signed by Fiona Rowland and retained on Department of Mines and Petroleum file No. EARS-POW-34390;* "Programme of Work on E47/1195-I, E47/1302-I, E47/1373-I, E47/1533-I and P47/1270-I for Fortescue Metals Group Ltd" (Reg ID 33376) dated 2 December 2011 signed by Mr Matt Dowling - Senior Environmental Advisor and |

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| | | retained on Department of Mines and Petroleum File No. POW-33376Where a difference exists between the above document(s) and the following conditions, then the following conditions shall prevail. |
| | TC-3572 | The development and operation of the project being carried out in such a manner so as to create the minimum practicable disturbance to the existing vegetation and natural landform. |
| | TC-3573 | All topsoil and vegetation being removed ahead of all mining operations and being stockpiled appropriately for later respreading or immediately respread as rehabilitation progresses. |
| E47/1861 | TC-4041 | All surface holes drilled for the purpose of exploration are to be capped, filled or otherwise made safe immediately after completion. |
| | TC-4042 | All disturbances to the surface of the land made as a result of exploration, including costeans, drill pads, grid lines and access tracks, being backfilled and rehabilitated to the satisfaction of the Environmental Officer, Department of Mines and Petroleum (DMP). Backfilling and rehabilitation being required no later than 6 months after excavation unless otherwise approved in writing by the Environmental Officer, DMP. |
| | TC-4043 | All waste materials, rubbish, plastic sample bags, abandoned equipment and temporary buildings being removed from the mining tenement prior to or at the termination of exploration program. |
| | TC-4044 | Unless the written approval of the Environmental Officer, DMP is first obtained, the use of drilling rigs, scrapers, graders, bulldozers, backhoes or other mechanised equipment for surface disturbance or the excavation of costeans is prohibited. Following approval, all topsoil being removed ahead of mining operations and separately stockpiled for replacement after backfilling and/or completion of operations. |
| | TC-4045 | The Licensee notifying the holder of any underlying pastoral or grazing lease by telephone or in person, or by registered post if contact cannot be made, prior to undertaking airborne geophysical surveys or any ground disturbing activities utilising equipment such as scrapers, graders, bulldozers, backhoes, drilling rigs; water carting equipment or other mechanised equipment. |
| | TC-4046 | The Licensee or transferee, as the case may be, shall within thirty (30) days of receiving written notification of:-* the grant of the Licence; or* registration of a transfer introducing a new Licensee;advise, by registered post, the holder of any underlying pastoral or grazing lease details of the grant or transfer. |
| | TC-4047 | No activities being carried out within the proposed railway corridor (designated FNA 8039 ) that interfere with or restrict any rail route investigation activities being undertaken by the rail line proponent. |
| E47/2037 | TC-4150 | All surface holes drilled for the purpose of exploration are to be capped, filled or otherwise made safe immediately after completion. |
| | TC-4151 | All disturbances to the surface of the land made as a result of exploration, including costeans, drill pads, grid lines and access tracks, being backfilled and rehabilitated to the satisfaction of the Environmental Officer, Department of Mines and Petroleum (DMP). Backfilling and rehabilitation being required no later than 6 months after excavation unless otherwise approved in writing by the Environmental Officer, DMP. |
| | TC-4152 | All waste materials, rubbish, plastic sample bags, abandoned equipment and temporary buildings being removed from the mining tenement prior to or at the termination of exploration program. |
| | TC-4153 | Unless the written approval of the Environmental Officer, DMP is first obtained, the use of drilling rigs, scrapers, graders, bulldozers, backhoes or other mechanised equipment for surface disturbance or the excavation of costeans is prohibited. Following approval, all topsoil being removed ahead of mining operations and separately stockpiled for replacement after backfilling and/or completion of operations. |
| | TC-4154 | The Licensee notifying the holder of any underlying pastoral or grazing lease by telephone or in person, or by registered post if contact cannot be made, prior to undertaking airborne geophysical surveys or any ground disturbing activities utilising equipment such as scrapers, graders, bulldozers, backhoes, drilling rigs; water carting equipment or other mechanised equipment. |

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| | TC-4155 | The Licensee or transferee, as the case may be, shall within thirty (30) days of receiving written notification of:-* the grant of the Licence; or* registration of a transfer introducing a new Licensee;advise, by registered post, the holder of any underlying pastoral or grazing lease details of the grant or transfer. |
| | TC-4156 | No activities being carried out within the proposed railway corridor (designated FNA 8039 ) that interfere with or restrict any rail route investigation activities being undertaken by the rail line proponent. |
| | TC-4157 | The construction and operation of the project and measures to protect the environment to be carried out in accordance with the document titled: * ;Programme of Work on E47/1196, E47/1301, E47/1302 and E47/2037 for Fortescue Metals Group Limited; (Reg ID 32579) dated 29 September 2011 signed by Mr Matt Dowling Senior Environmental Advisor and retained on Department of Mines and Petroleum File No. EARS-POW-32579 * ;Exploration Environmental Mangagement Plan; dated 25 July 2013 signed by S. Robinson and retained on Department of Mines and Petroleum file no. EARS-POW-62594 as Doc ID 4711671. Where a difference exists between the above document(s) and the following conditions, then the following conditions shall prevail. |
| | TC-4158 | The development and operation of the project being carried out in such a manner so as to create the minimum practicable disturbance to the existing vegetation and natural landform. |
| | TC-4159 | All topsoil and vegetation being removed ahead of all mining operations and being stockpiled appropriatley for later respreading or immediately respread as rehabilitation progresses. |
| E47/3291 | TC-13269 | All surface holes drilled for the purpose of exploration are to be capped, filled or otherwise made safe immediately after completion. |
| | TC-13270 | All disturbances to the surface of the land made as a result of exploration, including costeans, drill pads, grid lines and access tracks, being backfilled and rehabilitated to the satisfaction of the Environmental Officer, Department of Mines and Petroleum (DMP). Backfilling and rehabilitation being required no later than 6 months after excavation unless otherwise approved in writing by the Environmental Officer, DMP. |
| | TC-13271 | All waste materials, rubbish, plastic sample bags, abandoned equipment and temporary buildings being removed from the mining tenement prior to or at the termination of exploration program. |
| | TC-13272 | Unless the written approval of the Environmental Officer, DMP is first obtained, the use of drilling rigs, scrapers, graders, bulldozers, backhoes or other mechanised equipment for surface disturbance or the excavation of costeans is prohibited. Following approval, all topsoil being removed ahead of mining operations and separately stockpiled for replacement after backfilling and/or completion of operations. |
| E47/3292 | TC-13273 | All surface holes drilled for the purpose of exploration are to be capped, filled or otherwise made safe immediately after completion. |
| | TC-13274 | All disturbances to the surface of the land made as a result of exploration, including costeans, drill pads, grid lines and access tracks, being backfilled and rehabilitated to the satisfaction of the Environmental Officer, Department of Mines and Petroleum (DMP). Backfilling and rehabilitation being required no later than 6 months after excavation unless otherwise approved in writing by the Environmental Officer, DMP. |
| | TC-13275 | All waste materials, rubbish, plastic sample bags, abandoned equipment and temporary buildings being removed from the mining tenement prior to or at the termination of exploration program. |
| | TC-13276 | Unless the written approval of the Environmental Officer, DMP is first obtained, the use of drilling rigs, scrapers, graders, bulldozers, backhoes or other mechanised equipment for surface disturbance or the excavation of costeans is prohibited. Following approval, all topsoil being removed ahead of mining operations and separately stockpiled for replacement after backfilling and/or completion of operations. |
| | TC-13277 | The Licensee notifying the holder of any underlying pastoral or grazing lease by telephone or in person, or by registered post if contact cannot be made, prior to undertaking airborne geophysical surveys or any ground disturbing activities utilising |

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| | | equipment such as scrapers, graders, bulldozers, backhoes, drilling rigs; water carting equipment or other mechanised equipment. |
| | TC-13278 | The Licensee or transferee, as the case may be, shall within thirty (30) days of receiving written notification of:-* the grant of the Licence; or* registration of a transfer introducing a new Licensee;advise, by registered post, the holder of any underlying pastoral or grazing lease details of the grant or transfer. |
| E47/3334 | TC-13335 | All waste materials, rubbish, plastic sample bags, abandoned equipment and temporary buildings being removed from the mining tenement prior to or at the termination of exploration program. |
| | TC-13336 | Unless the written approval of the Environmental Officer, DMP is first obtained, the use of drilling rigs, scrapers, graders, bulldozers, backhoes or other mechanised equipment for surface disturbance or the excavation of costeans is prohibited. Following approval, all topsoil being removed ahead of mining operations and separately stockpiled for replacement after backfilling and/or completion of operations. |
| | TC-13337 | The Licensee notifying the holder of any underlying pastoral or grazing lease by telephone or in person, or by registered post if contact cannot be made, prior to undertaking airborne geophysical surveys or any ground disturbing activities utilising equipment such as scrapers, graders, bulldozers, backhoes, drilling rigs; water carting equipment or other mechanised equipment. |
| | TC-13338 | The Licensee or transferee, as the case may be, shall within thirty (30) days of receiving written notification of:-* the grant of the Licence; or* registration of a transfer introducing a new Licensee;advise, by registered post, the holder of any underlying pastoral or grazing lease details of the grant or transfer. |
| | TC-14336 | All disturbances to the surface of the land made as a result of exploration, including costeans, drill pads, grid lines and access tracks, being backfilled and rehabilitated to the satisfaction of the Environmental Officer, Department of Mines and Petroleum (DMP). Backfilling and rehabilitation being required no later than 6 months after excavation unless otherwise approved in writing by the Environmental Officer, DMP. |
| E47/3561 | TC-14226 | All waste materials, rubbish, plastic sample bags, abandoned equipment and temporary buildings being removed from the mining tenement prior to or at the termination of exploration program. |
| | TC-14227 | Unless the written approval of the Environmental Officer, DMP is first obtained, the use of drilling rigs, scrapers, graders, bulldozers, backhoes or other mechanised equipment for surface disturbance or the excavation of costeans is prohibited. Following approval, all topsoil being removed ahead of mining operations and separately stockpiled for replacement after backfilling and/or completion of operations. |
| E47/3562 | TC-14272 | All disturbances to the surface of the land made as a result of exploration, including costeans, drill pads, grid lines and access tracks, being backfilled and rehabilitated to the satisfaction of the Environmental Officer, Department of Mines and Petroleum (DMP). Backfilling and rehabilitation being required no later than 6 months after excavation unless otherwise approved in writing by the Environmental Officer, DMP. |
| | TC-14273 | All waste materials, rubbish, plastic sample bags, abandoned equipment and temporary buildings being removed from the mining tenement prior to or at the termination of exploration program. |
| | TC-14274 | Unless the written approval of the Environmental Officer, DMP is first obtained, the use of drilling rigs, scrapers, graders, bulldozers, backhoes or other mechanised equipment for surface disturbance or the excavation of costeans is prohibited. Following approval, all topsoil being removed ahead of mining operations and separately stockpiled for replacement after backfilling and/or completion of operations. |
| | TC-14275 | The Licensee notifying the holder of any underlying pastoral or grazing lease by telephone or in person, or by registered post if contact cannot be made, prior to undertaking airborne geophysical surveys or any ground disturbing activities utilising equipment such as scrapers, graders, bulldozers, backhoes, drilling rigs; water carting equipment or other mechanised equipment. |
| | TC-14276 | The Licensee or transferee, as the case may be, shall within thirty (30) days of receiving written notification of:-* the grant of the Licence; or* registration of a transfer introducing a new Licensee;advise, by registered post, the holder of any underlying pastoral or grazing lease details of the grant or transfer. |

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| E47/3686 | TC-14437 | All disturbances to the surface of the land made as a result of exploration, including costeans, drill pads, grid lines and access tracks, being backfilled and rehabilitated to the satisfaction of the Environmental Officer, DMIRS. Backfilling and rehabilitation being required no later than 6 months after excavation unless otherwise approved in writing by the Environmental Officer, DMIRS. |
| | TC-14438 | All waste materials, rubbish, plastic sample bags, abandoned equipment and temporary buildings being removed from the mining tenement prior to or at the termination of exploration program. |
| | TC-14439 | Unless the written approval of the Environmental Officer, DMIRS is first obtained, the use of drilling rigs, scrapers, graders, bulldozers, backhoes or other mechanised equipment for surface disturbance or the excavation of costeans is prohibited. Following approval, all topsoil being removed ahead of mining operations and separately stockpiled for replacement after backfilling and/or completion of operations. |
| | TC-14440 | The Licensee notifying the holder of any underlying pastoral or grazing lease by telephone or in person, or by registered post if contact cannot be made, prior to undertaking airborne geophysical surveys or any ground disturbing activities utilising equipment such as scrapers, graders, bulldozers, backhoes, drilling rigs; water carting equipment or other mechanised equipment. |
| | TC-14441 | The Licensee or transferee, as the case may be, shall within thirty (30) days of receiving written notification of:-* the grant of the Licence; or* registration of a transfer introducing a new Licensee;advise, by registered post, the holder of any underlying pastoral or grazing lease details of the grant or transfer. |
| M47/1509 | TC-14057 | All waste materials, rubbish, plastic sample bags, abandoned equipment and temporary buildings being removed from the mining tenement prior to or at the termination of exploration program. |
| | TC-14058 | Unless the written approval of the Environmental Officer, DMP is first obtained, the use of drilling rigs, scrapers, graders, bulldozers, backhoes or other mechanised equipment for surface disturbance or the excavation of costeans is prohibited. Following approval, all topsoil being removed ahead of mining operations and separately stockpiled for replacement after backfilling and/or completion of operations. |
| | TC-14059 | The Lessee notifying the holder of any underlying pastoral or grazing lease by telephone or in person, or by registered post if contact cannot be made, prior to undertaking airborne geophysical surveys or any ground disturbing activities utilising equipment such as scrapers, graders, bulldozers, backhoes, drilling rigs; water carting equipment or other mechanised equipment. |
| | TC-14060 | The Lessee or transferee, as the case may be, shall within thirty (30) days of receiving written notification of:-* the grant of the Lease; or* registration of a transfer introducing a new Lessee;advise, by registered post, the holder of any underlying pastoral or grazing lease details of the grant or transfer. |
| | TC-14061 | The prior written consent of the Minister responsible for the Mining Act 1978 being obtained before commencing any mining activities on Geodetic Station Reserve 40903. |
| | TC-14062 | No interference with Geodetic Survey Station JM 27 and mining within 15 metres thereof being confined to below a depth of 15 metres from the natural surface. |
| | TC-14404 | All disturbances to the surface of the land made as a result of exploration, including costeans, drill pads, grid lines and access tracks, being backfilled and rehabilitated to the satisfaction of the Environmental Officer, Department of Mines and Petroleum (DMP). Backfilling and rehabilitation being required no later than 6 months after excavation unless otherwise approved in writing by the Environmental Officer, DMP. |
| P47/1650 | TC-11044 | All surface holes drilled for the purpose of exploration are to be capped, filled or otherwise made safe immediately after completion. |
| | TC-11045 | All disturbances to the surface of the land made as a result of exploration, including costeans, drill pads, grid lines and access tracks, being backfilled and rehabilitated to the satisfaction of the Environmental Officer, Department of Mines and Petroleum (DMP). Backfilling and rehabilitation being required no later than 6 months after excavation unless otherwise approved in writing by the Environmental Officer, DMP. |

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| | TC-11046 | All waste materials, rubbish, plastic sample bags, abandoned equipment and temporary buildings being removed from the mining tenement prior to or at the termination of exploration program. |
| | TC-11047 | Unless the written approval of the Environmental Officer, DMP is first obtained, the use of drilling rigs, scrapers, graders, bulldozers, backhoes or other mechanised equipment for surface disturbance or the excavation of costeans is prohibited. Following approval, all topsoil being removed ahead of mining operations and separately stockpiled for replacement after backfilling and/or completion of operations. |
| | TC-11048 | The Licensee notifying the holder of any underlying pastoral or grazing lease by telephone or in person, or by registered post if contact cannot be made, prior to undertaking airborne geophysical surveys or any ground disturbing activities utilising equipment such as scrapers, graders, bulldozers, backhoes, drilling rigs; water carting equipment or other mechanised equipment. |
| | TC-11049 | The Licensee or transferee, as the case may be, shall within thirty (30) days of receiving written notification of:-* the grant of the Licence; or* registration of a transfer introducing a new Licensee;advise, by registered post, the holder of any underlying pastoral or grazing lease details of the grant or transfer. |
| P47/1667 | TC-11074 | All surface holes drilled for the purpose of exploration are to be capped, filled or otherwise made safe immediately after completion. |
| | TC-11075 | All disturbances to the surface of the land made as a result of exploration, including costeans, drill pads, grid lines and access tracks, being backfilled and rehabilitated to the satisfaction of the Environmental Officer, Department of Mines and Petroleum (DMP). Backfilling and rehabilitation being required no later than 6 months after excavation unless otherwise approved in writing by the Environmental Officer, DMP. |
| | TC-11076 | All waste materials, rubbish, plastic sample bags, abandoned equipment and temporary buildings being removed from the mining tenement prior to or at the termination of exploration program. |
| | TC-11077 | Unless the written approval of the Environmental Officer, DMP is first obtained, the use of drilling rigs, scrapers, graders, bulldozers, backhoes or other mechanised equipment for surface disturbance or the excavation of costeans is prohibited. Following approval, all topsoil being removed ahead of mining operations and separately stockpiled for replacement after backfilling and/or completion of operations. |
| | TC-11078 | The Licensee notifying the holder of any underlying pastoral or grazing lease by telephone or in person, or by registered post if contact cannot be made, prior to undertaking airborne geophysical surveys or any ground disturbing activities utilising equipment such as scrapers, graders, bulldozers, backhoes, drilling rigs; water carting equipment or other mechanised equipment. |
| | TC-11079 | The Licensee or transferee, as the case may be, shall within thirty (30) days of receiving written notification of:-* the grant of the Licence; or* registration of a transfer introducing a new Licensee;advise, by registered post, the holder of any underlying pastoral or grazing lease details of the grant or transfer. |
| | TC-11080 | No interference with Geodetic Survey Station SSM-JM 63 and mining within 15 metres thereof being confined to below a depth of 15 metres from the natural surface. |
| P47/1668 | TC-11081 | All surface holes drilled for the purpose of exploration are to be capped, filled or otherwise made safe immediately after completion. |
| | TC-11082 | All disturbances to the surface of the land made as a result of exploration, including costeans, drill pads, grid lines and access tracks, being backfilled and rehabilitated to the satisfaction of the Environmental Officer, Department of Mines and Petroleum (DMP). Backfilling and rehabilitation being required no later than 6 months after excavation unless otherwise approved in writing by the Environmental Officer, DMP. |
| | TC-11083 | All waste materials, rubbish, plastic sample bags, abandoned equipment and temporary buildings being removed from the mining tenement prior to or at the termination of exploration program. |
| | TC-11084 | Unless the written approval of the Environmental Officer, DMP is first obtained, the use of drilling rigs, scrapers, graders, bulldozers, backhoes or other mechanised equipment for surface disturbance or the excavation of costeans is prohibited. |

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| | | Following approval, all topsoil being removed ahead of mining operations and separately stockpiled for replacement after backfilling and/or completion of operations. |
| | TC-11085 | The Licensee notifying the holder of any underlying pastoral or grazing lease by telephone or in person, or by registered post if contact cannot be made, prior to undertaking airborne geophysical surveys or any ground disturbing activities utilising equipment such as scrapers, graders, bulldozers, backhoes, drilling rigs; water carting equipment or other mechanised equipment. |
| | TC-11086 | The Licensee or transferee, as the case may be, shall within thirty (30) days of receiving written notification of:-* the grant of the Licence; or* registration of a transfer introducing a new Licensee;advise, by registered post, the holder of any underlying pastoral or grazing lease details of the grant or transfer. |
| P47/1669 | TC-11087 | All surface holes drilled for the purpose of exploration are to be capped, filled or otherwise made safe immediately after completion. |
| | TC-11088 | All disturbances to the surface of the land made as a result of exploration, including costeans, drill pads, grid lines and access tracks, being backfilled and rehabilitated to the satisfaction of the Environmental Officer, Department of Mines and Petroleum (DMP). Backfilling and rehabilitation being required no later than 6 months after excavation unless otherwise approved in writing by the Environmental Officer, DMP. |
| | TC-11089 | All waste materials, rubbish, plastic sample bags, abandoned equipment and temporary buildings being removed from the mining tenement prior to or at the termination of exploration program. |
| | TC-11090 | Unless the written approval of the Environmental Officer, DMP is first obtained, the use of drilling rigs, scrapers, graders, bulldozers, backhoes or other mechanised equipment for surface disturbance or the excavation of costeans is prohibited. Following approval, all topsoil being removed ahead of mining operations and separately stockpiled for replacement after backfilling and/or completion of operations. |
| | TC-11091 | The Licensee notifying the holder of any underlying pastoral or grazing lease by telephone or in person, or by registered post if contact cannot be made, prior to undertaking airborne geophysical surveys or any ground disturbing activities utilising equipment such as scrapers, graders, bulldozers, backhoes, drilling rigs; water carting equipment or other mechanised equipment. |
| | TC-11092 | The Licensee or transferee, as the case may be, shall within thirty (30) days of receiving written notification of:-* the grant of the Licence; or* registration of a transfer introducing a new Licensee;advise, by registered post, the holder of any underlying pastoral or grazing lease details of the grant or transfer. |
| P47/1670 | TC-11093 | All surface holes drilled for the purpose of exploration are to be capped, filled or otherwise made safe immediately after completion. |
| | TC-11094 | All disturbances to the surface of the land made as a result of exploration, including costeans, drill pads, grid lines and access tracks, being backfilled and rehabilitated to the satisfaction of the Environmental Officer, Department of Mines and Petroleum (DMP). Backfilling and rehabilitation being required no later than 6 months after excavation unless otherwise approved in writing by the Environmental Officer, DMP. |
| | TC-11095 | All waste materials, rubbish, plastic sample bags, abandoned equipment and temporary buildings being removed from the mining tenement prior to or at the termination of exploration program. |
| | TC-11096 | Unless the written approval of the Environmental Officer, DMP is first obtained, the use of drilling rigs, scrapers, graders, bulldozers, backhoes or other mechanised equipment for surface disturbance or the excavation of costeans is prohibited. Following approval, all topsoil being removed ahead of mining operations and separately stockpiled for replacement after backfilling and/or completion of operations. |
| | TC-11097 | The Licensee notifying the holder of any underlying pastoral or grazing lease by telephone or in person, or by registered post if contact cannot be made, prior to undertaking airborne geophysical surveys or any ground disturbing activities utilising equipment such as scrapers, graders, bulldozers, backhoes, drilling rigs; water carting equipment or other mechanised equipment. |
| | TC-11098 | The Licensee or transferee, as the case may be, shall within thirty (30) days of receiving written notification of:-* the grant of the Licence; or* registration of a transfer |

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| | | introducing a new Licensee;advise, by registered post, the holder of any underlying pastoral or grazing lease details of the grant or transfer. |
| P47/1671 | TC-11099 | All surface holes drilled for the purpose of exploration are to be capped, filled or otherwise made safe immediately after completion. |
| | TC-11100 | All disturbances to the surface of the land made as a result of exploration, including costeans, drill pads, grid lines and access tracks, being backfilled and rehabilitated to the satisfaction of the Environmental Officer, Department of Mines and Petroleum (DMP). Backfilling and rehabilitation being required no later than 6 months after excavation unless otherwise approved in writing by the Environmental Officer, DMP. |
| | TC-11101 | All waste materials, rubbish, plastic sample bags, abandoned equipment and temporary buildings being removed from the mining tenement prior to or at the termination of exploration program. |
| | TC-11102 | Unless the written approval of the Environmental Officer, DMP is first obtained, the use of drilling rigs, scrapers, graders, bulldozers, backhoes or other mechanised equipment for surface disturbance or the excavation of costeans is prohibited. Following approval, all topsoil being removed ahead of mining operations and separately stockpiled for replacement after backfilling and/or completion of operations. |
| | TC-11103 | The Licensee notifying the holder of any underlying pastoral or grazing lease by telephone or in person, or by registered post if contact cannot be made, prior to undertaking airborne geophysical surveys or any ground disturbing activities utilising equipment such as scrapers, graders, bulldozers, backhoes, drilling rigs; water carting equipment or other mechanised equipment. |
| | TC-11104 | The Licensee or transferee, as the case may be, shall within thirty (30) days of receiving written notification of:-* the grant of the Licence; or* registration of a transfer introducing a new Licensee;advise, by registered post, the holder of any underlying pastoral or grazing lease details of the grant or transfer. |

## 2.4 *Land Administration Act 1997*

| Lease | Condition | Closure condition |
|---|---|---|
| L47/806 | TC-14404 | No activities being carried out within the proposed railway corridor (designated FNA 13576 ) that interfere with or restrict any rail route investigation activities being undertaken by the rail line proponent. |
| | TC-14405 | To properly maintain the installations as directed by the Environmental Officer, Department of Mines, Industry Regulation and Safety (DMIRS). |
| | TC-14406 | To construct a fence around all wells, bores, storage tanks, pumping stations and any other installations as determined by the Environmental Officer, Department of Mines, Industry Regulation and Safety (DMIRS) having such dimensions and to be constructed of such materials and be of such standard as determined by the Environmental Officer, DMIRS. |
| | TC-14407 | All topsoil that may be removed ahead of pipelaying operations to be stockpiled for replacement in accordance with the directions of the Environmental Officer, DMIRS. |
| | TC-14408 | Ingress and egress of pastoralists and tenement holders to be preserved by the construction of vehicular access crossings over any pipeline constructed pursuant to this licence. |
| | TC-14409 | The licensee shall keep clear such area around any powerline located within the licence area of any dry or other growth which has the potential to be a fire risk. |
| | TC-14410 | The electrical installation shall meet the requirements of relevant on-site conditions and be carried out to the satisfaction of the Special Inspector of Mines - Electrical, DMIRS. |
| | TC-14411 | Wherever any part of a road intersects an existing fence, the holder shall where necessary construct a gate or livestock grid having such dimensions and be |

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|---|---|---|
| | | constructed of such materials and be of such standard as agreed with the pastoralist or as determined by the Environmental Officer, DMIRS. |
| | TC-14412 | The road to be constructed using proper materials to suit the purpose for which it is being constructed, and further that it be constructed in a workman like manner and further that it be constructed to the satisfaction of the Environmental Officer, DMIRS. |
| | TC-14413 | The holder shall maintain the road from time to time as shall be required to ensure that it is safe for the purpose that it is constructed. |
| | TC-14414 | The area of the miscellaneous licence to be reduced as soon as practicable after construction, to a minimum for the safe maintenance and operation of the licence purposes. |
| L47/807 | TC-14415 | The Licensee notifying the holder of any underlying pastoral or grazing lease by telephone or in person, or by registered post if contact cannot be made, prior to undertaking airborne geophysical surveys or any ground disturbing activities utilising equipment such as scrapers, graders, bulldozers, backhoes, drilling rigs; water carting equipment or other mechanised equipment. |
| | TC-14416 | The Licensee or transferee, as the case may be, shall within thirty (30) days of receiving written notification of:-* the grant of the Licence; or* registration of a transfer introducing a new Licensee; advise, by registered post, the holder of any underlying pastoral or grazing lease details of the grant or transfer. |
| | TC-14417 | The prior written consent of the Minister responsible for the Mining Act 1978 being obtained before commencing any activities in respect to the licence purposes on CR 40902 Geodetic Station. |
| | TC-14418 | No interference with Geodetic Survey Station SSM-JM 28 and mining within 15 metres thereof being confined to below a depth of 15 metres from the natural surface. |
| | TC-14419 | To properly maintain the installations as directed by the Environmental Officer, Department of Mines, Industry Regulation and Safety (DMIRS). |
| | TC-14420 | To construct a fence around all wells, bores, storage tanks, pumping stations and any other installations as determined by the Environmental Officer, Department of Mines, Industry Regulation and Safety (DMIRS) having such dimensions and to be constructed of such materials and be of such standard as determined by the Environmental Officer, DMIRS. |
| | TC-14421 | All topsoil that may be removed ahead of pipelaying operations to be stockpiled for replacement in accordance with the directions of the Environmental Officer, DMIRS. |
| | TC-14422 | Ingress and egress of pastoralists and tenement holders to be preserved by the construction of vehicular access crossings over any pipeline constructed pursuant to this licence. |
| | TC-14423 | Wherever any part of a road intersects an existing fence, the holder shall where necessary construct a gate or livestock grid having such dimensions and be constructed of such materials and be of such standard as agreed with the pastoralist or as determined by the Environmental Officer, DMIRS. |
| | TC-14424 | The licensee shall keep clear such area around any powerline located within the licence area of any dry or other growth which has the potential to be a fire risk. |
| | TC-14425 | The road to be constructed using proper materials to suit the purpose for which it is being constructed, and further that it be constructed in a workman like manner and further that it be constructed to the satisfaction of the Environmental Officer, DMIRS. |
| | TC-14426 | The holder shall maintain the road from time to time as shall be required to ensure that it is safe for the purpose that it is constructed. |
| | TC-14427 | The electrical installation shall meet the requirements of relevant on-site conditions and be carried out to the satisfaction of the Special Inspector of Mines - Electrical, DMIRS. |
| | TC-14428 | The area of the miscellaneous licence to be reduced as soon as practicable after construction, to a minimum for the safe maintenance and operation of the licence purposes. |

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| | TC-14429 | No activities being carried out within the proposed railway corridor (designated FNA 13576 ) that interfere with or restrict any rail route investigation activities being undertaken by the rail line proponent. |

## 2.5 FMG- Puutu Kunti Kurrama and Pinikura Land Access Agreement dated 28 May 2010

| Commitment | Closure Condition |
|---|---|
| Not available for public release. Generalised content pertaining to closure is summarised below. | |
| | Within the Agreement Area, FMG must:<br>(1) maintain consistently high standards of environmental planning and management in connection with Project Operations;<br>(2) regularly monitor the environmental performance of Project Operations and ensure that proper management procedures are in place to meet its environmental responsibilities in connection with Project Operations;<br>(3) design Project Operations with the objective of minimising to the greatest extent practicable the release of contaminants during and after the life of the Project; and<br>(4) carry out Project Operations in a manner that practically minimises any negative impact on the environment. |
| | When conducting Project Operations, FMG must:<br>(1) not unreasonably damage or adversely alter any natural hydrological systems;<br>(3) take all practicable steps to prevent erosion; …<br>(5) take all reasonable steps to: …<br>(d) keep or make safe the Project Area by not creating, or by removing, any unusual or hidden dangers created, as a result of FMG's Mining Operations. In particular, FMG must secure and cap all exploration drill holes;<br>(e) accord with best practicable technology (subject to operational restraints and availability); and<br>(f) anticipate changing community values and be alert to technical advances which may improve environmental standards. |
| | Following the completion of any part of the Project Operations within the Agreement Area, FMG must rehabilitate those parts of the Project Area disturbed by the Project Operations with a view to meeting the following objectives:<br>(1) re-establishing an environment to the maximum reasonable extent, the pre-existing environment or the environment existing in adjacent areas;<br>(2) progressively revegetating areas with local native plant species similar in density and abundance to that existing prior to the commencement of Project Operations, in order to form an ecosystem the long term viability of which will not require a maintenance regime significantly different from that appropriate to those adjacent areas; and<br>(3) limiting erosion in rehabilitation areas, as far as can reasonably be achieved, to that characteristic of similar land forms in surrounding undisturbed areas. |
| | If the FMG Working Group reasonably requests FMG to provide any environmental related information, then FMG must use its best endeavours to provide that information to the FMG Working Group as soon as possible. |
| | If FMG has restricted access to any part of the Project Area in accordance with clause A11, then subject to statutory restrictions and reasonable operational requirements, representatives of the FMG Working Group may upon reasonable prior notice, from time to time or at regular intervals, inspect those restricted parts of the Project Area in relation to environmental concerns. |

## 2.6 Other licences and permits

No other licences or permits were identified that would influence closure planning.

# 3. OTHER COMMITMENTS

The following paraphrased commitments are subject to change, may be superseded or extinguished during the life of the mine, as a consequence of established regulatory review and update processes and other similar negotiations.

## 3.1 Management plans and similar documents

### Acid and Metalliferous Drainage Management Plan 100-PL-EN-1016

| Closure commitment | |
|---|---|
| To implement the plan | |
| | **Management actions** |
| | Validate and recalibrate hydro geologic and pit lake models |
| | Conduct contamination assessment, measure conditions against long-term closure objectives |
| | Cover and close WRLs |

### Borrow Pit Management Plan, 45-PL-EN-0018

| Closure commitment | |
|---|---|
| To implement the plan | |
| **Reference** | **Management actions** |
| 4.2.4 | Future Development of Closure Criteria – undertake baseline and annual LFA monitoring. |
| 4.2.5 | Development of Borrow Pits to Facilitate Future Rehabilitation and Closure – assess, design and develop. |
| 4.2.7 | Establishing a Safe and Stable Post-mining Land Surface – design & construction; drainage; slopes; landforms to resemble surrounding topography as much as possible. |
| 4.2.8 | Re-establishing a Self-generating Ecosystem – rehab, recontouring, reveg, drainage flows. |

### Chemical and Hydrocarbon Management Plan, 100-PL-EN-1011

| Closure commitment | |
|---|---|
| To implement the plan | |
| **Reference** | **Management action** |
| 1.5 | Ensure relevant personnel and contractors involved in chemical and hydrocarbon handling and storage activities are provided with the appropriate training and equipment as outlined in the *Chemical and Hydrocarbon Spills Procedures* (45-PR-EN-0014) and the *Hazardous Materials Management Procedure* (45-PR-SA-0051). |
| 1.9 | Chemicals and hydrocarbons should be stored in accordance with AS 1940, AS 3833 or AS 3780 to minimise the potential for environmental harm. Storage should only be in designated areas and within the limits specified in applicable Licence conditions under the *EP Act* (see Table 2). |
| 1.10 | Store chemicals and hydrocarbons in accordance with Licence conditions under the *EP Act*. Where a storage facility is not required to be licenced, store chemicals and hydrocarbons, other than goods classified as minor storage, in bunded compounds with a capacity of 110% of the volume of the largest vessel and at least 25% of the total volume in accordance with AS 1940, AS 3833 and AS 3780. |

| Closure commitment | |
|---|---|
| 1.11 | Ensure appropriate types and quantities of spill response equipment are maintained and are proportionate to the volume of chemicals and hydrocarbons stored and the risks identified in Action 1.2 to improve spill response time and effort and minimise the potential for environmental harm in accordance with the *Chemical and Hydrocarbon Spills Procedure* (45-PL-EN-0014). |
| 1.12 | Where a chemical or hydrocarbon spill has occurred, manage the spill including any contaminated material, in accordance with the *Chemical and Hydrocarbon Spills Procedure* (45-PL-EN-0014) and investigate and report the incident in accordance with the *Incident Event Management Procedure* (100-PR-SA-0011). |
| 1.14 | Where required, monitor groundwater quality in potential high risk areas identified in Action 1.2, to meet requirements of a Licence or Works Approval issued under the *EP Act* and in accordance with the *Groundwater Management Plan* (100-PL-EN-1009). |
| 1.15 | Where required, monitor surface water quality in potential high risk areas identified in Action 1.2, to meet requirements of a Licence or Works Approval issued under the *EP Act* and in accordance with the *Surface Water Monitoring Guidelines* (45-GU-EN-0002). |
| 2.1 | Ensure chemicals and hydrocarbons transported on roads open to or used by the public are in accordance with the Australian Dangerous Goods Code (ADGC) and the *Hazardous Materials Management Procedure* (45-PR-SA-0051). Ensure chemicals and hydrocarbons are appropriately stowed and restrained to prevent any movement which may result in a leak or spill. |
| 2.2 | When transporting chemicals or hydrocarbons by road in a container with a capacity greater than 500 L or with more than 500kg of a dangerous good in a container, ensure a licensed contractor is engaged in accordance with the Dangerous Goods Safety (Road and Rail Transport of Non-explosives) Amendment Regulations 2010. |
| 3.2 | Dispose of any waste materials contaminated with chemicals or hydrocarbons, including water contaminated with hydrocarbons, in accordance with the *Chemical and Hydrocarbon Spills Procedure (45-PR-EN-0014),* Licence requirements under the *EP Act* and where required the *Environmental Protection (Controlled Waste) Regulations 2004.* |
| 3.3 | Manage bioremediation facilities to ensure compliance with applicable Licence conditions and in accordance with the DER's *Contaminated Sites Management Series - Bioremediation of Hydrocarbon Contaminated Soils in Western Australia* (2004). |
| 3.4 | Remediate any area declared contaminated as defined under the *Contaminated Sites Act 2003* in accordance with the DER's *Contaminated Sites Management Series – Assessment Levels for Soil, Sediment and Water* (2011) and the *Rehabilitation and Revegetation Management Plan* (45-PL-EN-0023). |
| 4.1 | Develop and implement a greenhouse gas reporting system to ensure emissions data associated with chemical and hydrocarbon use is accurate, complete, transparent and auditable in accordance with the *Greenhouse Gas Emissions and Energy Reporting Management Plan* (100-PR-GH-0001) and to meet reporting requirements under the *National Greenhouse and Energy Reporting Act 2007*. |

## Conservation Significant Fauna Management Plan, 100-PL-EN-0022

| Closure commitment | |
|---|---|
| To implement the plan | |
| **Reference** | **Management actions** |
| 2.14 | Develop and implement a Feral Animal Program to effectively manage and control feral animals within Fortescue controlled sites to minimise impacts on conservation significant fauna. |
| 2.15 | Manage waste materials and on-site landfill facilities in accordance with the *Waste Management Plan* (45-PL-EN-0014) to minimise potential impacts on fauna and the likelihood of increases in feral animal numbers. |
| 2.20 | Conduct progressive rehabilitation of disturbed areas, particularly those areas with known conservation significant fauna and associated habitat |
| 3.1 | Where populations of conservation significant fauna listed under the *Wildlife Conservation Act 1986* or the *Environment Protection and Biodiversity Conservation Act 1999* have been recorded in Fortescue controlled sites, develop and implement a Conservation Significant Fauna Monitoring |

| Closure commitment | |
|---|---|
| | Program in accordance with the *Conservation Significant Fauna Monitoring Guidelines* (100-GU-EN-0034). |
| 4.1 | Where a fauna injury or death has occurred as a result of Fortescue Operations, investigate and report the incident in accordance with the *Incident Event Reporting Procedure* (100-PR-SA-0011) and employ corrective actions in accordance with Section 9 of this Plan. |
| 4.2 | When an incident has occurred, review mitigation measures and monitoring programs and update where require to inform an adaptive management approach for the life of the project. |

## Groundwater Management Plan, 100-PL-EN-1009

| Closure commitment | |
|---|---|
| To implement the plan | |
| **Reference** | **Management action** |
| 2.3 | When required as a condition of a licence issued under the *Rights in Water and Irrigation Act 1914*, develop and implement a Groundwater Operating Strategy in accordance with the Operational policy 5.08: Use of operating strategies in the water licensing process (DoW). |
| 2.10 | Ensure chemicals and hydrocarbons are managed in accordance with the *Chemical and Hydrocarbon Management Plan* (100-PL-EN-0011) to reduce the risk of soil or groundwater contamination. |
| 2.11 | When an uncontrolled release of water has occurred as a result of Fortescue activities and the release has caused or is likely to cause pollution or environmental harm as defined in the *Environmental Consequence Descriptors Matrix* (100-MX-EN-0001), investigate and report the incident in accordance with the *Incident Event Management Procedure* (100-PR-SA-0011). |
| 2.12 | To ensure erosion, water quality and groundwater flow regimes are minimally impacted conduct progressive rehabilitation in accordance with the *Rehabilitation and Revegetation Management Plan* (45-PL-EN- 0023) or where applicable a Mine Closure Plan developed in accordance with the Guidelines for Preparing Mine Closure Plans. |
| 5.1 | Develop and implement a groundwater monitoring program in accordance with an approval, license or works approval issued under the *Environmental Protection Act 1986*, an approval under the *Environment Protection and Biodiversity Conservation Act 1999, a* licence issued under the *Rights in Water and Irrigation Act 1914* and where applicable a Groundwater Operating Strategy developed in accordance with the Operational policy 5.08: Use of operating strategies in the water licensing process (DoW). |

## Mine and Rail Dust Management Plan, 45-PL-EN-0030

| Closure commitment | |
|---|---|
| To implement the plan | |
| **Reference** | **Management actions** |
| 2.4 | Develop and implement a monitoring program as outlined in the *Dust Monitoring Guidelines* (45-GU-EN-0004) |
| 3.2 | To ensure vegetation conservation values are maintained, conduct progressive rehabilitation in accordance with the Rehabilitation and Revegetation Management Plan (45-PL-EN-0023) or where applicable a Mine Closure Plan developed in accordance with the Guidelines for Preparing Mine Closure Plans. |

## Significant Flora and Vegetation Management Plan, 45-PL-EN-0017

| Closure commitment |
|---|
| To implement the plan |

| Closure commitment | |
|---|---|
| **Reference** | **Management actions** |
| 2.6 | Ensure all vehicles, plant and equipment, including trailered equipment, are clean, inspected and certified prior to entry into the Fortescue Operations Area in accordance with the *Weed Management Plan* (100-PL-EN-1017 formerly 45-PL-EN-0013). |
| 2.9 | To minimise the potential for dust deposition on vegetation, implement dust suppression measures in accordance with the *Mine and Rail Dust Management Plan* (45-PL-EN-0030). |
| 3.1 | When significant flora and vegetation are known or likely to occur in the Fortescue Operations Area, develop and implement a monitoring program as outlined in the *Significant Flora and Vegetation Monitoring Guidelines* (45-GU-EN-0001) |
| 4.1 | When unauthorised disturbance of significant flora or vegetation occurs, report and investigate the incident in accordance with the *Incident Event Reporting Procedure* (100-PR-SA-0011). |
| 4.2 | To ensure vegetation conservation values are maintained, conduct rehabilitation in accordance with the … applicable a Mine Closure Plan developed in accordance with the Guidelines for Preparing Mine Closure Plans. |
| 4.3 | Develop and implement targeted research projects to investigate key areas related to significant flora and vegetation. |

## Surface Water Management Plan, 100-PL-EN-1015

| Closure commitment | |
|---|---|
| To implement the plan | |
| **Aspect** | **Management action** |
| Roads | Develop and implement a surface water monitoring program, which includes the inspection of all drainage infrastructure, in accordance with the *Surface Water Monitoring Guidelines (*100-GU-EN-0037).<br>To ensure erosion, water quality and surface water flow regimes are minimally impacted conduct rehabilitation in accordance with the Rehabilitation and Revegetation Management Plan (45-PL-EN-0023) or where applicable a Mine Closure Plan developed in accordance with the Guidelines for Preparing Mine Closure Plans.<br>Where appropriate, re-establish natural stream and drainage flows where practicable to resemble original drainage patterns, including rehabilitation of major drainage channels. |
| Railway Infrastructure | Manage chemicals and hydrocarbons in accordance with the *Chemical and Hydrocarbon Management Plan* (100-PL-EN-0011).<br>Develop and implement a surface water quality monitoring program, which includes the inspections of all drainage infrastructure, in accordance with the *Surface Water Monitoring Guidelines (*100-GU-EN-0037).<br>To ensure erosion, water quality and surface water flow regimes are minimally impacted conduct rehabilitation in accordance with the Rehabilitation and Revegetation Management Plan (45-PL-EN-0023) or where applicable a Mine Closure Plan developed in accordance with the Guidelines for Preparing Mine Closure Plans<br>Where appropriate, re-establish natural stream and drainage flows to resemble original drainage patterns, including rehabilitation of major drainage channels |
| Mines | Manage chemicals and hydrocarbons in accordance with the *Chemical and Hydrocarbon Management Plan* (45-PL-EN-0011).<br>Develop and implement a surface water quality monitoring program, which includes the inspection of all drainage infrastructure, in accordance with the *Surface Water Monitoring Guidelines (*45-GU-EN-0002).<br>To ensure erosion, water quality and surface water flow regimes are minimally impacted conduct rehabilitation in accordance with the Rehabilitation and Revegetation Management Plan (45-PL-EN-0023) or where applicable a Mine Closure Plan developed in accordance with the Guidelines for Preparing Mine Closure Plans<br>Where appropriate, re-establish natural stream and drainage flows to resemble original drainage patterns, including rehabilitation of major drainage channels |

| Closure commitment | |
|---|---|
| Operational Works | Manage chemicals and hydrocarbons in accordance with the *Chemical and Hydrocarbon Management Plan* (45-PL-EN-0011).<br>Develop and implement a surface water quality monitoring program, which includes the inspection of all drainage infrastructure, in accordance with the *Surface Water Monitoring Guidelines (*45-GU-EN-0002).<br>To ensure erosion, water quality and surface water flow regimes are minimally impacted conduct rehabilitation in accordance with the Rehabilitation and Revegetation Management Plan (45-PL-EN-0023) or where applicable a Mine Closure Plan developed in accordance with the Guidelines for Preparing Mine Closure Plans<br>Where appropriate, re-establish natural stream and drainage flows to resemble original drainage patterns, including rehabilitation of major drainage channels. |

### Weed Management Plan, 100-PL-EN-1017

| Closure commitment | |
|---|---|
| To implement the plan | |
| **Reference** | **Management actions** |
| 1.5 | Undertake weed mapping every two years to ensure spatial data for presence and distribution of weeds in Fortescue controlled sites is up to date to enable effective weed management practices to be implemented. |
| 1.6 | Undertake periodic inspections of weed risk areas to ensure new populations of priority weed species are identified and included in the site specific weed control program. |
| 2.4 | Develop and implement a weed control program for priority weed species in identified weed risk areas. |
| 3.1 | Develop and implement a weed monitoring program to determine the effectiveness of the weed management strategies and weed control program. |
| 3.3 | Where monitoring results indicate: a potential impact on conservation values of conservation significant flora, vegetation and/or fauna habitat<br>Implement corrective actions defined in Table 7 and any reporting requirements defined in Section 7. Update the following to reflect the monitoring outcomes:<br>• the weed mapping dataset and the weed control program<br>• the Plan where required, to inform an adaptive management approach to weed management across the business. |

## 3.2 Project proposal and description documents

### Summary of key closure-related conditions on *Mining Act 1978* tenements

| Description |
|---|
| The construction and operation of the project and measures to protect the environment being carried out generally in accordance with the [submitted Proposal] |
| The development and operation of the project being carried out in such a manner so as to create the minimum practicable disturbance to the existing vegetation and natural landform. |
| The Lessee notifying the holder of any underlying pastoral or grazing lease by telephone or in person, or by registered post if contact cannot be made, prior to undertaking airborne geophysical surveys or any ground disturbing activities utilising equipment such as scrapers, graders, bulldozers, backhoes, drilling rigs; water carting equipment or other mechanised equipment. |
| All costeans and other disturbances to the surface of the land made as a result of exploration, including drill pads, grid lines and access tracks, being backfilled and rehabilitated to the satisfaction of the Regulatory Environmental |

| |
|---|
| Officer. Backfilling and rehabilitation being required no later than 6 months after excavation unless otherwise approved in writing by the relevant regulator. |
| No interference with Geodetic Survey Stations and mining within 15 metres thereof being confined to below a depth of 15 metres from the natural surface. |
| Ingress and egress of pastoralists and tenement holders to be preserved by the construction of vehicular access crossings over any pipeline constructed pursuant to this licence. |
| Wherever any part of a road intersects an existing fence, the holder shall where necessary construct a gate or livestock grid having such dimensions and be constructed of such materials and be of such standard as agreed with the pastoralist or as determined by the Regulatory Environmental Officer. |
| The area of the miscellaneous licence to be reduced as soon as practicable after construction, to a minimum for the safe maintenance and operation of the licence purposes. |
| All surface holes drilled for the purpose of exploration are to be capped, filled or otherwise made safe immediately after completion. |
| All topsoil and vegetation being removed ahead of [activity] and being stockpiled appropriately for later respreading or immediately respread as rehabilitation progresses. |
| All waste materials, rubbish, plastic sample bags, abandoned equipment and temporary buildings being removed from the mining tenement prior to or at the termination of exploration program. |

# 4. RELEVANT LEGISLATION

A list of potentially relevant legislation is provided below, but is not necessarily exhaustive. A comprehensive legal review will be required as closure approaches to ensure that all relevant legislative requirements are identified.

| Act / Regulation |
|---|
| **Australian Commonwealth Legislation** |
| *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* |
| *Environmental Protection and Biodiversity Conservation Act 1999* |
| *Native Title Act 1993* |
| *Workplace Relations Act 1996* |
| **Western Australian State Legislation** |
| *Aboriginal Affairs Planning Authority Act 1972* |
| *Aboriginal Heritage Act 1972* |
| *Biosecurity Act 2015* |
| *Contaminated Sites Act 2003* |
| Contaminated Sites Regulations 2006 |
| *Conservation and Land Management Act 1984* |
| *Criminal Code Compilation Act 1913* |
| *Environmental Protection Act 1986* |
| Environmental Protection Regulations 1987 |
| Environmental Protection (Controlled Waste) Regulations 2004 |
| Environmental Protection (Unauthorised Discharges) Regulations 2004 |
| *Mining Act 1978* |
| Mining Regulations 1981 |
| Mining Rehabilitation Fund Regulations 2013 |
| *Mines Safety and Inspection Act 1994* |
| Mines Safety and Inspection Regulations 1995 |
| *Occupiers Liability Act 1985* |
| *Parks and Reserves Act 1895* |
| *Rights in Water and Irrigation Act 1914* |
| *Railway and Port (The Pilbara Infrastructure Pty Ltd) Agreement Act 2004* |
| *Wildlife Conservation Act 1950* |

# 5. RELEVANT GUIDELINES AND STANDARDS

Closure planning has been prepared so as to be considered with relevant content of these guidelines and standards.

| Guideline or Standard | Author |
|---|---|
| Guidelines for the Preparing Mine Closure Plans (2015) | Western Australian Department of Mines and Petroleum and Environmental Protection Authority |
| Leading Practice Sustainable Development Program for the Mining Industry - Mine Closure and Completion (2006) | Commonwealth Department of Industry Trade and Resources |
| Leading Practice Sustainable Development Program for the Mining Industry - Mine Rehabilitation (2006) | Commonwealth Department of Industry Trade and Resources |
| Mine rehabilitation in the Australian minerals industry (2016) | Minerals Council of Australia |
| Guideline for the Assessment of Environmental Factors: Rehabilitation of Terrestrial Ecosystems (2006) | Western Australian Environmental Protection Authority |
| Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2000) | Agriculture and Resource Management Council of Australia and New Zealand and the Australian and New Zealand Environment and Conservation Council |
| Mine Void Water Resource Issues in Western Australia (2003) | Western Australian Water and Rivers Commission |
| Assessment and Management of Contaminated Sites - Contaminated Sites Guidelines | Western Australian Department of Environmental Regulation |
| Environmental Notes on Mining: Acid Mine Drainage (2009) | Western Australian Department of Mines and Petroleum |
| Environmental Notes on Mining: Waste Rock Dumps (2009) | Western Australian Department of Mines and Petroleum |
| Safety Bund Walls Around Abandoned Open Pit Mines (1997) | Western Australian Department of Industry and Resources |
| Draft Guidance Materials Characterisation Baseline Data Requirements for Mining Proposals (2016) | Western Australian Department of Mines and Petroleum |
| Guidelines for Mining Proposals in Western Australia (2016) | Western Australian Department of Mines and Petroleum |
| Guide to departmental requirements for the management and closure of tailings storage facilities (TSFs) (2015) | Western Australian Department of Mines and Petroleum |
| Global Acid Rock Drainage Guide (2014) | International Network for Acid Prevention |
| Australian Standard 2601: The Demolition of Structures (2001) | Standards Australia |
| Australian Standard 4976: The Removal of Underground Petroleum Storage Tanks (2008) | Standards Australia |
| Demolition Work Code of Practice (2015) | Safe Work Australia |
| National Strategy for Ecologically Sustainable Development (1992) | Department of Environment |
| ScheduleB1 Guideline Investigation Levels for Soil and Groundwater (2013) | National Environment Protection Council |

# **Appendix 2:** Stakeholder engagement register

A stakeholder engagement register specific to closure discussions will be developed following further engagement with stakeholders.

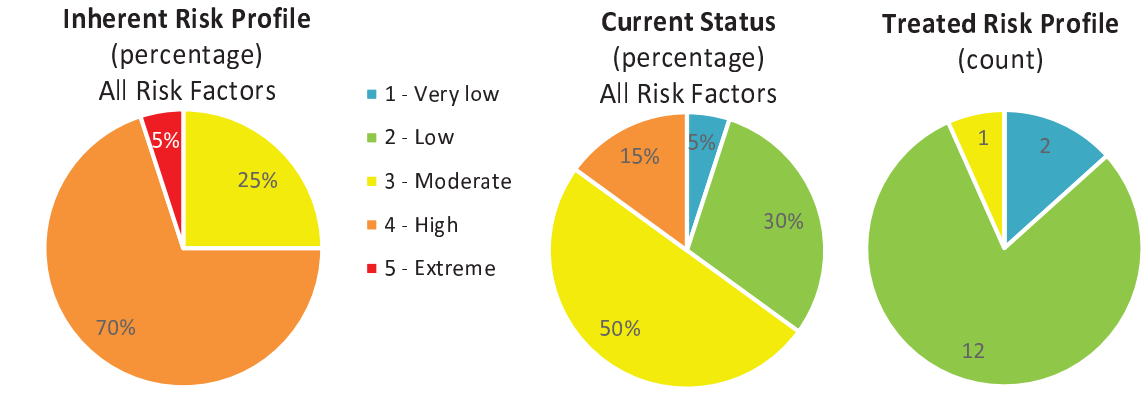
**Appendix 3:** Closure risk assessment

# Mine Closure Risk Assessment

## Eliwana

### Closure SharePoint Document
### 21 February 2018

**Figure 1. Closure risk summary**




Factors assessed: Financial, Health and Safety, Natural Environment, Social and Reputation, and Compliance

| **Mine Closure Risk Assessment** | | | **Closure SharePoint Document** |
|---|---|---|---|
| **Revision Number** | **2A** | | |
| **Status** | **Issued for Information** | | |
| **Author** | Kirsty Beckett | Kirsty Beckett<br>Signature | 21/02/2018<br>Date |
| **Checked** | Squad check | FMG-SQ-100-00622<br>Signature | 9/02/2018<br>Date |
| **Approved** | Kirsty Beckett | Kirsty Beckett<br>Signature | 21/02/2018<br>Date |
| **Confidentiality** | Fortescue Staff & Contractors | **Publish on Extranet** | **No** |
| **Review Date** | 31/05/2018 | | |

***Attendance register:***
***The following people attended one or more risk sessions and provided input into this risk assessment***

**Date of risk session:** Tuesday, 17 October 2017

| Name | Position / Department | Subject Matter Expert Area |
|---|---|---|
| Adel Vatandoost | Ops Planning | Processing |
| Ryan Warrington | Ops Planning | Surface Water |
| Chris Oppenheim | Ops Planning | Groundwater |
| Craig Finn | Ops Planning | Study Manager |
| Justin Dixon | Ops Planning | Geotechnical Engineering |
| Rachel Sharp | Environment | Approvals |
| Colleen Burgers | Ops Planning | Geochemistry |
| Zena Harman | Environment | Compliance |
| Aaron Rowley | Communities | Heritage |
| Michael Carroll | Ops Planning | Groundwater |
| Clayton Brandwood | Communities | External Relations |
| Tom Weaver | Communities | Native Title |
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***Key definitions:***

| Term | Definition |
|---|---|
| Action | Defined tasks and/or plans required to further mitigate the risk in addition to the existing risk mitigation strategies |
| Cause | Contributing internal or external factors which lead to a risk event occurring. |
| Consequence | The cumulative impact that is expected to arise should the risk event occur within the defined timeframe. This should consider both positive opportunities and negative impacts |
| Control | An activity that reduces or prevents (preventative controls) the likelihood of risk event or eliminates or reduces the impact on the business (mitigating controls) if the risk event occurs. |
| Control Owner | Person responsible for ensuring that a control is operating and / or further action is implemented |
| Likelihood | Assessment of the probability and/or frequency of the event occurring with the expected consequence within the defined timeframe |
| Residual Risk Rating | Measure of the risk remaining taking into consideration planned and/or implemented controls and other risk management strategies. The calculation of residual risk should assume that identified risk mitigation strategies (including controls) are operating effectively |
| Risk | Negative effects from an uncertain future event or circumstance where Fortescue has limited ability to control the occurrence of the risk with the consequential impact to the business being mitigated by appropriate risk management strategies. |
| Risk Owner | Person or function with the accountability and authority to manage a risk |
| Risk Response Plan | A defined set of activities or processes to manage the risk to an acceptable level. This would normally include the critical preventative and mitigating controls related to the risk |
| Status | State of whether a action or control is open/planned, completed/implemented or rejected/expired respectively. |

| Timeframe for actions | Description |
|---|---|
| Now | Within the next 18 months. Should be part of short-term work plans. |
| Next 5 years | Within the next 5 years Should be part of long-term work plans. |
| >5years | More than 5 years away. Not part of current work plans / programs. |

**Consequence**

| Rating | Financial (AUD) | Health and Safety | Natural Environment | Social and Reputation | Compliance |
|---|---|---|---|---|---|
| 1 | < 100K | No medical treatment required. | Limited damage to minimal area of low significance. | Concern restricted to local complaints about Fortescue. | Low level legal issues. |
| 2 | 100K – 1M | No medical treatment required. | Minor effects on biological or physical. | Minor, adverse complaints about Fortescue or local media attention. | Multiple minor breaches of laws or regulations and potential complaints. |
| 3 | 1M – 5M | Minor first aid – no disabling. | Moderate, short-term (<5 year) effects before recovery but not affecting ecosystem function. | Attention from local media and/or heightened concern by local community complaints. | Minor breach of laws or regulations could result in civil litigation. Closure delayed |
| 4 | 5M – 10M | Disabling incident requiring medical treatment with no permanent impact. | Serious medium term (<10 year) environmental effects or local ecosystem impairment. | Ongoing serious social issues. Independent arbiter required. Significant adverse national media and public attention. | Single significant breach of laws or regulations resulting in litigation and potential class actions. Relinquishment delayed |
| 5 | 10M – 100M | Serious (permanent) disabling injury that was life threatening – “near miss”. | Serious, long-term (50 year) environmental impairment of habitat or ecosystem function, or loss of high value species. | Serious public or media outcry, adverse international coverage. | Multiple significant breaches of laws resulting in major civil litigation, fines and penalties. |
| 6 | 100M – 500M | A fatality or very serious irreversible injury to a small number of people in localised area. | Reversible, unplanned impact on species, habitat, or ecosystem with conservation value. | International media condemnation. | Major breach of laws or regulations. Potential fines and criminal prosecutions. Temporary closure of operating sites. |
| 7 | >500M | Multiple fatalities or very serious irreversible injury to multiple persons in localised area. | Irreversible, unplanned destruction of species, habitat, or ecosystem with conservation value. | Prolonged international condemnation. | Multiple major breaches of laws resulting in imprisonment of executives/directors. Loss of licence to operate. |

**Likelihood**

| Rating | | Qualitative Description | Probability |
|---|---|---|---|
| 1 | Extremely Remote | The event is not expected to occur in most circumstances | <1% |
| 2 | Remote | The event is not expected | 1%-10% |
| 3 | Rare | The event may occur only in exceptional circumstances | 10%-25% |
| 4 | Unlikely | The event could occur at some time | 25%-50% |
| 5 | Possible | The event should occur at some time | 50%-75% |
| 6 | Likely | The event will probably occur in most circumstances | 75%-90% |
| 7 | Almost Certain | The event is expected to occur in most circumstances | >90% |

**Risk rating interpretation**

| Risk rating | Inherent (Raw) Risk Conclusion | Current Risk Status | Treated Outcome |
|---|---|---|---|
| 1 - Very Low | Evidence is available to demonstrate this hazard is not present at this site. | Evidence is available to demonstrate this hazard has been eliminated as a threat. | Risk reduced to as low as reasonably practicable (ALARP) |
| 2 - Low | Evidence suggests this hazard is not a threat to successful closure of this site. | Evidence is available to demonstrate the proposed management will successfully control the threat.<br><br>Ongoing review of this threat is recommended lest site conditions change. | |
| 3 - Moderate | Evidence suggests this hazard could pose a threat to successful closure of this site. | There is (some) evidence or widely accepted professional opinion that the proposed management will successfully control the threat.<br><br>Further action and/or monitoring is required to validate success of the proposed management. | Consider if ALARP has been achieved. Discuss residual risk acceptance with stakeholders. |
| 4 - High | Evidence suggests this hazard poses a substantive threat to successful closure of this site.<br><br>OR<br><br>Absence of adequate information prevents this threat from being satisfactorily assessed, and professional opinion suggests this hazard would pose a threat to successful closure of this site. | Professional opinion suggests the proposed management is likely to control the threat.<br><br>Actions have been proposed to validate the threat assessment and to validate the success of the proposed management.<br><br>Further refinement of the proposed management may be required based on the action outcomes. | Risk is too high. Identify other management strategies to reduce risk. |
| 5 - Extreme | Evidence and / or professional opinion suggests this hazard has the potential for irreversible impairment to a conservation significant ecosystem or site of cultural significance. | Professional opinion suggests the proposed management is unlikely to control the threat.<br><br>Irreversible impairment to a conservation significant ecosystem or site of cultural significance is still possible. | |

| ID | Subject | Hazard Scenario / Activity | Where | Cause / Why / Risk Pathway (Given known baseline conditions) | H & S | Env | S & R | C | Raw Likelihood | Raw Risk / Do nothing | Raw Env Risk / Do nothing | Treatment: What controls are implemented during operations | Treatment: What controls are planned to be implemented on closure | Current closure Risk: Control cost | Current closure Risk: Likelihood current | Current closure Risk: Current Risk | Current closure Risk: Response | Further work / Planned improvements / Comments | Env Risk: Likelihood with control | Env Risk: Environmental Treated Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | Infrastructure | Presence of surface contamination | All | Hydrocarbon spill seepage under facilities and underground, identified on demolition / removal of infrastructure | | 2 | | 3 | Possible | 23 | 14 | Hydrocarbon management, including bunded storage | Hydrocarbon inspection as part of demolition / decommissioning activities | 1 | Rare | 16 | Actions on closure | | Rare | 9 |
| 4 | Infrastructure | Rubbish in environment | All | Mining rubbish, demolition waste left on surface littering environment. Rubbish from tip uncovered due to erosion. | | 2 | | 3 | Possible | 23 | 14 | Landfill site operated in accordance with license conditions | Establish additional licensed landfill sites for demolition waste. Identify capacity requirements as part of decommissioning study. | 2 | Remote | 11 | Actions on closure | | Remote | 8 |
| 5 | Landform | Problematic materials outside mine area | Heavy Disturbance, Indirect Impact | Cuts through in situ geology as part of establishing infrastructure areas expose designated fibrous materials (fibres that pose health issues) or AMD generating material | 5 | 4 | 4 | | Possible | 34 | 30 | Fibrous materials management plan | Check to identify if problematic materials identified. Establish location specific solutions when encountered | 2 | Possible | 34 | Priority action | Establish AMD management plan for infrastructure areas. | Remote | 19 |
| 6 | Landform | Erosional instability of built landform | Waste Dumps, Indirect Impact | Waste rock surface erodes due to rainfall and surface water runoff, releases problematic (fibrous or AMD) materials encapsulated within waste dump or sediment chokes local creek. | 5 | 4 | 3 | 3 | Possible | 34 | 30 | Fibrous materials management plan<br>LoM AMD management plan | Waste dumps to be rehabilitated to achieve acceptable rates of erosion ~<6t/Ha/yr.<br>10m encapsulation with inert material to prevent release of problematic material.<br>Waste dumps designed to contain rainfall, to minimise erosion.<br>Continuous review of waste rock material properties. | 5 | Rare | 27 | Action required | Feature specific waste dump designs and encapsulation processes to be developed prior to Mining approval. | Remote | 19 |
| 7 | Landform | Geotechnical stability of built landform | Waste Dumps | Waste rock slumps or otherwise fails, releases problematic materials or sediment chokes local creek, collapse smothers fauna. | 5 | 4 | 3 | 3 | Possible | 34 | 30 | Geotechnical Ground Control Management plan.<br>Geotechnical evaluation of foundation prior to construction.<br>Waste dump be located outside of pit geotechnical zones of instability. | Waste dump design based on waste rock characteristics, and rehabilitation design to achieve overall slope stability factor of safety of 1.5 for design conditions.<br>Continuous review of waste rock material properties. | 1 | Extremely Remote | 21 | Action required | Feature specific waste dump designs to be developed prior to Mining approval. | Extremely Remote | 18 |

| ID | Subject | Hazard Scenario / Activity | Where | Cause / Why / Risk Pathway (Given known baseline conditions) | H & S | Env | S & R | C | Raw Likelihood | Raw Risk / Do nothing | Raw Env Risk / Do nothing | Treatment: What controls are implemented during operations | Treatment: What controls are planned to be implemented on closure | Current closure Risk: Control cost | Likelihood current | Current Risk | Response | Further work / Planned improvements / Comments | Env Risk: Likelihood with control | Environmental Treated Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8 | Landform | Falls from open edge | Pit | Open edges in accessible areas lead to falls over edge or land beneath footing collapses into mine void. | 6 | | | | Unlikely | 37 | | Geotechnical Ground Control Management plan | Abandonment bunds used to limit access into geotechnical zones of instability, where access is possible. Sign post used to notify of travellers of potential hazards. Provide alternate access to visited sites that keeps travellers clear of high risk areas. | 3 | Extremely Remote | 28 | Action required | Alternative access routes to sites of interest to be investigated. Management of surface water flow may be difficult to manage with abandonment bunds. Further work required to understand legal obligation for bund and subsequently to identify acceptable alternatives. | | |
| 9 | Landform | Pit wall instability | Pit | Rock dislodges from pit walls and falls on people or animals. Groundwater recovery reduces pit wall stability. Wall collapse falls in pit lake, disrupts flows, changes water balance, release of AMD generating geology changes water quality. Exposure of hazardous (to health) fibrous materials. | 5 | 4 | | | Possible | 34 | 30 | Fibrous Materials Management Plan Geotechnical Ground Control Management plan LoM AMD management plan | Retain or construct safe access routes through mine area to encourage people to stay away from hazards. Sign post used to notify of travellers of potential overhead hazards. Identify areas of risk on pit walls and ensure pit walls with problematic material exposures are suitably stabilised, to prevent human health issues or direct AMD generation. Post-closure elevation monitoring to detect erosion, and corrective actions. | 3 | Rare | 27 | Action required | Ongoing review of pit designs required to identify potential for problematic materials to appear in pit walls. Alternate options to stabilise or cover exposures may be required if materials present very high in the pit wall. Review influence of groundwater recovery on pit wall stability and manage appropriately. | Rare | 20 |
| 10 | Landform | Creek erosion acceleration due to water flowing into pit (waterfall) | Pit, Indirect Impact | Surface water flowing into pits creates fast moving water upstream of pit, leads to ongoing bank and bed erosion (head cut) upstream of pit, ongoing riparian impacts, expanding zone of geotechnical instability, unstable ground underfoot. | | 4 | | | Likely | 31 | 31 | Identification of potential risks via surface water management plan | Develop pit specific surface water management solution to manage surface water ingress risk. Post-closure elevation monitoring to detect erosion, and corrective actions. | 3 | Unlikely | 25 | Action required | Evaluate potential for head cut where creeks are located within geotechnical zone of instability. Stabilise pit walls where it is essential to keep the creek out of the pit. Develop controls, where require, for facilitate surface water ingress and egress. | Rare | 20 |

| ID | Subject | Hazard Scenario / Activity | Where | Cause / Why / Risk Pathway (Given known baseline conditions) | H & S | Env | S & R | C | Raw Likelihood | Raw Risk / Do nothing | Raw Env Risk / Do nothing | Treatment: What controls are implemented during operations | Treatment: What controls are planned to be implemented on closure | Current closure Risk: Control cost | Likelihood current | Current Risk | Response | Further work / Planned improvements / Comments | Env Risk: Likelihood with control | Environmental Treated Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11 | Landform | Pit lake egress instability | Pit | Presence of water in pit attracts fauna / people. Ground inherently unstable around water, traps fauna / people in lake area, leads to fauna drowning, need to save people | 6 | 4 | | | Possible | 41 | 30 | No control identified | Develop pit specific egress solution to manage surface water ingress risk. | 3 | Rare | 36 | Action required | Identify where pit lake may develop, if likely to be attractive to people/animals and the type of egress appropriate to future land use (e.g. consider cattle drinking water & restricted access to poor water)<br>Stabilise or otherwise design & construct stable & safe access to water edge.<br>Consider ongoing needs for sampling, groundwater recovery levels, use of vegetation and interfaces with surface water. | Rare | 20 |
| 12 | Water | Acid and / or metalliferous drainage released to downstream environment | Waste Dumps, Pits, Indirect Impact | Leaching of water through waste dumps, from pits containing AMD. Leachate release to surface / creeks. Metals/salts released into creeks impact downstream water bodies, impairs riparian ecosystem, affect veg / fauna health. Ongoing pit erosion perpetuates / increases AMD generation. | | 4 | | | Possible | 30 | 30 | Site conceptual model of source-path-receivers established.<br>LoM AMD management plan, including sampling and risk verification.<br>AMD potential materials to be encapsulated in 10m of benign waste rock. | Ongoing kinetic geochemical tests to improve understanding of long term leaching process.<br>Undertake unsaturated flow modelling through waste dumps to evaluate leachate potential including volume and quality.<br>Post-closure water quality monitoring in select downstream indict impact locations and corrective actions. | 2 | Unlikely | 25 | Priority action | Complete unsaturated flow modelling based on specific dump designs and results of kinetic tests, to confirm low risks of AMD generation.<br>Identify native plant species capable of consuming water when excess water is available for waste rock landform rehabilitation.<br>If required, evaluate the benefits of applying a cover of low permeability material to reduce infiltration. Need to link to appropriate native vegetation. | Remote | 19 |
| 13 | Water | Groundwater contamination - non geological source | Heavy Disturbance | Leaching from the landfill into the water table | | 3 | | | Possible | 23 | 23 | Landfill site operated in accordance with license conditions | Landfill closed in accordance with license conditions. Assumed to be capped / rehabilitated, and located outside of groundwater table recovery areas.<br>Post-closure groundwater level and quality monitoring and corrective actions. | 1 | Rare | 16 | Actions on closure | | Rare | 16 |

| ID | Subject | Hazard Scenario / Activity | Where | Cause / Why / Risk Pathway (Given known baseline conditions) | Impacts (max reasonable consequence) H & S | Env | S & R | C | Raw Likelihood | Raw Risk / Do nothing | Raw Env Risk / Do nothing | Treatment: What controls are implemented during operations | Treatment: What controls are planned to be implemented on closure | Current closure Risk: Control cost | Likelihood current | Current Risk | Response | Further work / Planned improvements / Comments | Env Risk: Likelihood with control | Environmental Treated Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 14 | Water | Groundwater contamination - geological source - acid and / or metalliferous drainage | Waste Dumps, Pits (no groundwater lake) | Leaching of water through waste dumps, pits containing AMD. Leachate release direct to groundwater table, with limited ponding time on surface. Contamination of stygo habitat. Restriction of future groundwater use. | | 3 | 3 | | Possible | 23 | 23 | Site conceptual model of source-path-receivers established.<br>LoM AMD management plan, including sampling and risk verification.<br>AMD potential materials to be encapsulated in 10m of benign waste rock. | Ongoing kinetic geochemical tests to improve understanding of long term leaching process.<br>Undertake unsaturated flow modelling through waste dumps to evaluate leachate potential including volume and quality. Evaluate potential for leachate to contaminate groundwater.<br>Develop pit specific solutions to manage identified risk.<br>Post-closure groundwater level and quality monitoring and corrective actions. | 1 | Unlikely | 17 | Action required | Ongoing review of pit designs required to identify potential for problematic materials to appear in pit walls.<br>Alternate options to stabilise or cover exposures may be required if materials present very high in the pit wall. Seek alternate drainage management measures if surface water ingress encourages contamination.<br>Complete waste dump unsaturated flow modelling. Identify if cover designs could reduce leachate / improve groundwater quality. | Unlikely | 17 |
| 15 | Water | Degraded pit lake water quality impacts downstream ecosystem. | Pit, Indirect Impact | Pit lake develops poor / incompatible water quality over time. People / fauna access to pit lake water and / or overtopping of lake increases ecosystem interactions.<br>Causes health issues in fauna / people. Source of toxic algae, eutrophic water, malefic bacteria, weeds.<br>Inaccurate water quality, water balance predictions.<br>Future climate very different from past climate.<br>Biomagnification / bioaccumulation of metals etc in lake flora/fauna. | | 5 | | | Possible | 34 | 34 | Site conceptual model of source-path-receivers established.<br>LoM AMD management plan, including sampling and risk verification.<br>Groundwater monitoring.<br>Surface water management plan. | Closure objectives established to ensure protection of downstream ecosystem.<br>Pit specific closure strategies to be developed, before Mining Approval, to ensure closure objectives can be met.<br>Some pit lakes with degraded water quality may be retained when no further impact to the environment is identified.<br>Water quality predictive models used to characterise long-term water quality evolution, in consideration of surface water ingress and climate.<br>Post-closure water quality monitoring and corrective actions. | 1 | Unlikely | 33 | Priority action | Develop specific pit closure strategies that will achieve closure objectives.<br>At every mine stage development, review and revised pit closure strategy including pit lake development and predict water quality outcomes.<br>Establish stock drinking water quality as minimum standard where there is the potential for stock to interact with pit lake.<br>Integrate means to minimise / prevent fauna access to pools of poor water quality.<br>Minimise plant growth where poor water quality expected to minimise biomagnication processes. | Remote | 26 |

| ID | Subject | Hazard Scenario / Activity | Where | Cause / Why / Risk Pathway (Given known baseline conditions) | Impacts (max reasonable consequence) H & S | Env | S & R | C | Raw Likelihood | Raw Risk / Do nothing | Raw Env Risk / Do nothing | Treatment: What controls are implemented during operations | Treatment: What controls are planned to be implemented on closure | Current closure Risk: Control cost | Likelihood current | Current Risk | Response | Further work / Planned improvements / Comments | Env Risk: Likelihood with control | Environmental Treated Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 16 | Vegetation | Reduction / termination of flow to creeks outside mine area | Indirect Impact | Temporary diversion employed during operations, and discharge to creeks, is terminated on closure and / or flow contribution is reduced. Reduction in surface and subsurface flow impacts riparian ecosystem. (Boundary of potential impacted area indicated in environmental approval) Underestimation of impacts results in increased ecosystem disturbance. | | 4 | | | Likely | 31 | 31 | Ongoing evaluation of surface water management in accordance with the Surface Water Management Plan. Regular review of predicted impacts based on updated knowledge base. Monitoring of indirect disturbance areas, where required. | Pit specific closure strategies to establish which creeks may be retained or created post-closure. Created creeks designed in consideration of changed upper catchment conditions (through former mine area) to maintain downstream environmental values where possible. Where values may be impacted, stakeholders are consulted. Plan to monitor and assist vegetation to transition to new 'lower flow' norms. Continued monitoring of affected ecosystems to ensure impact remains within approved limits. | 2 | Unlikely | 25 | Actions on closure | Confirm areas of indirect impact, and monitor to assist transition to new normal. | Remote | 19 |
| 17 | Vegetation | Undesirable lake vegetation conditions | Pit | Noxious weeds develop in lake fringe / water, healthy plants fail to establish, leads to poor water quality (algae bloom). No aquatic fauna breeding habitat (littoral zone) means no natural waterborne disease controls. | 4 | 4 | | | Possible | 30 | 30 | Weed management plan | Pit specific closure strategies to establish vegetation strategies for individual pits, based on pit shape, surface water ingress and planned egress areas. Revegetation of in pit waste dumps expected where lake is accessible to fauna / people. Ongoing weed management and monitoring. Water quality and vegetation monitoring. | 3 | Unlikely | 25 | Action required | Study and trials to establish plant species selection, preferred habitat plants, planting succession (given changes in water level prior to groundwater recovery etc.), and plants for erosion controls. | Rare | 20 |

| ID | Subject | Hazard Scenario / Activity | Where | Cause / Why / Risk Pathway (Given known baseline conditions) | Impacts (max reasonable consequence) H&S | Env | S&R | C | Raw Likelihood | Raw Risk / Do nothing | Raw Env Risk / Do nothing | Treatment: What controls are implemented during operations | Treatment: What controls are planned to be implemented on closure | Current closure Risk: Control cost | Likelihood current | Current Risk | Response | Further work / Planned improvements / Comments | Env Risk: Likelihood with control | Environmental Treated Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 18 | Vegetation | Non-sustainable ecosystem | All | Returned vegetation don't mature, seed bank fails to develop due to age of topsoil. Lack of rainfall. Pests eat plants. Lack of keystone species. Weed competition. Soil chemistry inhibits growth. Soil quality, depth doesn't support vegetation development. | | 4 | | | Possible | 30 | 30 | Topsoil stockpile management.<br>Chemical analysis of waste rock and encapsulation of deleterious waste rock.<br>Monitoring of vegetation control sites to understand natural condition variability.<br>Weed management. | Returned topsoil to supply nutrients, seedbank. Ancillary seeding of gap species where required.<br>Chemical analysis of waste rock and encapsulation of deleterious waste rock.<br>Monitoring of progressive rehabilitation to identify rehabilitation issues.<br>Monitoring of vegetation.<br>Ongoing weed management.<br>Monitoring of vegetation control sites to understand natural condition variability.<br>Weed management. | 3 | Unlikely | 25 | Action required | Identify opportunities to prolong topsoil stockpile health, or develop alternatives to improve topsoil health.<br>Develop seed species lists based on end of mining / rehabilitation landforms conditions.<br>Undertake pot and field trials to ensure vegetation can flourish in waste rock.<br>Identify if additional nutrients or water improve growth. | Rare | 20 |
| 19 | Heritage | Heritage site / values impacted | All | Heritage site destroyed during rehabilitation activities. Some sites close to mine area. Landform fails to stabilise, mass erosion and sediment deposition over heritage site (archaeological or ethnographic). | | | 5 | | Unlikely | 33 | | Land Use Certificate (LUC) process to identify potential heritage values before activities commence.<br>Ongoing heritage surveys to identify values / sites.<br>Section 18 process to disturb sites. | Ongoing use of LUC.<br>Inclusion of heritage team in closure planning. | 1 | Extremely Remote | 21 | Effective - No further actions | | | |
| 20 | Heritage | Visual amenity value conflict | All | Change of landform shapes, function, vegetation & introduction of permanent water bodies, changes visual appearance / amenity of landscape affects cultural values. | | | 4 | | Unlikely | 25 | | Ongoing heritage surveys to identify values / sites.<br>Ongoing stakeholder consultation to communicate changes to landscape. | Inclusion of heritage team in closure planning.<br>Ongoing stakeholder discussions during life of mine. | 1 | Rare | 20 | Effective - No further actions | | | |

| ID | Subject | Where | Hazard Scenario / Activity | Cause / Why / Risk Pathway (Given known baseline conditions) | Impacts (max reasonable consequence) H&S | Env | S&R | C | Raw Likelihood | Raw Risk / Do nothing | Raw Env Risk / Do nothing | Treatment: What controls are implemented during operations | Treatment: What controls are planned to be implemented on closure | Current closure Risk: Control cost | Likelihood current | Current Risk | Response | Further work / Planned improvements / Comments | Env Risk: Likelihood with control | Environmental Treated Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21 | Stakeholders | All | Stakeholders conflicted over retained infrastructure / access | Need to retain access routes for ongoing monitoring, return access to heritage sites lost by mining. Opportunities to handover infrastructure for next-use instead of demolish. Failure to establish binding agreements with third parties. Difference of opinion on closure standard / need for retention. Difference of opinion as to appropriate access locations and land uses. Different authorities have different demands: Pastoral, Traditional Owners, DBCA, DMIRS, Lands Board etc. | | | 4 | 4 | Possible | 30 | | Land Use Certificate (LUC) process to identify potential heritage values before activities commence. Ongoing heritage surveys to identify values / sites. Section 18 process to disturb sites. Ongoing stakeholder consultation. | Inclusion of heritage team in closure planning. Identification of safe access routes for ongoing monitoring and access to heritage sites (where appropriate), with stakeholders. Ongoing stakeholder consultation. Long post-closure observation period (due to presence of pit lakes) provides long period for negotiation. | 2 | Unlikely | 25 | Action required | Ongoing stakeholder discussion and cross-stakeholder awareness, to encourage understanding of needs / requests. | | |

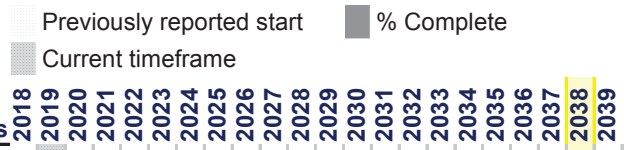
| ID | Subject | Where | Hazard Scenario / Activity | Cause / Why / Risk Pathway (Given known baseline conditions) | Impacts (max reasonable consequence) H&S | Env | S&R | C | Raw Likelihood | Raw Risk / Do nothing | Raw Env Risk / Do nothing | Treatment: What controls are implemented during operations | Treatment: What controls are planned to be implemented on closure | Current closure Risk: Control cost | Likelihood current | Current Risk | Response | Further work / Planned improvements / Comments | Env Risk: Likelihood with control | Environmental Treated Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 22 | Stakeholders | Pits | Stakeholder's conflicted over post-closure land use / management | Pit development restricts future land-use (regardless of lake presence, can't continue pre-mining landuse/raise cattle in pits). Good quality water in lakes offers alternative land uses. Government interagency conflicts over post-mining objectives (economic vs native vegetation). Closure outcomes potentially inconsistent with existing agreements (i.e. Land Access Agreements, Rangeland use). Conflicts over post-mining land management costs e.g. for cumulative impacts. Changes in stakeholder expectations / authority / recommendations. Changes in Law etc. | | | 5 | 4 | Possible | 34 | | Ongoing stakeholder consultation, including presentation of stage by stage closure strategies. Trials to demonstrate likely outcomes before final rehabilitation. Seek agreement with stakeholders before significant expenditure on progressive rehabilitation. Review and revision of closure plan based on evolving knowledge base. Reporting of progress via Annual Environmental Reports. Regular update of Mine Closure Plan. Biannual closure provisioning. | Ongoing stakeholder consultation, including discussion with neighbouring mines. Monitoring with inclusion of maintenance triggers and contingency actions. Long post-closure monitoring period, to enable groundwater table to recover (where ecosystem influenced by groundwater presence). | 2 | Rare | 27 | Action required | Update stakeholders with current closure strategy and educate on stage-by-stage mining approach. Establish field trials to address stakeholder concerns. | | |

| TRID | Hazard Scenario | Domain | Current risk | Action | Details |
|---|---|---|---|---|---|
| L5/1 | Problematic materials outside mine area | Heavy Disturbance, Indirect Impact | High | Review and update | Review geology exposed in cut geology, and determine if fibres or AMD present. Review Fibrous Materials Management Plan. Establish if management addresses in perpetuity requirement. Establish long-term solutions. |
| L6/1 | Erosional instability of built landform | Waste Dumps, Indirect Impact | Moderate | Data gap | Review and update material type erosion characteristics by waste dump |
| L6/2 | Erosional instability of built landform | Waste Dumps, Indirect Impact | Moderate | Gap study | Develop waste dump rehabilitation designs for all waste dumps. Consider encapsulated materials and Pilbara acceptable erosion rate guidance. |
| L7/1 | Geotechnical stability of built landform | Waste Dumps | Low | Gap study | Ensure planned waste dumps achieve geotechnical factors of safety of 1.5 or better for design conditions |
| L8/1 | Falls from open edge | Pit | Moderate | Gap study | Establish geotechnical zone of instability as part of pit design process. Integrate abandonment bund into design, before pit constructed, where practical. |
| L8/2 | Falls from open edge | Pit | Moderate | Gap study | Investigate (and negotiate with stakeholders) alternate management when drainage flows into pit. |
| L8/3 | Falls from open edge | Pit | Moderate | Gap study | On closure / C&M, block access roads and install sign posts to minimise interaction with pit edge and notify travellers of risks |
| L9/1 | Pit wall instability | Pit | Moderate | Gap study | Review potential post-mining land uses of pit areas, including fauna use, tourist access and Traditional Owners. Develop strategies to provide safe access around potential hazards where possible. Consider wall stabilisation where not possible to divert access. |
| L9/2 | Pit wall instability | Pit | Moderate | Gap study | Identify and verify presence of /potential for designated fibrous materials that remain in the pit walls within the geotechnical zone of instability. Develop strategies to stabilise or otherwise ensure fibrous materials are not exposed. |
| L10/1 | Creek erosion acceleration due to water flowing into pit (waterfall) | Pit, Indirect Impact | Moderate | Gap study | Assess creek head cut potential and implement strategy to stabilise the creek erosion, in consideration of local erosion rates and interface with the pit and pit egress ramps. |
| L11/1 | Pit lake egress instability | Pit | High | Gap study | Design pit ramps or otherwise construct waste rock ramps with shallow angles, that provide same egress routes for people and animals to access / leave ephemeral and permanent water bodies |
| L11/2 | Pit lake egress instability | Pit | High | Gap study | Investigate influence of groundwater recovery on pit wall stability. Where recovery may reduce wall stability identify management options and implement controls. |
| W12/1 | Acid and / or metalliferous drainage released to downstream environment | Waste Dumps, Pits, Indirect Impact | Moderate | Gap study | Implement AMD management plan. Establish where and when AMD material will be excavated and integrate encapsulation into mine plan. |
| W14/1 | Groundwater contamination - geological source - acid and / or metalliferous drainage | Waste Dumps, Pits (no groundwater lake) | Low | Gap study | Implement AMD management plan. Review potential connectivity between pit lakes and waste dumps. Review impact on water quality where connected. Utilise connectivity information in pit lake retention assessment. |

| TRID | Hazard Scenario | Domain | Current risk | Action | Details |
|---|---|---|---|---|---|
| W15/1 | Degraded pit lake water quality impacts downstream ecosystem. | Pit, Indirect Impact | High | Gap study | Develop pit lake retention decision process. Consider ecological triggers for fauna and vegetation health, bioaccumulation and biomagnification. |
| W15/2 | Degraded pit lake water quality impacts downstream ecosystem. | Pit, Indirect Impact | High | Gap study | Undertake pit lake modelling to predict post-closure water quality evolution. Consider shape of final void including egress ramps and in pit waste rock contribution, groundwater and creek flow contribution, pit wall talus contribution, climate change and climate variability (including pit water level flux), stratification, biological triggers i.e. from vegetation. |
| W15/3 | Degraded pit lake water quality impacts downstream ecosystem. | Pit, Indirect Impact | High | Gap study | Identify which downstream receptors may be impacted by overtopping pit lakes. Review likelihood of impact and unmitigated recovery period to determine level of risk. Use to inform pit lake retention decision process. |
| V16/1 | Reduction / termination of flow to creeks outside mine area | Indirect Impact | Moderate | Gap study | Establish areas of indirect disturbance and manage / reconcile predicted impacts during operation of mine. |
| V16/2 | Reduction / termination of flow to creeks outside mine area | Indirect Impact | Moderate | Gap study | Continue to monitor post-closure impacts until decline stabilises and ecosystem achieve new normal. Develop contingency actions for decline beyond predicted impact. |
| V17/1 | Undesirable lake vegetation conditions | Pit | Moderate | Gap study | Undertake pit lake rehabilitation trial to establish appropriate vegetation selection, planting / seeding methods, weed management for wet areas. Consider progression / succession of vegetation was water tables rise and pit lakes are established. Consider interface with local creeks. |
| V18/1 | Non-sustainable ecosystem | All | Moderate | Review and update | Review and revise rehabilitation strategy to integrate developing restoration knowledge, best practice techniques and lessons learnt from progressive rehabilitation implementation and monitoring. |
| V18/2 | Non-sustainable ecosystem | All | Moderate | Gap study | Implement progressive rehabilitation trials in each domain to test rehabilitation assumptions. |
| S21/1 | Stakeholders conflicted over retained infrastructure / access | All | Moderate | Review and update | Ongoing discussion with heritage team to identify heritage locations where safe access to specific sites must be retained or provided post-closure. |
| S22/1 | Stakeholder's conflicted over post-closure land use / management | Pits | Moderate | Review and update | Present results of pit lake retention process and water quality modelling to stakeholders. |

**Progressive Rehabilitation Studies**

2038 **Projected closure year (highlight yellow)**




| TRID | Hazard scenario | Domain | Progress |
|---|---|---|---|
| L6/2 | Erosional instability of built landform | Waste Dumps, Indirect Impact | 0% |
| L6/1 | Erosional instability of built landform | Waste Dumps, Indirect Impact | 0% |
| W12/1 | Acid and / or metalliferous drainage released to downstream | Waste Dumps, Pits, Indirect Impact | 0% |
| L5/1 | Problematic materials outside mine area | Heavy Disturbance, Indirect Impact | 0% |
| L7/1 | Geotechnical stability of built landform | Waste Dumps | 0% |
| L8/1 | Falls from open edge | Pit | 0% |
| L10/1 | Creek erosion acceleration due to water flowing into pit (waterfall) | Pit, Indirect Impact | 0% |
| W15/1 | Degraded pit lake water quality impacts downstream ecosystem. | Pit, Indirect Impact | 0% |
| V16/1 | Reduction / termination of flow to creeks outside mine area | Indirect Impact | 0% |
| S21/1 | Stakeholders conflicted over retained infrastructure / access | All | 0% |
| W14/1 | Groundwater contamination - geological source - acid and / or | Waste Dumps, Pits (no groundwater lake) | 0% |
| W15/3 | Degraded pit lake water quality impacts downstream ecosystem. | Pit, Indirect Impact | 0% |
| L11/1 | Pit lake egress instability | Pit | 0% |
| V18/1 | Non-sustainable ecosystem | All | 0% |
| V18/2 | Non-sustainable ecosystem | All | 0% |
| S22/1 | Stakeholder's conflicted over post-closure land use / management | Pits | 0% |
| W15/2 | Degraded pit lake water quality impacts downstream ecosystem. | Pit, Indirect Impact | 0% |
| L9/1 | Pit wall instability | Pit | 0% |
| L8/2 | Falls from open edge | Pit | 0% |
| V17/1 | Undesirable lake vegetation conditions | Pit | 0% |
| L8/3 | Falls from open edge | Pit | 0% |
| L9/2 | Pit wall instability | Pit | 0% |
| L11/2 | Pit lake egress instability | Pit | 0% |
| V16/2 | Reduction / termination of flow to creeks outside mine area | Indirect Impact | 0% |

**Appendix 4:** Geochemical risk assessment for closure

Fortescue
The New Force in Iron Ore

Report

# Western Hub Stage 1 - Eliwana and Flying Fish

## Geochemistry Risk Assessment for Closure

**16 February 2018**

750WH-5700-RP-HY-0009_Rev0

| | **Western Hub Stage 1 - Eliwana and Flying Fish – Geochemistry Risk Assessment for Closure** | | |
|---|---|---|---|
| **Revision Number** | **750WH-5700-RP-HY-0009_REV0** | | 16 February 2018 |
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**Revision History** *(to be completed for each version retained by document control)*

| Author | Checker | Approver | Rev No. | Status | Issued Date |
|---|---|---|---|---|---|
| Initial/Surname | Initial/Surname | Initial/Surname | | Choose an item | Click here to enter a date |
| Initial/Surname | Initial/Surname | Initial/Surname | | Choose an item | Click here to enter a date |

## TABLE OF CONTENTS



## List of tables



## List of figures

# 1. INTRODUCTION

Fortescue Metals Group Ltd (Fortescue) is proposing to develop the Western Hub Stage 1 Iron Ore Mine Project (the Project) comprising the Eliwana and Flying Fish deposits in the Pilbara region of Western Australia.

## 1.1 Objectives

The main aim of the Closure Risk Assessment is to outline and describe the contaminant-transport-receptor (CTR) model based on the *National Environmental Protection Measures* (NEPM) guidelines for assessing contamination (NEPM, 2013).

## 1.2 Reference documents

This *Western Hub Stage Geochemistry Risk Assessment for Closure* document number 750WH-5700-RP-HY-0009 was prepared using the following resources:

- *Acid and/or Metalliferous Drainage Management Plan*, Report Ref.: 100-PL-EN-1016_Rev1 (Fortescue, 2014);
- *Western Hub Stage 1 – Geological Summary Report* (Fortescue, 2015)*;*
- *Western Hub - Dewatering and Water Supply Assessment - Hydrogeological Conceptual Model Report*, Report Ref.: 1671484-002-R-Rev0; Golder Associates (Golder, 2017);
- *Western Hub Stage 1 – Eliwana and Flying Fish Subsurface Material Characterisation Assessment,* Report Ref.: 750WH-5700-RP-HY-0007 (Fortescue, 2017a);
- *Western Hub Stage 1 Conceptual Site Model and Operational Risk Assessment*, Report Ref.: 750WH-5700-RP-HY-0008 (Fortescue, 2017b);
- *Western Hub Stage 1 Conceptual Mine Void Water Assessment*, Report Ref.: 750WH-5700-RP-HY-0010 (Fortescue, 2017c).

# 2. QUALITATIVE RISK ASSESSMENT CRITERIA

In order to minimise AMD risk and optimise reserves the results from the geochemical testwork, geological distribution of ore, geotechnical data as well as surface and groundwater considerations have been incorporated into the mine planning design. This integrated approach is required to be conducted with the knowledge and expertise of geochemical and contamination issues as strict compliance with regulatory guidelines does not necessarily reduce risk. No legislation can adequately account for all potential geological and mining scenarios or risks to the environment, and guidelines only provide a strategic outline for how to address general concepts. While Australian and international references have been heavily relied on for this assessment, the conclusions, risks, recommendations and management options are entirely site specific.

## 2.1 Purpose

The purpose of a geochemical risk assessment is to highlight all potential risks to internal and external stakeholders such that the mitigation of risks is a collaborative effort where the best strategies are utilised to reduce harm and the most efficient use of resources is implemented. Mining operations are capital intensive and inherently hazardous and operational failures can be costly with significant impacts on the environment, if risk is not affectively assessed and managed (DIIS, 2016b). The goal of any risk management strategy is the sustainability of the environment while operating a successful business and being responsible for social and ecological aspects.

## 2.2 Geochemical risk

Figure 1 details the matrix used to determine the contamination risk soluble analytical concentration may pose to the environment and whether there would be a deleterious impact on any biota exposed to the concentration. Potential impact is based on three factors:

1. How often a particular parameter is detected in samples is the Likelihood of Occurrence;
2. The solubility and consequent ecotoxicology of a particular parameter in a natural system i.e. a highly soluble parameter, such as sodium is less toxic in an environment that has evolved to tolerate it, while a sparingly soluble parameter is naturally more toxic (except in an environment which has locally, naturally, high concentrations). Solubility can depend on the environmental and weathering conditions and can be changed by mineral processing; while ecotoxicology is dependent on the sensitivity of the receptor. For example in a highly saline environment additional salinity is unlikely to have a significant effect on biota, while in a pristine, sensitive glacial environment additional salinity could be toxic. Elements like arsenic or mercury would ordinarily be deemed to be highly toxic except in environments where they occur naturally and the local biota have evolved a tolerance;
3. The third determinant of risk takes into account specific, quantitative, legislative limits, also based on ecotoxicology, and local site specific trigger values based on the groundwater quality of the likely receptor.

A potentially high impact would occur when the ecotoxicology of the parameter given in the ANZECC Guidelines is high and the relative solubility of that species in local groundwater, as based

on the ITV, is very low, or “trace”; the concentration that the element occurs at exceeds the site specific trigger values *and* the occurrence of that element is possible to certain (ANZECC & ARMCANZ, 2000). Elements that are not detected are not considered to be of concern. In terms of risk, if a parameter is detected in less than 3% of samples (rare), exceeds the ITV and is a trace, highly toxic parameter, it is only a minor concern as a result of the rarity of occurrence on the balance of probability.

Any qualitative statements made concerning the relative risk of concentrations of any parameter can be interpreted according to this risk matrix.

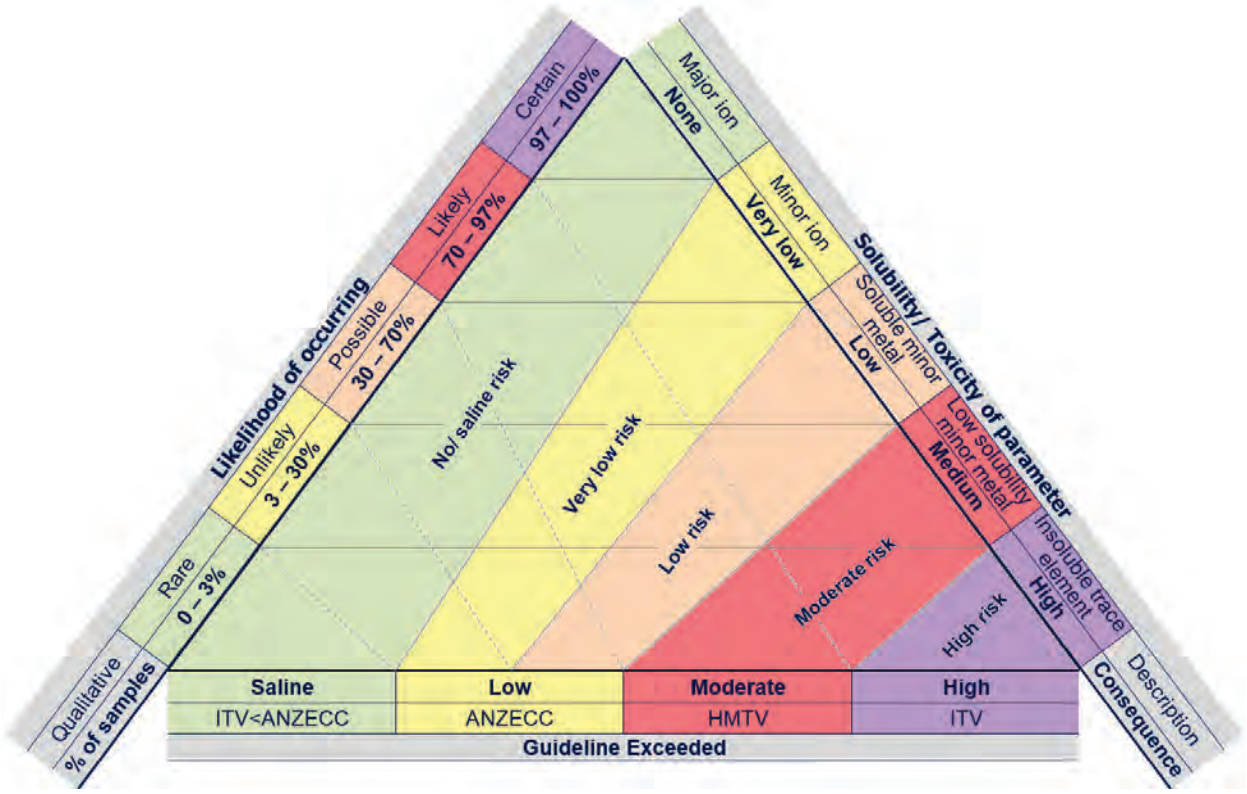


**Figure 1: Qualitative risk matrix for evaluating dissolved element concentrations**

## 2.3 Method

The geochemical study was conducted in a phased approach whereby analytical characterisation increased in detail. The preliminary assessment highlighted key issues and integrates detail from other studies such as the ore deposit geology, climate, topography, surface and groundwater regimes as well as pertinent mining detail, such as waste rock volumes and method of production and beneficiation. The detailed characterisation provided further information concerning where deleterious material is located, whether it remains in the wall rock, or will be excavated to waste, along with what potential for acid drainage exists, likely soluble metals, potential transport pathways and risk to water resources. Based on these considerations the risk of specific material located in the landscape that may constitute a source, and the likely connection to pathways to potential receptors has been assessed for the post-closure regime. A detailed description of the consequence, likelihood, duration and extent categories used for this assessment is given, with terminology definitions, in Tables 1, 2, 3, 4 and 5.

**Table 1: Consequence Categories**

| Rating Level | Health and Safety | Social and Natural Environment | Reputation and Brand | Compliance |
|---|---|---|---|---|
| 1 | No medical treatment required. | Insignificant damage of low significance. | Public concern restricted to local complaints about Fortescue brand. | Low level legal issues. |
| 2 | No medical treatment required. | Slight effects on biological or physical or social environment. | Minor, adverse local public or media attention and complaints about Fortescue brand. | Multiple minor breaches of laws or regulations and potential complaints. |
| 3 | Minor first aid – no disabling. | Intermediate effects but not affecting ecosystem function or ongoing social issues. | Attention from local media and/or heightened concern by local community complaints. | Minor breach of laws or regulations could result in civil litigation. Closure delayed |
| 4 | Disabling incident requiring medical treatment with no permanent impact. | Medium environmental effects or ongoing serious social issues. | Independent review of outcomes required. Significant adverse national media and public attention impacting on Fortescue brand and shareholder brand. | Single significant breach of laws or regulations resulting in litigation and potential class actions. Relinquishment delayed |
| 5 | Serious (permanent) disabling injury that was life threatening – “near miss”. | Significant environmental impairment of ecosystem function or ongoing widespread social impacts. | Serious public or media outcry International coverage with significant impact on Fortescue brand and shareholder brand | Multiple significant breaches of laws resulting in major civil litigation, fines and penalties. |
| 6 | A fatality or very serious irreversible injury to a small number of people in localised area. | Very significant impact on highly valued species, habitat, or eco system or breakdown in social order. | International media condemnation with major impact on Fortescue brand and shareholder brand. | Major breach of laws or regulations. Potential fines and criminal prosecutions. Temporary closure of operating sites. |
| 7 | Multiple fatalities or very serious irreversible injury to multiple persons in localised area. | Severe impact on highly valued species, habitat or eco system or complete breakdown in social order. | Prolonged international condemnation with permanent damage to Fortescue brand and shareholder brand. | Objective impossible to achieve. Multiple major breaches of laws resulting in imprisonment of executives/directors. Loss of licence to operate. |

**Table 2: Likelihood**

| Rating | Qualitative Description | Probability |
|---|---|---|
| 1 Extremely Remote | Not expected in most circumstances: Less than once in 100 years | <1% |
| 2 Remote | Not expected to occur: Once in 100 years | 1%-10% |
| 3 Rare | May occur in exceptional circumstances: Once in 50 years | 10%-25% |
| 4 Unlikely | Could occur at some time: Once in 25 years | 25%-50% |
| 5 Possible | Should occur at some time: Once in 10 years | 50%-75% |
| 6 Likely | Probably occur in most circumstances: At least once in 2 years | 75%-90% |
| 7 Almost certain | Occurs in most circumstances: At least once per year | >90% |

**Table 4: Duration**

| Timeframe | Description |
|---|---|
| 1 Hours | Negligible issue such as a spill, clean up/ resolved immediately |
| 2 Days | Brief issue will attenuate naturally within days or require minimal attention |
| 3 Weeks | Minor occurrence - can be resolved with a few weeks of action |
| 4 Months | Moderate action required |
| 5 Years | High consequence - large and sustained response required to resolve |
| 6 Decades | Serious occurrence - management strategy and mine plan response required |
| 7 Centuries | Severe action - rehabilitation and relinquishment impacted, liability not able to be ended |

**Table 5: Extent of disturbance**

| Distance | Description |
|---|---|
| 1 Immediate | Several metres |
| 2 Confined | Small area affected |
| 3 Limited | Minor area, up to half of footprint |
| 4 Internal | Will not exceed disturbance footprint |
| 5 Local | Travel off disturbance footprint for some distance <10-20 km |
| 6 Regional sub-catchment | Extended area of up to 100 km |
| 7 Regional Basin | Large extent affected >100 km |

**Table 3: Key Definitions**

| Term | Definition |
|---|---|
| Action | Defined tasks and/or plans required to further mitigate the risk in addition to the existing risk mitigation strategies |
| Cause | Contributing internal or external factors which lead to a risk event occurring. |
| Consequence | The cumulative impact that is expected to arise should the risk event occur within the defined timeframe. This should consider both positive opportunities and negative impacts |
| Control | An activity that reduces or prevents (preventative controls) the likelihood of risk event or eliminates or reduces the impact on the business (mitigating controls) if the risk event occurs. |
| Control Owner | Person responsible for ensuring that a control is operating and / or further action is implemented |
| Hazard | Maximum reasonable outcome (consequence) given the current level of knowledge and effectiveness of implemented controls. |
| Inherent Risk Rating | Measure of the current risk given what has been implemented / constructed on site, the current level of knowledge and effectiveness of implemented controls. |
| Likelihood | Assessment of the probability and/or frequency of the event occurring with the expected consequence within the defined timeframe. |
| Residual Risk Rating | Measure of the risk remaining taking into consideration planned and/or implemented controls and other risk management strategies. The calculation of residual risk should assume that identified risk mitigation strategies (including controls) are operating effectively. |
| Risk | Negative effects from an uncertain future event or circumstance where Fortescue has limited ability to control the occurrence of the risk with the consequential impact to the business being mitigated by appropriate risk management strategies |
| Risk Owner | Person or function with the accountability and authority to manage a risk |
| Risk Response Plan | A defined set of activities or processes to manage the risk to an acceptable level. This would normally include the critical preventative and mitigating controls related to the risk |
| Status | State of whether an action or control is open/planned, completed/implemented or rejected/expired respectively |

From the assessment of the Consequences of a source being connected to a receptor, the Likelihood of that occurring, the Duration it may occur for, and the likely Extent or distance that potential contamination could travel, a risk rating is calculated. The risk matrix is given below in Table 6 with each category given a rating out of seven for severity and has been adapted from *Preventing Acid and Metalliferous Drainage* guideline (DIIS, 2016c). The maximum possible risk rating would be a value of 2,401 which is the maximum severity of seven for all four categories multiplied i.e. 7 x 7 x 7 x 7.

The maximum risk rating for each risk level is the value when two of the four factors are in the next category (i.e. 1 x 2 x 2 x 1 = 4, 5 x 4 x 5 x 4 = 400 etc.). As a result of the multiplication of categorisation factors, not every number in the range of risk ratings is possible (i.e. prime numbers greater than 11 do not occur).

**Table 6: Risk rating matrix**

| Lvl | Consequence | Likelihood | Duration | Extent | Risk Rating | Risk Level Description |
|---|---|---|---|---|---|---|
| 1 | Insignificant | Extremely Remote | Hours | Immediate | 1 to 4 | Very Low |
| 2 | Slight | Remote | Days | Confined | 5 to 36 | Low |
| 3 | Intermediate | Rare | Weeks | Limited | 37 to 144 | Minor |
| 4 | Medium | Unlikely | Months | Internal | 145 to 400 | Moderate |
| 5 | Significant | Possible | Years | Local | 401 to 900 | High |
| 6 | Very Significant | Likely | Decades | Catchment | 901 to 1764 | Serious |
| 7 | Severe | Almost Certain | Centuries | Regional | 1765 to 2401 | Extreme |

## 3. CONCEPTUAL SITE MODEL

The conceptual site model (CSM) describes all the likely sources of potential contamination in the mining area and assesses the likely transport pathways to any local or regional receptors. This risk assessment is designed to highlight areas of high risk and potential uncertainty that require management to mitigate, or further study to quantify more fully. The potential sources, pathways and receptors are described in detail in the *Western Hub Stage 1 Conceptual Site Model and Operational Risk Assessment*, Report Ref. 750WH-5700-RP-HY-0008 (Fortescue, 2017b).

A summary of the predicted surface and groundwater regimes is given in Table 7. This table collates the planned depth of mining for each pit, with the surface and groundwater models to detail which mine void will intersect groundwater and have inflow in the current plan, and which mine voids are situated within a floodplain. With a large enough rainfall event any mine void in the floodplain could intercept surface water flow, even if just for a few hours. The table indicates whether mine void water will be permanent enough to form a pit lake and whether outflow may occur during rain events. The compilation of these scenarios has allowed the risk of contamination to be assessed.

**Table 7: List of mine voids showing planned depth and water regime**

| | Pit name | Planned Depth (mAHD) | Groundwater Inflow | Position in Floodplain | Pit Lake | Surface water outflow |
|---|---|---|---|---|---|---|
| Eliwana | Broadway West 3 | 363 | **Likely** | **Within** | **Likely** | **Almost certain - yearly** |
| | Broadway West 2 | 411 | Remote | **Within** | Remote | N/A |
| | Broadway West 1 | 408 | Remote | **Within** | Remote | N/A |
| | Broadway East 2 | 435 | **Likely** | **Within** | **Likely** | Very Rare – Extreme |
| | Broadway East 1 | 453 | **Likely** | **Within** | **Likely** | |
| | Broadway | 483 | Remote | Above | Remote | Very Rare – Extreme |
| | Broadway South | 444 | Remote | Above | Remote | Very Rare – Extreme |
| | Eagles Nest | 492 | **Likely** | Above | **Likely** | N/A |
| | East 1 (now called Swan) | 543 | Remote | Above | Remote | N/A |
| | East 2 | 510 | Remote | Above | Remote | N/A |
| | East 3 (now called Piccadilly) | 543 | Remote | Above | Remote | N/A |
| | East 4 | 546 | Remote | Above | Remote | N/A |
| | MM1 (now called Talisman East) | 489 | Remote | Above | Remote | N/A |
| | MM4-6 (now called M6) | 450 | **Likely** | Above | **Likely** | N/A |
| | P Tenement 1 (P1) | 486 | Remote | Above | Remote | N/A |
| | P Tenement 2 (P2) | 570 | Remote | Above | Remote | N/A |
| | P Tenement 3 (P3) | 423 | Remote | Above | Remote | N/A |
| | P Tenement 4 (P4) | 417 | Remote | Above | Remote | N/A |
| | Talisman 1 | 480 | Remote | **Within** | Remote | N/A |
| | Talisman 2 | 426 | **Likely** | **Within** | **Likely** | Very Rare – Extreme |
| | West End | 310 | **Likely** | Above | **Likely** | N/A |
| | West Side | 456 | **Likely** | Above | **Likely** | N/A |
| Flying Fish 1 | | - | Remote | **Within** | Remote | Rare |
| Flying Fish 2 | | - | Remote | Above | Remote | N/A |

Table 8 gives the results of the risk assessment for closure while Figure 2 show the connections between source, pathways and receptors in operations graphically. All relevant potential sources of contamination are assessed for each likely transport pathway and each likely potential receptor. The unmitigated risk is rated based on the severity of the consequence that specific geochemical contaminants identified in the characterisation program would pose, the likelihood that such contaminants or transport pathway would occur, the duration a potential source or pathway may exist and the extent of distance that a pathway might affect.

The risk is then described with potential mitigation methods be implemented to reduce the risk. Not all unmitigated risks are sufficiently high to require mitigation as either likelihood of contamination is low or the consequence of any contamination is not of environmental significance. Where potential sources such as tailings storage facilities, waste rock landforms or mine voids will remain following closure the duration of these potential sources is the maximum time of centuries and cannot be mitigated. In these instances the only way mitigation of the risk can be achieved is to reduce the consequence, likelihood and extent. This may be achieved by excluding water and air from contact with material that may leach and/or oxidise. All risks that are rated as minor to serious have been indicated to require management (there are no extreme risks).

**Table 8:** **Summary of conceptual site model post-closure** (A3 size page)

| Source | Specific concern | Transport | Potential Receptors | Consequence | Likelihood | Duration | Extent | Unmitigated Risk Rating | Description of risk and possible mitigation measures to reduce risk post- closure |
|---|---|---|---|---|---|---|---|---|---|
| **Aboveground waste rock landforms** | Acid generation and neutral/ alkaline metalliferous drainage containing aluminium, arsenic, manganese, selenium and zinc with minor beryllium, cobalt and thallium | Direct | Pastoralists/ Future/ Indigenous land users | 1 | 1 | 1 | 1 | 1 | ***Very Low Risk*** that any people or animals exposed directly to waste rock will be effected by chemical contamination and does not require mitigation following closure. |
| | | Seepage | Shallow Tertiary Detrital Aquifer | 6 | 7 | 7 | 5 | 1470 | ***Serious Risk*** that deleterious waste rock can oxidise and cause AMD if not properly disposed of in the waste rock landform. The consequence, likelihood and extent can be **mitigated to *Low Risk*** if WRL design and waste scheduling is carefully managed and maintained to prevent the ingress of oxygen and water as the duration of WRL will remain centuries |
| | | | Mineralised Brockman Aquifer | 2 | 3 | 1 | 2 | 12 | ***Low Risk*** that leaching of contaminants from waste rock material could reach the aquifer. The potential area of impact is limited to the immediate vicinity of the source by a low likely volume of seepage, and capture by nearby dewatering or only reaching the shallow groundwater aquifers. |
| | | | Wittenoom Aquifer | 2 | 3 | 1 | 1 | 6 | |
| | | Surface water and runoff | Runoff | 6 | 6 | 7 | 3 | 756 | ***High Risk*** that runoff from waste rock landforms will cause AMD if not properly disposed of. The consequences, likelihood and extent can be mitigated if the WRL is properly designed with only benign, water shedding, material as cover but the duration of WRL will remain centuries and as a result the risk can be **mitigated to *Low Risk*** |
| | | | Pinarra Creek and other minor onsite tributaries | 5 | 6 | 7 | 3 | 630 | ***High Risk*** that the Pinarra Creek, which is situated in the centre of the mining footprint, will be heavily impacted by either runoff or flow interruption. The consequence of this impact can be reduced to insignificant with properly managed WRLs and because the Pinarra Creek is not of specific ecological importance. The risk can be **reduced to *Minor Risk***. |
| | | | Boolgeeda Creek | 4 | 3 | 7 | 3 | 252 | ***Moderate Risk*** that the Boolgeeda Creek, downgradient of the mining footprint will be impacted either by runoff or interruption of flow. It is likely that significant runoff will only result after large rainfall events in which any metal or salt load is likely to be diluted, however planned WRLs are situated in tributaries and material locations and compactions must be carefully planned to reduce the consequence and likelihood to insignificant and remote, respectively, in order for the risk to be **reduced to *Low Risk*** |
| | | | Duck Creek | 3 | 2 | 7 | 2 | 84 | ***Minor Risk*** that the Duck Creek, further downgradient of the mining footprint will be impacted either by runoff or interruption of flow. It is likely that significant runoff will only result after large rainfall events in which any metal or salt load is likely to be diluted as a result the consequence can be reduced to insignificant and the risk **reduced to *Low Risk*** |
| **Sub-grade ore stockpiles** | Acid generation and aluminium, iron, manganese, selenium, thallium and zinc | Direct | Pastoralists/ Future/ Indigenous land users | 1 | 1 | 1 | 1 | 1 | ***Very Low Risk*** that any people or animals exposed directly to sub-grade ore will be effected by chemical contamination and does not require mitigation following closure. |
| | | Seepage | Shallow Tertiary Detrital Aquifer | 3 | 5 | 7 | 2 | 210 | ***Moderate Risk*** that deleterious sub-grade ore can oxidise and cause AMD seepage if not properly stored. The consequence, likelihood and extent can be **mitigated to *Low Risk*** if sub-grade ore (specifically basal Dales Gorge Member unit D1) is assessed for AMD drainage potential prior to storage or sent to waste disposal instead, if the risk is high, and the stockpiles are capped with benign material on closure, as the duration of ore stockpiles my remain for centuries |
| | | Surface water and runoff | Pinarra Creek and other minor onsite tributaries | 2 | 5 | 7 | 2 | 140 | ***Minor Risk*** that deleterious sub-grade ore can oxidise and cause AMD runoff if not properly stored. The consequence, likelihood and extent can be **mitigated to *Low Risk*** if sub-grade ore (specifically basal Dales Gorge Member unit D1) is assessed for AMD drainage potential prior to storage or sent to waste disposal instead if the risk is high, and the stockpiles are capped with benign material on closure, as the duration of ore stockpiles my remain for centuries |
| | | | Boolgeeda Creek | 2 | 1 | 2 | 4 | 16 | ***Low Risk*** that the Boolgeeda and Duck Creeks, downgradient of the mining footprint will be impacted by runoff. A significant volume of runoff could only reach these creeks during a very large event which would result in any metal or salt load being highly diluted. |
| | | | Duck Creek | 1 | 1 | 2 | 5 | 10 | |
| **Tailings storage facilities** | Early stage uncertainty and minor chromium drainage | Direct | Pastoralists/ Future/ Indigenous land users | 1 | 1 | 1 | 1 | 1 | ***Very Low Risk*** that any people or animals exposed directly to tailings will be effected by chemical contamination and does not require mitigation following closure. |
| | | Seepage | Shallow Tertiary Detrital Aquifer | 1 | 6 | 5 | 2 | 60 | ***Minor Risk*** from tailings seepage into the Tertiary Aquifer. The water quality is unlikely to be poor and thus the consequence is low, however the likelihood and duration cannot be mitigated, the extent could be reduced by slurry return and dewatering operations to **mitigate to Low Risk**. |
| | | | Mineralised Brockman Aquifer | 1 | 6 | 1 | 1 | 6 | ***Low Risk*** from tailings seepage to this aquifer: while the likelihood of seepage occurring is high, the quality is unlikely to adversely impact the aquifer and the consequence of any seepage is low. |
| | | | Wittenoom Aquifer | 4 | 6 | 5 | 3 | 360 | ***Moderate Risk*** from tailings seepage into the Wittenoom Aquifer. The seepage may cause AMD if coming into contact with pyritic shale material and thus the consequence is higher and the likelihood and duration cannot be mitigated. The only mitigation measure available is to avoid this scenario by siting the TSF away from any pyritic shale material and reducing seepage volume by dewatering operations and efficient water return to **reduce to *Low Risk***. |
| | | Surface water and runoff | Pinarra Creek and other minor onsite tributaries | 1 | 5 | 5 | 1 | 25 | ***Low Risk*** from tailings seepage into the Pinarra Creek. While the likelihood of seepage occurring is high, the quality is unlikely to adversely impact the aquifer and the consequence of any seepage is low. |
| | | | Boolgeeda Creek | 1 | 1 | 2 | 3 | 6 | ***Low Risk*** that the Boolgeeda and Duck Creeks, downgradient of the mining footprint will be impacted by tailings seepage as the distances are too great. A significant volume of seepage could only reach these creeks during a very large, rare event which would result in any metal or salt load being highly diluted. |
| | | | Duck Creek | 1 | 1 | 2 | 5 | 10 | |

| Source | Specific concern | Transport | Potential Receptors | Consequence | Likelihood | Duration | Extent | Unmitigated Risk Rating | Description of risk and possible mitigation measures to reduce risk post- closure |
|---|---|---|---|---|---|---|---|---|---|
| Mine void wall rock | Acid generation and neutral/ alkaline drainage containing aluminium, arsenic, manganese, selenium and zinc with minor beryllium, cobalt, chromium, copper, thallium and nickel | Direct | Pastoralists/ Future/ Indigenous land users | 1 | 1 | 1 | 1 | 1 | ***Very Low Risk*** that any people or animals exposed directly to wall rock will be effected by chemical contamination and does not require mitigation following closure. |
| | | Seepage | Shallow Tertiary Detrital Aquifer | 4 | 4 | 6 | 2 | 192 | ***Moderate Risk*** from wall rock seepage into the aquifers. There is a risk to water quality if West Angela Member shale is exposed in the walls of mine voids that are in connection with aquifers the consequence, likelihood and duration can be reduced if exposure is reduced and risk can be **mitigated to *Low Risk***. |
| | | | Mineralised Brockman Aquifer | 4 | 4 | 6 | 2 | 192 | |
| | | | Wittenoom Aquifer | 4 | 3 | 6 | 2 | 144 | ***Minor Risk*** from wall rock seepage into the Wittenoom Aquifer. There is a risk to water quality if West Angela Member shale is exposed in the walls of mine voids that are in connection with aquifers, however the risk is lower as the shale units will reduce the permeability into the Wittenoom Aquifer. The consequence, likelihood and duration can be reduced if exposure is reduced and risk can be **mitigated to *Low Risk***. |
| | | Surface water and runoff | Pinarra Creek and other minor onsite tributaries | 4 | 5 | 2 | 3 | 120 | ***Moderate Risk*** from wall rock seepage into the Pinarra Creek. There is a risk to water quality if West Angela Member shale is exposed in the walls of mine voids that are in connection with surface water. The consequence, likelihood and duration can be reduced if exposure is reduced and risk can be **mitigated to *Low Risk***. |
| | | | Boolgeeda Creek | 2 | 3 | 2 | 3 | 36 | ***Low Risk*** that the Boolgeeda and Duck Creeks, downgradient of the mining footprint will be impacted by wall rock runoff as the distances are too great. A significant volume of runoff could only reach these creeks during a very large, rare event which would result in any metal or salt load being highly diluted. |
| | | | Duck Creek | 1 | 2 | 2 | 5 | 20 | |
| Backfill material / below or above water table waste rock / tailings storage | Acid generation and neutral/ alkaline drainage containing aluminium, arsenic, manganese, selenium and zinc with minor beryllium, cobalt and thallium | Direct | Pastoralists/ Future/ Indigenous land users | 1 | 1 | 1 | 1 | 1 | ***Very Low Risk*** that any people or animals exposed directly to backfill will be effected by chemical contamination and does not require mitigation following closure. |
| | | Seepage | Shallow Tertiary Detrital Aquifer | 4 | 4 | 2 | 2 | 64 | ***Minor Risk*** that deleterious backfill material can oxidise and cause AMD if not properly disposed of in backfill. The consequence, likelihood and extent can be **mitigated to *Low Risk*** if backfill design and waste scheduling is carefully managed and maintained to prevent the ingress of oxygen and water as the duration of backfill will remain centuries |
| | | | Mineralised Brockman Aquifer | 4 | 4 | 2 | 2 | 64 | |
| | | | Wittenoom Aquifer | 2 | 2 | 2 | 1 | 8 | ***Low Risk*** that deleterious backfill can oxidise and cause AMD if not properly disposed of in backfill as interbedded shale units will reduce the permeability into the Wittenoom Aquifer. |
| | | Groundwater Flow | Shallow Tertiary Detrital Aquifer | 4 | 5 | 6 | 1 | 120 | ***Minor Risk*** that groundwater in contact with backfill can cause AMD if deleterious material is not properly disposed of in backfill. The consequence can be reduced if only benign material is used and **mitigated to *Low Risk***. |
| | | | Mineralised Brockman Aquifer | 4 | 5 | 6 | 1 | 120 | |
| | | | Wittenoom Aquifer | 1 | 1 | 1 | 1 | 1 | ***Very Low Risk*** from groundwater in contact with backfill impacting the aquifer as interbedded shale units will reduce the permeability into the Wittenoom Aquifer. |
| | | Surface water and runoff | Pinarra Creek and other minor onsite tributaries | 4 | 6 | 2 | 3 | 144 | ***Minor Risk*** that backfill runoff into the Pinarra and Boolgeeda Creeks can cause AMD if deleterious material is not properly disposed of in backfill. The consequence can be reduced if only benign material is used and **mitigated to *Low Risk***. |
| | | | Boolgeeda Creek | 3 | 2 | 2 | 5 | 60 | |
| | | | Duck Creek | 1 | 2 | 2 | 5 | 20 | ***Low Risk*** that Duck Creek downgradient of the mining footprint will be impacted by backfill runoff as the distance is too great. A significant volume of runoff could only reach these creeks during a very large, rare event which would result in any metal or salt load being highly diluted. |
| Episodic, ephemeral/ semi-permanent mine void water | Acid generation and neutral/ alkaline drainage containing aluminium, arsenic, manganese, selenium and zinc with minor beryllium, cobalt and thallium | Direct | Pastoralists/ Future/ Indigenous land users | 2 | 2 | 1 | 1 | 4 | ***Very Low Risk*** that any people or animals exposed directly to episodic, ephemeral or semi-permanent water will be effected by chemical contamination and does not require mitigation following closure. |
| | | Groundwater Flow | Shallow Tertiary Detrital Aquifer | 1 | 5 | 6 | 1 | 30 | ***Low Risk*** that groundwater quality in contact with episodic, ephemeral or semi-permanent water would deteriorate. The quality of ingress water will mostly be controlled by rainfall with minor addition of salts and metals in contact with wall rock and through evapoconcentration and will likely be less saline than the groundwater. Surface water and rainfall ingress may result in groundwater recharge with fresher water |
| | | | Mineralised Brockman Aquifer | 1 | 5 | 6 | 1 | 30 | |
| | | | Wittenoom Aquifer | 1 | 1 | 1 | 1 | 1 | ***Very Low Risk*** from groundwater in contact with backfill impacting the aquifer as interbedded shale units will reduce the permeability into the Wittenoom Aquifer. |
| | | Surface water and runoff | Pinarra Creek and other minor onsite tributaries | 4 | 2 | 2 | 3 | 48 | ***Minor Risk*** that accumulated salts and metals from the evapoconcentration of episodic, ephemeral or semi-permanent water would impact the Pinarra Creek. A significant volume of precipitation could only resume creek flow during a very large, rare event (less than once in 100 years) which would result in any metal or salt load being highly diluted and not a risk of contamination. The consequence can be reduced if only benign material is used for any backfill and no deleterious wall rock is exposed and **mitigated to *Low Risk***. |
| | | | Boolgeeda Creek | 3 | 1 | 2 | 5 | 30 | ***Low Risk*** that Duck and Boolgeeda Creeks, downgradient of the mining footprint will be impacted by episodic, ephemeral or semi-permanent water as the distance is too great. A significant volume of runoff could only resume creek flow during a very large, rare event (less than once in 100 years) which would result in any metal or salt load being highly diluted. |
| | | | Duck Creek | 1 | 1 | 2 | 5 | 10 | |

| Source | Specific concern | Transport | Potential Receptors | Consequence | Likelihood | Duration | Extent | Unmitigated Risk Rating | Description of risk and possible mitigation measures to reduce risk post- closure |
|---|---|---|---|---|---|---|---|---|---|
| Permanent groundwater-fed terminal sink | Acid generation and neutral/ alkaline drainage containing aluminium, arsenic, manganese, selenium and zinc with minor beryllium, cobalt and thallium | Direct | Pastoralists/ Future/ Indigenous land users | 1 | 2 | 7 | 1 | 14 | ***Low Risk*** that any people or animals exposed directly to permanent water will be effected by chemical concentrations at acute levels so as to suffer from poisoning. It is far more likely that water would contain too much salt load to be palatable and does not require mitigation following closure. |
| | | Gw Flow | Shallow Tertiary Detrital Aquifer | 1 | 1 | 7 | 1 | 7 | ***Low Risk*** that aquifers or surface water will ever be connected to the permanent pit lake water. The mine voids are bounded to the north and south by impermeable shale and to east and west by impermeable dolerite dykes and groundwater movement is restricted. In addition the mine voids are large and is never likely to sustain sufficient direct rainfall or runoff to fill and impact creek flow. High evaporation will also ensure that these sources remains terminal sinks. Water quality will likely deteriorate with high salt load and possible metalliferous drainage from exposed Mount McRae or West Angela shales in the wall, but no transport pathways to any receptors exists. |
| | | | Mineralised Brockman Aquifer | 1 | 1 | 7 | 1 | 7 | |
| | | | Wittenoom Aquifer | 1 | 1 | 7 | 1 | 7 | |
| | | Surface water & runoff | Pinarra Creek and other tribs | 1 | 1 | 7 | 1 | 7 | |
| | | | Boolgeeda Creek | 1 | 1 | 7 | 1 | 7 | |
| | | | Duck Creek | 1 | 1 | 7 | 1 | 7 | |
| | | Fractures | Unexpected/ unknown connection to aquifers | 4 | 1 | 7 | 3 | 84 | ***Minor Risk*** that permanent water from groundwater ingress in the West End mine void has an unknown connection to the Wittenoom Aquifer. This Likelihood is Extremely Remote considering that such a fracture, or other feature allowing transport of contaminated groundwater, would have to be contiguous through both Mount McRae and Mount Sylvia Formations. If mine void water is acidic it is likely that the dolomitic Wittenoom Formation would neutralise this acidity and low pH is not considered to be a risk. The prospect of metalliferous drainage would be reduced as a result of the throughflow of groundwater in the mine void and reduced evapoconcentration. The volume of any groundwater outflow would also be likely to be fairly low and potential metalliferous contamination may be diluted. However, there is the potential for groundwater dependent ecosystems to be in contact and certainty that connection does not exist will be gained in operations or mitigation measures will be implement if proven otherwise |
| Permanent surface and groundwater sourced mine void terminal sink | Acid generation and neutral/ alkaline drainage containing aluminium, arsenic, manganese, selenium and zinc with minor beryllium, cobalt and thallium | Direct | Pastoralists/ Future/ Indigenous land users | 1 | 2 | 7 | 1 | 14 | ***Low Risk*** that any people or animals exposed directly to permanent water will be effected by chemical concentrations at acute levels so as to suffer from poisoning. It is more likely that water would contain too much salt load to be palatable and does not require mitigation following closure. |
| | | Groundwater Flow | Shallow Tertiary Detrital Aquifer | 4 | 4 | 7 | 1 | 112 | ***Minor Risk*** that permanent water from surface and groundwater ingress in the Talisman or Broadway East mine voids will impact the local groundwater quality of the shallow Tertiary Detrital Aquifer. As groundwater contains more dissolved salts than surface water the potential for groundwater evapoconcentration increases the risk of water quality deterioration. However, high evaporation rates will likely ensure that this permanent water remains a terminal sink. Surface water modelling indicates that only a significant volume of rainfall and creek ingress could increase the water level in the mine void to be in contact with the shallow aquifer, during a very large, rare event (less than once in 100 years), which would result in any metal or salt load being highly diluted and not a risk for contamination. Reducing the amount of deleterious wall rock in contact with permanent water could reduce the consequence of any connection to the shallow aquifer and **mitigate to *Low Risk***. |
| | | | Mineralised Brockman Aquifer | 3 | 4 | 7 | 1 | 84 | ***Minor Risk*** that permanent water from surface and groundwater ingress in the Talisman or Broadway East mine voids will impact the local groundwater quality of the Mineralised Brockman Aquifer. As groundwater contains more dissolved salts than surface water the potential for groundwater evapoconcentration increases the risk of water quality deterioration. However, groundwater flow in this aquifer is severely restricted by the Roy Hill Jeerinah Shale Formation to the north and is further compartmentalised by vertical dolerite dykes. In addition high evaporation rates will likely ensure that this permanent water remains a terminal sink. Reducing the amount of deleterious wall rock in contact with permanent water could reduce the consequence of any connection to the shallow aquifer and **mitigate to *Low Risk***. |
| | | | Wittenoom Aquifer | 1 | 1 | 7 | 1 | 7 | ***Low Risk*** that permanent water in the Talisman or Broadway East mine voids will impact groundwater quality as interbedded shale units reduces the permeability into the Wittenoom Aquifer. |
| | | Surface water and runoff | Pinarra Creek and other minor onsite tributaries | 3 | 2 | 7 | 1 | 28 | ***Low Risk*** of surface water outflow from mine voids with both surface and groundwater inflows. Ingress of groundwater and minor creek tributaries, likely to be captured by mine voids, may result in permanent water but high evaporation rates will also ensure that this water remains in the void as a terminal sink. Surface water modelling indicates that only a significant volume of surface water could resume creek flow during a very large, rare event (less than once in 100 years) which would result in any metal or salt load being highly diluted and not a risk for contamination. However, the sensitivity of the ecosystem to minor salt increases is not yet known and this uncertainty is captured in the consequence. |
| | | | Boolgeeda Creek | 2 | 2 | 7 | 1 | 28 | |
| | | | Duck Creek | 2 | 2 | 7 | 1 | 28 | |
| Permanent surface & groundwater fed throughflow mine void | Acid generation and neutral/ alkaline drainage containing aluminium, arsenic, manganese, selenium and zinc with minor beryllium, cobalt and thallium | Direct | Pastoralists/ Future/ Indigenous land users | 1 | 3 | 7 | 5 | 105 | ***Low Risk*** that any people or animals exposed directly to permanent water will be effected by chemical concentrations at acute levels so as to suffer from poisoning. It is more likely that water would contain too much salt load to be palatable and does not require mitigation following closure. |
| | | Groundwater Flow | Shallow Tertiary Detrital Aquifer | 1 | 4 | 7 | 3 | 84 | ***Minor Risk*** that permanent water from surface and groundwater ingress in the Broadway West 3 mine void will impact the local groundwater quality of the shallow Tertiary Detrital Aquifer as quality would be natural groundwater diluted by surface water, with low risk from evapoconcentration. |
| | | | Mineralised Brockman Aquifer | 2 | 1 | 7 | 1 | 14 | ***Low Risk*** that permanent water from surface and groundwater ingress in the Broadway West 3 mine void will impact the local groundwater quality of the Mineralised Brockman Aquifer as mine void is situated in the Marra Mamba Formation & has no connection to the Mineralised Brockman Aquifer. |
| | | | Wittenoom Aquifer | 1 | 1 | 7 | 1 | 7 | ***Low Risk*** that permanent water in the Broadway West 3 mine void will impact groundwater quality as interbedded shale units will reduce the permeability into the Wittenoom Aquifer. |
| | | Surface water & runoff | Pinarra Creek and other tribs | 1 | 1 | 7 | 1 | 7 | ***Low Risk*** that the Pinarra Creek will be impacted as it is located upgradient of this mine void |
| | | | Boolgeeda Creek | 2 | 2 | 7 | 1 | 28 | ***Low Risk*** that the Boolgeeda Creek will be impacted as the majority of its length is located upgradient of the Broadway West mine voids |
| | | | Duck Creek | 3 | 7 | 7 | 5 | 735 | ***High Risk*** of surface water outflow from the Broadway West 3 mine void with both surface and groundwater inflows. It is estimated that the quality of this water will not be highly evapoconcentrated as a result of the throughflow but some West Angela wall rock may cause AMD. The likelihood is almost certain and duration will be centuries, with a possible extent offsite for 10-20 km. This risk could be reduced to ***Moderate*** by greater certainty that the water quality will not have a negative impact, and potentially controlling the volume of the out flow by changing the shape of the mine void to reduce the extent. |

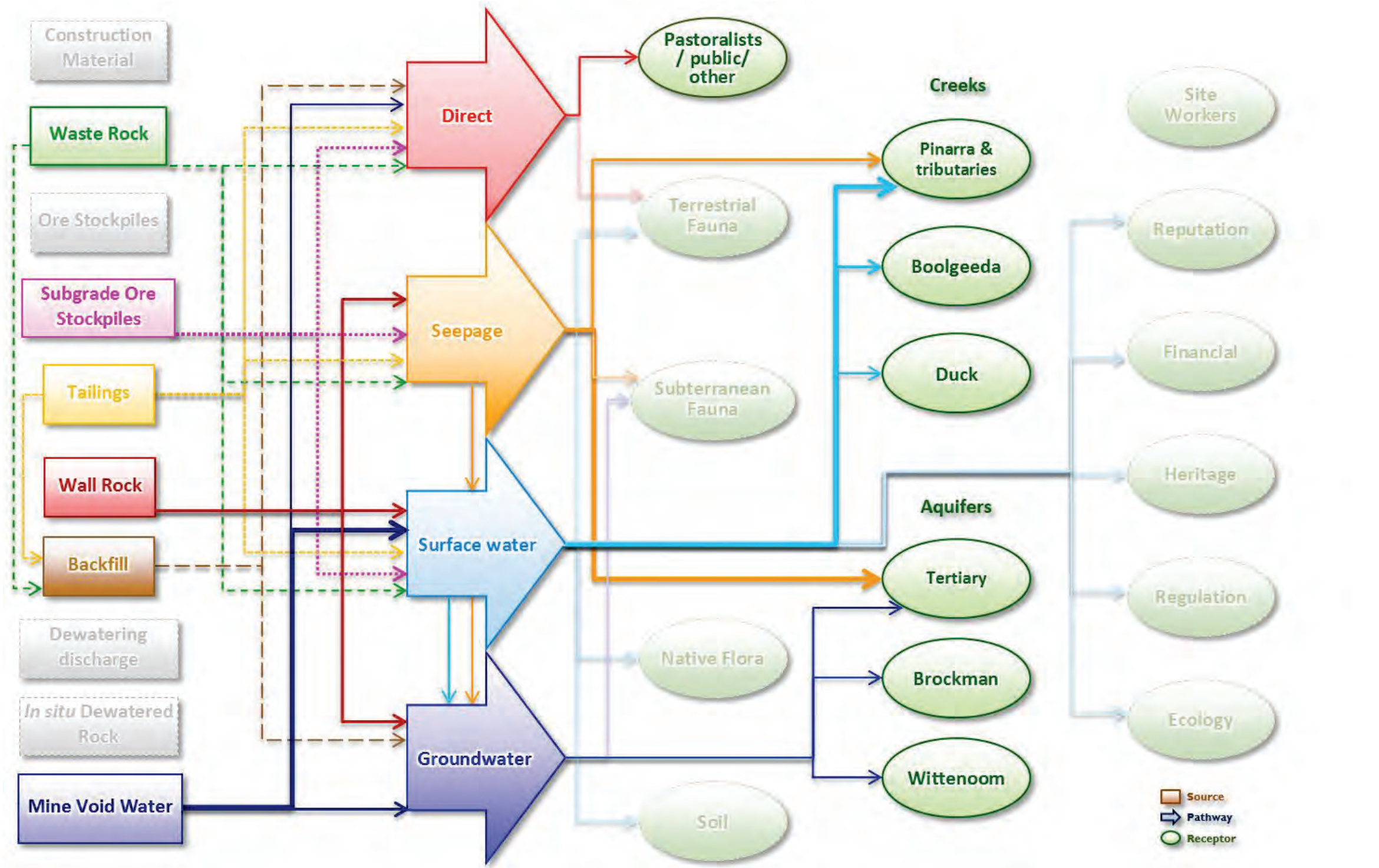


**Figure 2:** **Source-Pathway-Receptor connections post-closure** (A3 size page)

The conceptual site model is presented in Figure 3. The compartmentalised nature of the pre-mining groundwater levels is shown along with the likely surface and groundwater movement for different scenarios. The northern mine void is representative of the mine void risks situated in the Marra Mamba Formation while the southern mine void represents the risks from mine voids situated in the Brockman Formation. This conceptual model is a general case and specific detail, such as mine void volumes and exact extents, is subject to change. The key factors that require consideration are as follows:

- Shale units have very low permeability and risk of generating acid drainage from *in situ* dewatering of pyritic material is therefore low. Horizontal bores potentially installed to depressurise these units may cause AMD during operations, however the volume of this water would be very low and as such dewatered or depressurised units as a potential source are not considered to pose a risk to the environment in the assessment.
- Waste rock landforms require planning and management to ensure that material that may generate acid or leach metals is excluded from contact with air and water. These materials include but may not be limited to Mount McRae Shale and West Angela Member shale;
- All mine voids will temporarily contain water from direct precipitation and runoff. This water is likely to be episodic, ephemeral or semi-permanent and will quickly infiltrate and evaporate. Salt build-up as a result is not expected to be high or to pose a risk of contamination in the event of a flushing episode;
- Permanent water will occur where mining is conducted below the pre-disturbance water level ;
- Hydrological and hydrogeological modelling has indicated that groundwater-only dependent pit lakes will form in the West Side, West End, Eagles Nest and M6 (also called MM4-6) mine voids. The water quality is likely to deteriorate as a result of evaporation and runoff from Mount McRae and West Angela shale exposed in the wall rock and, over time, will contain high salinity and dissolved metals. These pit lakes will be terminal, evaporative sinks and are unconnected to any transport pathways or receptors. As such they are not considered to pose a risk to the environment, surface water or groundwater;
- The Talisman and Broadway East mine voids are highly likely to have inflows from both fresher surface water and more saline groundwater but will likely be evaporative sinks. Water quality will deteriorate over time as a result of evapoconcentration and potential exposure of West Angela Member shale in the footwall rock. There is a remote likelihood that very large, rare events of a 1:100-year's volume of rainfall will allow flushing and resumption of creek flow to occur. These events are unlikely to pose a risk of contamination from evapoconcentrated salts and metals as a result of the large dilution factor and high infiltration reducing the consequence and extent.
- The highest risk for surface and groundwater contamination is posed by the Broadway West mine voids. The risk of outflow is almost certain as a result of the larger rainfall catchment to which Broadway West is connected. This water may not undergo significant evapoconcentration as a result of significant dilution volumes but groundwater inflow is more saline naturally, there is some West Angela shale in the wall rock that may leach and impact the downstream environment.

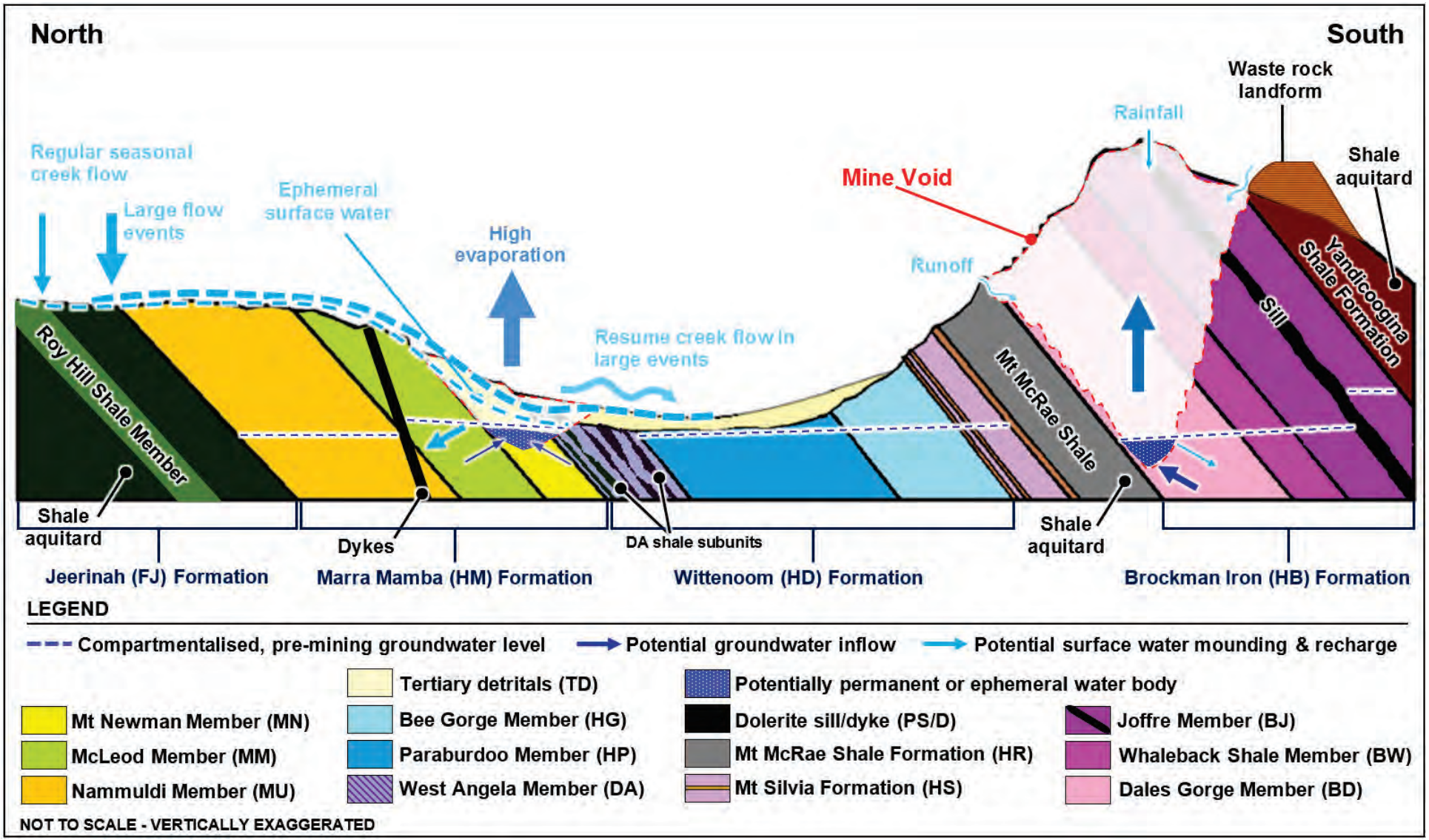


**Figure 3: Conceptual site model**

## 4. REFERENCES


1. DIIS, 2016b. *LPSDP-13: Risk Management - Leading Practice Sustainable Development Program for the Mining Industry,* Department of Industry, Innovation and Science, Commonwealth Government of Australia, Canberra: 14 September 2016, Pp 125.
2. Fortescue, 2014. *Acid and/or Metalliferous Drainage Management Plan.* FMG Report Ref.: 100-PL-EN-1016_Rev1; Fortescue Metals Group Pty. Ltd, 31 December 2014; Pp. 163.
3. Fortescue, 2015. *Western Hub Stage 1 - Geological Summary Report,* FMG Report Ref.: 2014_Draft; Fortescue Metals Group Pty Ltd.: 5 June 2015; Pp. 69.
4. Fortescue, 2017a. *Western Hub - Stage 1 Eliwana and Flying Fish: Subsurface Materials Characterisation,* FMG Report Ref.: 750WH-5700-RP-HY-0007; Fortescue Metals Group Pty. Ltd.: 31 December 2017; Pp 461.
5. Fortescue, 2017b. *Western Hub Stage 1 Conceptual Site Model and Operational Risk Assessment,* FMG Report Ref.: 750WH-5700-RP-HY-0008; Fortescue Metals Group Pty. Ltd.: 31 December 2017; Pp 41.
6. Fortescue, 2017d. *Western Hub Stage 1 Conceptual Mine Void Water Assessment,* FMG Report Ref.: 750WH-5700-RP-HY-0010; Fortescue Metals Group Pty. Ltd.: 31 December 2017; Pp 40.
7. Golder, 2017. *Western Hub - Dewatering and Water Supply Assessment - Hydrogeological Conceptual Model Report,* Report Ref.: 1671484-002-R-Rev0; Golder Associates Pty Ltd.: 30 August 2017; Pp 180.
8. NEPM, 2013. *National Environmental Protection Measure - Assessment of Site Contamination: Guideline on Site Characterisation,* Report Ref.: F2013C00288, Volume 3: Schedule B2; Office of Parliamentary Counsel, Canberra: 16 May 2013, Pp. 150.

**Appendix 5:** Closure-related management plan (CMP)

Fortescue
The New Force in Iron Ore

Plan

# Closure-related Management Plan

Eliwana Iron Ore Mine

**21 February 2018**
EW-PL-EN-0002 Rev 0

| | **Closure-related Management Plan** | | |
|---|---|---|---|
| **Document Revision Number** | EW-PL-EN-0002 Rev 0 | | **21/02/2018** |
| **Status** | **IFI - ISSUED FOR INFO** | | |
| **Author** | Bioscope Environmental | Signature | 14/02/2018 |
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| **Approved** | Kirsty Beckett | Kirsty Beckett Signature | 21/02/2018 |
| **Access to this document:** | **PUBLIC USE (ACCESS TO ALL)** | **Next Review Date (if applicable)** | N/A |

| **This document was prepared on behalf of Fortescue Metals Group Limited by Bioscope Environmental Consulting** | | | |
|---|---|---|---|
| **Approved by Fortescue:** | Kirsty Beckett | Kirsty Beckett Signature | 21/02/2018 |

## EXECUTIVE SUMMARY

This Closure-related Management Plan (the Plan) has been prepared for the Eliwana Iron Ore Mine (Eliwana Mine), which is proposed for development by Fortescue Metals Group (Fortescue) 90 km west-northwest of Tom Price (110 km south-west of the existing Solomon Iron Ore Project). The first phase of mine development will include mine pits, temporary and permanent Waste Rock Landforms, ore processing facilities and associated infrastructure. Subsequent development may include Tailings Storage Facilities. Development of the overall Eliwana Mine will result in approximately 8,560 ha of ground disturbance within a Mine Development Envelope of approximately 70,000 ha.

The proposed Mine is currently undergoing assessment under Part IV of the *Environmental Protection Act 1986* at the Public Environmental Review (PER) level of assessment. This Closure-related Management Plan has been prepared to support the PER and outlines the management-based provisions that will be used in key disciplines to support planning for closure of the Mine.

Fortescue considers closure planning to be a core part of its business. Fortescue's provisional closure objectives for the Eliwana Mine are based on a proposed pastoral post-mining land use and are as follows:

1. Infrastructure is removed or retained in line with agreements reached with future land users and managing authorities.
2. Waste rock landforms are safe to people and animals and geotechnically stable.
3. Rehabilitated areas support local native, self-sustaining vegetation and native fauna foraging.
4. Sediment movement within, and downstream of, rehabilitated areas does not adversely impact environmental or heritage values.
5. Water quality does not adversely impact downstream environmental or heritage values.
6. Pit lakes do not present a significant risk to human health or a significant ecological threat.
7. Changes to hydrological regimes do not adversely impact downstream environmental or heritage values.

The key elements of this Closure-related Management Plan are summarised in Table ES-1.

**Table ES-1: Key Elements of this Closure-related Management Plan**

| Element | Description | |
|---|---|---|
| Title of Proposal | Eliwana Iron Ore Mine | |
| Proponent | Fortescue Metals Group Ltd | |
| Ministerial Statement Number | To be advised | |
| Purpose of the Management Plan | This Closure-related Management Plan outlines the actions to be implemented so that Fortescue can be effective in the rehabilitation and closure of the Eliwana Iron Ore Mine and, through implementation of monitoring, audits and reviews, establish a process for continual improvement of rehabilitation and closure performance during the life of the mine. | |
| Key Environmental Factors and Objectives | Flora and Vegetation | To protect flora and vegetation so that biological diversity and ecological integrity are maintained |
| | Subterranean Fauna | To protect subterranean fauna so that biological diversity and ecological integrity are maintained |
| | Terrestrial Fauna | To protect terrestrial fauna so that biological diversity and ecological integrity are maintained |
| | Hydrological Processes | To maintain the hydrological regimes of groundwater and surface water so that environmental values are protected |
| | Inland Waters Environmental Quality | To maintain the quality of groundwater and surface water so that environmental values are protected |
| | Air Quality | To maintain air quality and minimise emissions so that environmental values are protected |
| | Social Surroundings | To protect social surroundings from significant harm |
| Condition Clauses | Not applicable | |

| Element | Description |
|---|---|
| Key Provisions | • Overarching closure management-based provisions (including stakeholder engagement)<br>• Rehabilitation and revegetation management-based provisions<br>• Water management-based provisions<br>• Landform closure management-base provisions |

This Closure-related Management Plan has been prepared as a supporting document for the Eliwana Mine Closure Plan (MCP). If the Mine is approved by the Minister for the Environment following completion of the PER process, this plan will be integrated into the Eliwana MCP. Consequently, it is static document and will not be updated. Instead, the MCP (which is a live document) will be revised on an as-needs basis to ensure that it remains up to date.

## TABLE OF CONTENTS

## List of Tables



## LIST OF FIGURES

# 1. CONTEXT, SCOPE AND RATIONALE

## 1.1 Proposal

Fortescue Metals Group (Fortescue) is proposing to develop the Eliwana Iron Ore Mine (the Mine) 90 km west-northwest of Tom Price and 110 km south-west of the existing Solomon Iron Ore Project (Figure 1). The Eliwana Mine includes two deposits (Eliwana and Flying Fish) which span a distance of approximately 50km east to west, along a series of similarly-oriented valleys (Figure 2). Initial development proposed for the Mine will include mine pits, temporary and permanent Waste Rock Landforms (WRLs), ore processing facilities and associated infrastructure. Subsequent development of the Mine may include Tailings Storage Facilities (TSFs).

Development of the proposed Mine will result in approximately 8,560 ha of ground disturbance within an area of approximately 70,000 ha known as the Mine Development Envelope (MDE). Pending receipt of relevant approvals, Fortescue proposes to commence broad-scale construction of the Eliwana Mine in June 2019 and has a target date for first ore production of June 2020.

The Eliwana Mine is proposed for development on the Hamersley, Rocklea, Cheela Plains and Mount Stuart pastoral leases. Other land uses within the MDE include public and private infrastructure (including roads and railways) and Vacant Crown Land (VCL). The project area also includes portions of Unallocated Crown Land (UCL) and third-party tenure, but no disturbance will occur in these areas unless tenure or access arrangements are negotiated. The MDE may be refined as project development progresses to align with changes in tenure or access agreements.

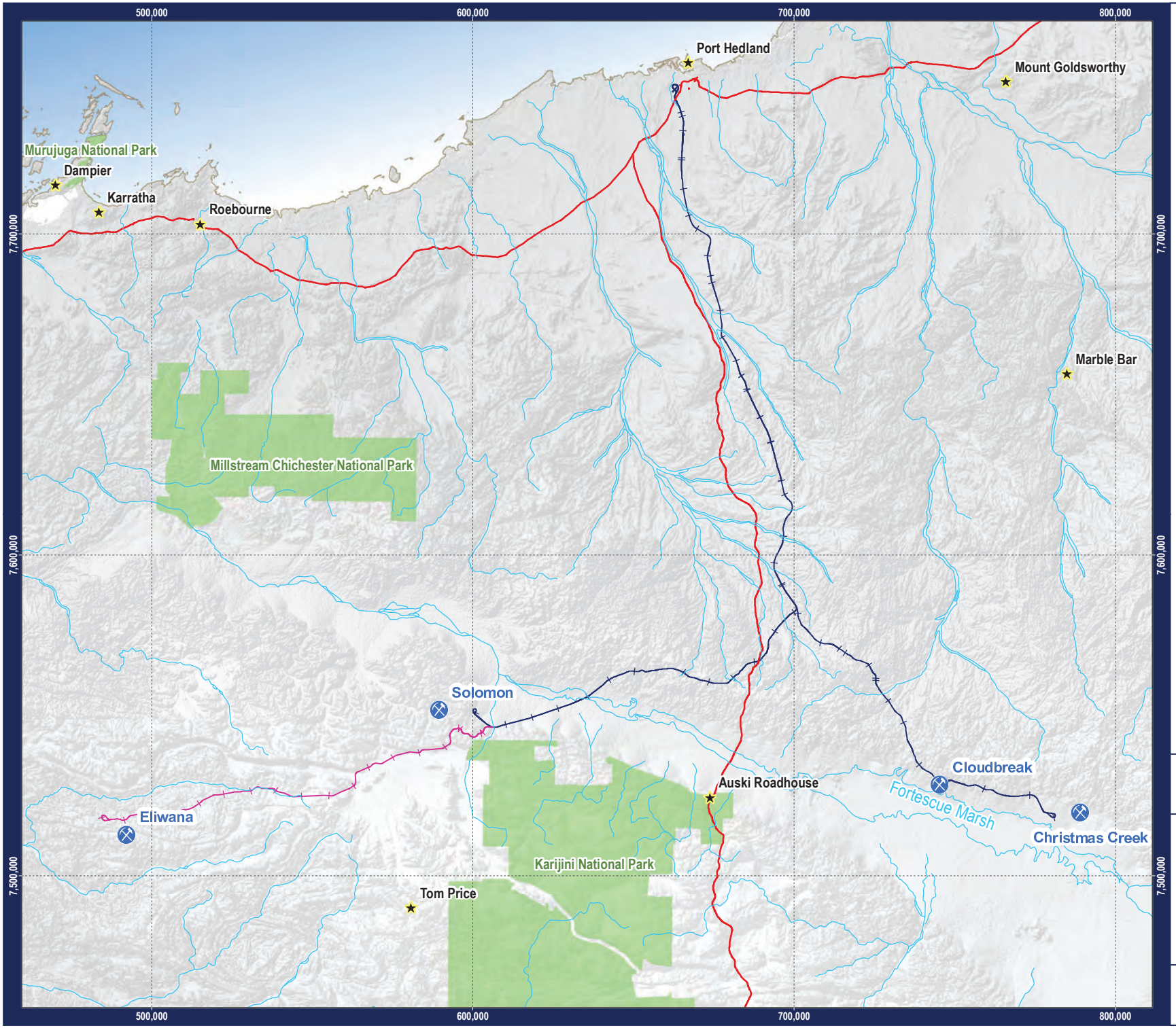
Fortescue's proposal to develop the Eliwana Mine was referred to the Environmental Protection Authority (EPA) on 7 July 2017. The EPA set the level of assessment for the proposed mine at the Public Environmental Review (PER) level of assessment due to potential significant environmental effects associated with clearing of 8,560 ha of native vegetation, dewatering of stygofauna habitat, discharge of surplus mine water to the environment and removal of habitat critical to the survival of threatened species.

Mine closure planning is an integral part of Fortescue's project development for the Eliwana Mine. Following cessation of mining, the company proposes to return the Mine to a state that will provide future use and value within the context of a pastoral post-mining land use. It is recognised that some areas (such as open pits and portions of constructed landforms) may not be suitable for pastoral purposes. In these areas, the objective would be to ensure that these areas do not adversely affect or otherwise impede use of adjacent areas for pastoral activities.

This Closure-related Management Plan (the Plan) has been developed by Fortescue and Bioscope Environmental with input from Mine Earth and Mine Lakes Consulting to document the

closure strategies and processes proposed for the Eliwana Mine, as part of the development of the Eliwana Mine Closure Plan (MCP) (EW-PL-EN-0001).

The proposed 120 km long Eliwana Railway will connect the Mine with Fortescue's Hamersley Line near the Solomon Mine. The railway project is not included in this Plan. TSF closure is also excluded from the Plan.





**LEGEND**

- Fortescue Projects
- Towns
- Major Drainage
- Major Roads
- Eliwana Proposed Railway
- Fortescue Rail Alignments
- National Park

Data Sources:
Water Source Areas, DOW, 2014.
Proposed for Conservation 2015, National Park, DPaW.
Towns, Major Roads, Drainage, Landgate.
SRTM, GA.
All other data, FMG, 2017.

N

0 20 40 60 80
Kilometres

**Figure 1: Eliwana Location Map**

Requested By: J. Lister
Drawn By: S. Costello
Revised By: scostello
Approved By: P. Mastalir
Scale: 1:1,600,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: 750EW_MP_OP_0002.004_r0

Date: 29-Dec-17
Size: A4L
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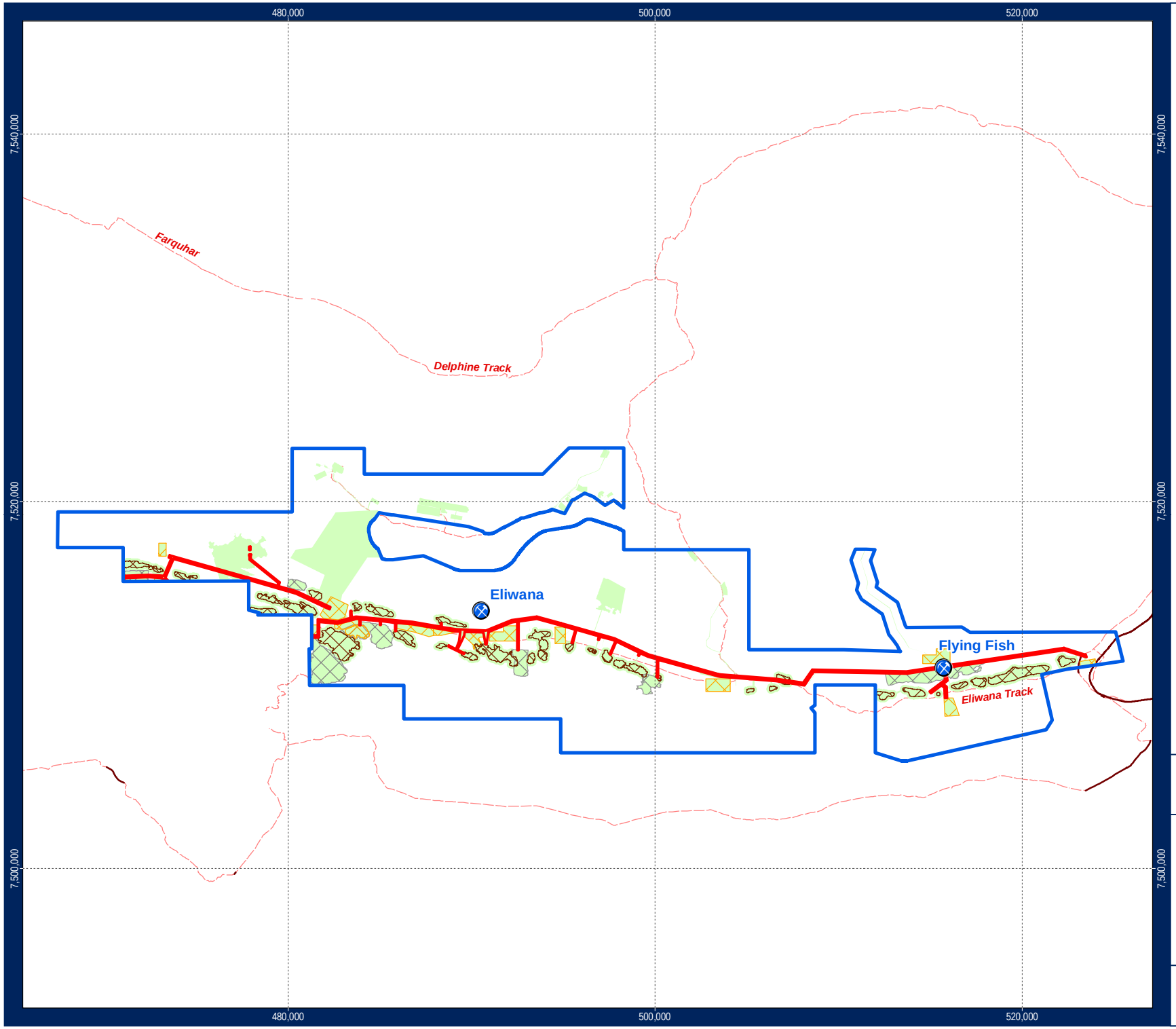


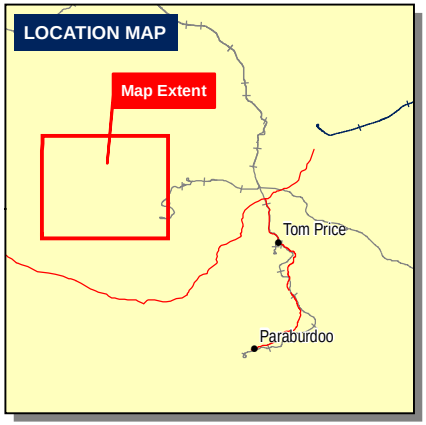


**LEGEND**

- Project Area
- Road
- Major Track
- Mine Development Envelope

**Mine Footprints**

- Pits
- Stockpiles
- Waste Dumps
- Roads
- Ground Disturbance

Data Sources:
Roads, FMG and Landgate.

N

0 2 4 6 8 10
Kilometres

## Eliwana Site Layout

Requested By: S. Robinson
Drawn By: S. Costello
Revised By: nrappa
Approved By: S. Costello
Scale: 1:280,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: 750EW_MP_OP_0002.005_r0_10_4

Date: 8/27/2018
Size: A4L
Revision: 1
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## 1.2 Key Environmental Factors

The key environmental factors associated with development of the Eliwana Mine are listed in Table 1, along with the EPA's objectives for these factors.

**Table 1: Key Environmental Factors and Objectives**

| Theme | Key Environmental Factors | EPA Objectives |
|---|---|---|
| Land | Flora and Vegetation | To protect flora and vegetation so that biological diversity and ecological integrity are maintained |
| | Subterranean Fauna | To protect subterranean fauna so that biological diversity and ecological integrity are maintained |
| | Terrestrial Fauna | To protect terrestrial fauna so that biological diversity and ecological integrity are maintained |
| Water | Hydrological Processes | To maintain the hydrological regimes of groundwater and surface water so that environmental values are protected |
| | Inland Waters Environmental Quality | To maintain the quality of groundwater and surface water so that environmental values are protected |
| Air | Air Quality | To maintain air quality and minimise emissions so that environmental values are protected |
| People | Social Surroundings | To protect social surroundings from significant harm |

Table 2 outlines the way in which closure of the Eliwana Mine could affect the preliminary key environmental factors listed above and the site-specific environmental values, existing and/or potential uses, ecosystem health condition or sensitive components of these factors. This table is based on information provided in a closure risk register prepared by Fortescue in October 2017 (see Section 1.4.3 for further information on the closure risk register).

**Table 2: Key Environmental Factors and Potential Impacts of Closure Activities**

| Key Environmental Factor | Relevant Proposal Closure Activities | Value and Impacts |
|---|---|---|
| Flora and Vegetation | • Land clearing during closure works<br>• Groundwater injection (if required at or following mine closure)<br>• Alterations of surface water flows during closure/rehabilitation earthworks<br>• Potential surface discharge of excess water injection (if required at or following mine closure)<br>• Closure earthworks and vehicle/truck movements during closure phase<br>• Pit lake closure works<br>• Rehabilitation and revegetation | • Localised loss of flora and vegetation if clearing is required for closure works<br>• Minor impacts to flora and vegetation due to dust generated during the closure phase<br>• Changes in the characteristics/values of water-dependent vegetation such as riparian ecosystems and other vegetation types where there is long term reduction in surface water flow; overflow or discharge of pit lake water to downstream drainage lines during or following closure; groundwater injection; erosion/sedimentation; concentrations of contaminants in water; and/or acid or metalliferous drainage<br>• Inadequate vegetation development in rehabilitation areas due to slope instability, inadequate topsoil and other soil issues, erosion/sedimentation, seeding or germination issues, drought, grazing pressures and/or drainage shadows all resulting in a risk of not meeting completion criteria<br>• Introduction and/or spread of weeds during closure works<br>• Direct loss of terrestrial habitat by pit lakes |
| Subterranean Fauna | • Groundwater abstraction or injection (if required at or following mine closure)<br>• Closure of landfills and WRLs<br>• Storage, use or accidental spillage of hydrocarbons during closure works<br>• Development of pit lakes | • Direct impacts to subterranean fauna habitat, assemblages and/or individuals due to changes in groundwater levels and quality as a result of long term pit lake performance<br>• Indirect impacts to stygofauna due to elevated concentrations of contaminants in water due to chemical or hydrocarbon spills, AMD generation from landfills, WRLs and TSFs |
| Terrestrial Fauna | • Clearing of fauna habitat during closure works<br>• Alteration of surface water flows during closure works<br>• Closure earthworks, vehicle use and other closure activities<br>• Rehabilitation and revegetation | • Reduction in the fragmentation of fauna habitat that occurred during construction/operations<br>• Mortality and/or indirect impacts to fauna due vehicle interactions, light, noise and vibration, increased dust, inadequate rubbish disposal and/or attraction of feral predators during closure works |

| Key Environmental Factor | Relevant Proposal Closure Activities | Value and Impacts |
|---|---|---|
| | | • Fauna habitat modifications due to changes in characteristics of riparian ecosystems due to reduction of flows where drainage lines have been terminated, overflow or discharge of pit lake water to downstream drainage lines, groundwater injection and groundwater seepage throughout the project area<br>• Inadequate fauna habitat development in rehabilitation areas due to insufficient revegetation and other issues<br>• Fauna injury or mortality due to pit lake ingress and egress |
| Hydrological Processes | • Groundwater abstraction or injection (if required at or following mine closure)<br>• Controlled release of excess water into inactive mining voids or via surface discharge (if required at or following mine closure)<br>• Alterations of surface water flows during closure/rehabilitation earthworks | • Groundwater drawdown and alteration of hydrogeological processes<br>• Groundwater mounding in areas of surplus water injection or due to seepage from WRLs<br>• Impacts to surface water flow resulting from drainage diversions or drainage modifications during closure works<br>• Drainage shadowing in areas if sheet flow is modified during closure works<br>• Altered hydrogeology and water balance associated with the creation of permanent and ephemeral pit lakes |
| Inland Waters Environmental Quality | • Closure of WRLs, TSFs and landfills<br>• Hydrocarbon or chemical spills during the closure phase | • Changes in groundwater and surface water quality due to outflow of pit lake water<br>• Impacts to water quality from elevated concentrations of contaminants in inland waters as a result of chemical or hydrocarbon spills, and/or leaching from landfills and/or WRLs<br>• Impacts to water quality due to erosion/sedimentation from rehabilitation areas |
| Air Quality | • Power generation during closure phase<br>• Operation of earthmoving equipment and vehicles during the closure phase | • Generation of greenhouse gases through combustion of fossil fuels during power generation in the closure phase<br>• Generation of dust during the closure phase |

| Key Environmental Factor | Relevant Proposal Closure Activities | Value and Impacts |
|---|---|---|
| Social Surroundings | • Closure earthworks and other activities<br>• Abstraction of groundwater<br>• Discharge of excess water<br>• Alterations of surface water flows during closure/rehabilitation earthworks<br>• Rehabilitation and revegetation | • Disturbance of Aboriginal heritage sites<br>• Change of access to an Aboriginal heritage site<br>• Changes to the attributes of the environment which may impact on Aboriginal heritage places<br>• Reduction in visual amenity<br>• Public health issues due to elevated concentrations of contaminants in water due to chemical or hydrocarbon spills, and/or leaching from landfills and/or WRLs<br>• Public health issues due to presence of fibrous materials during closure works and/or following closure<br>• Public safety issues due to slope and substrate instability, erosion and/or inadvertent pit lake access<br>• Changes to public access routes<br>• Opportunities for transfer of infrastructure and other assets |

## 1.3 Condition Requirements

As indicated in Section 1.1, Fortescue's proposal to develop the Eliwana Mine is being assessed as a PER. Following EPA assessment of the proposal, the Minister for the Environment will determine if the Mine should be approved and what environmental conditions should be applied to implementation of this proposal if it is approved. At that time, this Closure-related Management Plan will be integrated into the Eliwana MCP and it will be that plan that will be revised to include any relevant conditions.

## 1.4 Rationale and Approach

The findings of baseline studies (Section 1.4.1) along with relevant assumptions and uncertainties (Section 1.4.2) have been used to inform the management approach developed by Fortescue to meet the EPA's environmental objectives listed in Table 1 (based on a proposed pastoral post-mining land use).

Fortescue's approach to closure management is outlined in Section 1.4.3.

The rationale for selection of management provisions is discussed in Section 1.4.4. The management provisions themselves are outlined in Section 2.

### 1.4.1 Survey and Study Findings

Surveys and studies conducted by Fortescue that are relevant to the closure of the Eliwana Mine are listed in Table 3. This table also identifies which studies are relevant to the preliminary key environmental factors.

**Table 3: Eliwana Studies Relevant to Key Environmental Factors**

| Study | Preliminary Key Environmental Factors | | | | | | |
|---|---|---|---|---|---|---|---|
| | Flora and Vegetation | Subterranean Fauna | Hydrological Processes | Terrestrial Fauna | Inland Waters Environmental Quality | Social Surroundings | Air Quality |
| Vegetation, Flora and Fauna Assessment, and Targeted Conservation Significant Flora and Fauna Survey: Eliwana, June 2012 (Ecoscape, 2012a) | X | | | X | | X | |
| Eliwana and Flying Fish Level 2 Flora and Vegetation Survey, October 2012. (Ecoscape, 2012b) | X | | | | | X | |
| Eliwana and Flying Fish Level 2 Flora and Vegetation Survey (Phase 2) Volume 1, January 2015. (Ecoscape, 2015) | X | | | | | X | |
| Eliwana Targeted Flora Survey, December 2016. (Ecoscape, 2016) | X | | | | | X | |
| Eliwana Consolidated Detailed Flora and Vegetation Phase 2, Revision B Draft, November 2017. (Biota, 2017) | X | | | | | X | |
| Western Hub Project – Eliwana and Flying Fish Terrestrial Vertebrate Fauna Assessment, January 2015. (Ecologia, 2015) | | | | X | | X | |
| Eliwana Consolidated Terrestrial Fauna Survey – Phase 1 Field Summary Report, June 2017. (Ecoscape, 2017a) | | | | X | | X | |
| Eliwana Targeted Pilbara Leaf-nose Bat and Ghost Bat Survey, July 2017. (Ecoscape, 2017b) | | | | X | | X | |
| Eliwana Consolidated Terrestrial Fauna Survey – Targeted Fauna Field Trip Summary Report, August 2017. (Ecoscape, 2017c) | | | | X | | X | |
| Western Hub Baseline Subterranean Fauna Assessment, February 2015. (Bennelongia, 2015) | | X | | | | X | |

| Study | Preliminary Key Environmental Factors | | | | | | |
|---|---|---|---|---|---|---|---|
| | Flora and Vegetation | Subterranean Fauna | Hydrological Processes | Terrestrial Fauna | Inland Waters Environmental Quality | Social Surroundings | Air Quality |
| Interim Report – Eliwana Subterranean Fauna Assessment, June 2017. (Biologic, 2017) | | X | | | | X | |
| Western Hub – Stage 1 Eliwana and Flying Fish – Subsurface Materials Characterisation, December 2017. (Fortescue, 2017a) | | | X | | X | X | X |
| Baseline Geomorphology Assessment for Eliwana and Flying Fish Deposits Fortescue Western Hub, August 2017. (Tetra Tech, 2017a) | | | X | | X | X | |
| Baseline Geomorphology Assessment for Eliwana and Flying Fish Deposits Fortescue Western Hub: Potential Impacts Assessment, September 2017. (Tetra Tech, 2017b) | | | X | | X | X | |
| Western Hub – Dewatering and Water Supply Assessment – Hydrogeological Conceptual Model Report, March 2017. (Golder, 2017a) | | | X | | | X | |
| Western Hub Hydrogeological Assessment – Groundwater Model Development and Calibration Report, September 2017. (Golder, 2017b) | | | X | | X | X | |
| Western Hub Hydrogeological Assessment – Mine Dewatering and Water Supply Modelling, September 2017. (Golder, 2017c) | X | X | X | X | X | X | |
| Surface Water Impact Assessment – Eliwana Mine Project, Draft Revision A, October 2017. (Fortescue, 2017b) | X | | X | X | X | X | |
| Western Hub Stage 1 – Conceptual Mine Void Water Assessment, December 2017 (Fortescue, 2017c) | | X | X | X | X | X | |
| Eliwana Project – Soil Characterisation Study, November 2017. (Soilwater Group, 2017) | X | | | X | X | X | |

A summary of those study findings relevant to mine closure and rehabilitation is provided below.

## Soils

The soil characterisation study conducted by Soilwater Group (Soilwater Group, 2017) for the Eliwana Mine indicates that soil resources in the MDE can be categorised as two main management groups. Soil Group One comprises soils in the Boolgeeda and Platform Land Systems. These are generally located on the valley floors of the project area and have relatively deep profiles compared to the soil resources located on mid to upper slopes of the landscape. Soil Group Two comprises soils in the Newman, Rocklea and Robe Land Systems. These soils occur on hill slopes and ridges, and are generally shallower and contain higher levels of gravelly material than the lower valley soils (Soilwater Group, 2017).

Overall, the main difference between the two soil groups in terms of soil chemical parameters can be attributed to lower salinity and slightly lower soil fertility in the red/brown non-cracking clay and red shallow loam soils of Soil Group One when compared to the stonier soils in Soil Group Two (Soilwater Group, 2017). In general, the soils were not water repellent, but exhibited poor aggregate stability with most samples slaking and dispersing in water. This suggests the soils are likely to be hardsetting and erodible once their rock mantle has been disturbed.

*Implications for Closure*

Soil Group One has been identified by Soilwater Group (2017) as beneficial for use in rehabilitation activities as soils in this group have relatively deep profiles compared to the soil resources located on mid to upper slopes of the landscape. These soils will be stripped and stockpiled during construction and operations for use in rehabilitation (see Section 2.2).

Soil Group Two comprises soils that are generally shallower and contain higher levels of gravelly material than the lower valley soils. They will also be striped and stockpiled for use in rehabilitation (see Section 2.2). These soils are likely to be more suitable for application to sloping rehabilitation areas.

## Vegetation

A number of flora and vegetation studies have occurred at the Eliwana Mine including Ecoscape (2012a and 2012b), Ecoscape (2015) and Ecoscape (2016). The information from these studies was consolidated by Biota Environmental and supplemented with additional data from vegetation and flora surveys of the broader Eliwana Mine and rail project areas by Biota Environmental (2017). As a result of this consolidated report, it is understood that the Eliwana MDE is characterised by open *Triodia* hummock grasslands, *Acacia* shrublands and eucalypt species. Forty-four vegetation types were mapped along with five mosaic units that incorporate two of the vegetation types. The four major land units on which these plant communities occur are described as:

- ridge lines;
- low rises;
- stony plains; and
- drainage lines.

A number of vegetation units identified in the project area have conservation significance. These are:

- "*Triodia* sp. Robe River assemblages of mesas of the West Pilbara", which is a Priority Ecological Community (Priority 3) that comprises three plant communities (ElAcAarTwTspr, ElAcTwTspr and ElApTspr).
- Vegetation units identified as being Groundwater Dependent Vegetation (GDV) or potentially groundwater dependent. These units include vegetation units MaMgCYPv, EcAcEUaTe, EvAcCcERIt and EvAcMgERIt, and are generally located near drainage lines.
- The "*Triodia* aff. sp. Karijini (S. van Leeuwen 4111) community" (GsTak), which is a plant community of regional significance.
- Vegetation units dominated by *Triodia basitricha* (Priority 3). These comprise the vegetation units AtruTbt, CdAiTwTbt and ElAkTbt, and are of local significance.

*Implications for Closure*

It is unlikely that all of the plant communities that will be disturbed within the proposed Mine footprint will be able to be replaced directly as some of the component species are unlikely to be suited to the new conditions that will exist within particular closure domains. Species selection for inclusion in seed lists for revegetation will take consideration of the conditions that will exist at mine closure.

The species list for revegetation will also take into account the proposed pastoral post-mining land use, where appropriate. It is common for mine sites in WA's Pilbara region to be rehabilitated for pastoral purposes, but this can be adversely affected if stocking rates are established without consideration of a site's carrying capacity. In turn, carrying capacity and stocking rates for the rehabilitated mine landforms will be strongly influenced by rangeland productivity, ecological sustainability and pastoral management.

## Flora

A total of 555 taxa representing 180 genera and 57 families was identified in the Biota Environmental (2017) reconciliation of previous surveys and new surveys for the MDE. No threatened flora have been recorded in the project area, but 23 species of Priority Flora have been identified. The majority of those species recorded within the MDE are well known from the vicinity, being recorded by several previous surveys and/or included in the Department of Biodiversity, Conservation and Attractions (DBCA) database (Biota Environmental, 2017).

Fifteen introduced flora (weed) species have been recorded from the project area. None of these species are listed as Declared Weeds under the Western Australian *Biosecurity and Agriculture Management Act 2007*. The majority of the introduced species identified within the MDE are well known from the locality and are within their known distributions (Biota Environmental, 2017).

*Implications for Closure*

As indicated above, some of the component flora species are unlikely to be suited to the new conditions that will exist within particular closure domains. The species to be included on seed lists for revegetation will be selected based on consideration of the conditions that will exist at mine closure.

If weeds are present in areas proposed for clearing, this may prevent the stockpiling of cleared vegetation and topsoil for future use in rehabilitation (see Section 2.2 for further discussion). Weed control will be important in the management of rehabilitated areas in order to minimise competition for water and nutrients.

## Terrestrial Fauna

Various terrestrial fauna surveys have been conducted for the Eliwana Mine including (Ecoscape, 2012a), Ecologia (2015) and Ecoscape (2017a-c). As a result of these studies, the fauna habitats in the Eliwana MDE have been characterised into four major categories:

- Hilltops, hillslopes, ridges and cliffs.
- Mixed acacia woodlands.
- Foot slopes and plains.
- Major creeks.

Fauna species of conservation significance recorded during the terrestrial fauna surveys conducted in 2017 comprise the Northern Quoll, Peregrine Falcon, Long-tailed Dunnart, the Lined Soil-crevice Skink, Rainbow Bee-eater, Fork-tailed Swift and the Western Pebble-mound Mouse (Ecoscape, 2017a-c). Other conservation species are likely to occur in the Eliwana area as they have been recorded in previous fauna surveys (Ecoscape, 2017a-c). These include the Pilbara Olive Python, the Pilbara Leaf-nosed Bats and the Ghost Bat.

All habitat types recorded in the survey area are widespread and are not restricted to the survey area. The gorges and gully habitat type amongst the hilltops, hillslopes, ridges and cliffs is the most significant habitat type as it has the potential to provide critical habitat for significant species such as the Pilbara Olive Python, Northern Quoll, Pilbara Leaf-nosed Bat and Ghost Bat (Ecoscape, 2017c).

Further analysis of field data and camera data collected in the 2017 surveys needs to be conducted to appropriately define the terrestrial fauna values of the Eliwana Mine.

*Implications for Closure*

Fauna plays an important role in the re-establishment of a functional ecosystem. Not only do fauna species form an integral component of an area's biodiversity, but they also influence many of the components and processes that enhance rehabilitation success including nutrient cycling, soil aeration and structure, plant composition and productivity, pollination, dispersal of seeds and spores, and control of insect pests (Cristescu et al., 2012).

The success of rehabilitation and revegetation programs strongly influences the return of fauna to a closed mine site, with the colonising species dependant on how closely revegetated areas match the habitat resource requirements of the individual species. If these programs are able to provide fauna habitat and resources, and mobile fauna are present in undisturbed areas adjacent to rehabilitation areas, it would be reasonable to expect that fauna utilisation of rehabilitation areas would occur. However, it is expected that the rate and type of utilisation will vary according to species, the characteristics of the rehabilitation areas, time since rehabilitation and other factors. Techniques which may enhance fauna return to rehabilitation areas include:

- Implementing surface drainage controls and erosion control measures to improve surface stability.
- Increasing landscape complexity by respreading cleared vegetation over rehabilitation areas where available, ripping of growth media and use of rock armouring (where necessary for stability).
- Respreading fresh topsoil where available.
- Direct seeding using local provenance flora species.
- Control of feral predators and herbivores (if these occur).

Some areas such as pit voids will not be rehabilitated to a landform that will support most fauna. Pit lakes are likely to attract fauna, but it is unlikely that pit lakes will provide a beneficial habitat due to the steep pit walls and absence of littoral and riparian zones, and potential degrading water quality over time. It is unlikely that this permanent loss of habitat will significantly impact surrounding vertebrate fauna populations.

## Subterranean Fauna

A baseline subterranean fauna assessment of the MDE was conducted during 2013 (Bennelongia, 2015) and an additional round of more targeted subterranean fauna sampling occurred in 2017 (Biologic, 2017). Subterranean fauna (comprising six stygofauna taxa and 14 troglofauna taxa) were identified in 19 of the 44 holes sampled by Biologic (2017). The majority

of the taxa belong to taxonomic groups known to occur in the local area from previous surveys (Biologic, 2017).

*Implications for Closure*

The return of subterranean fauna to areas affected by open pit mining at the Eliwana Mine may be influenced by long term changes to groundwater conditions in the zone of influence around the pit voids and potential chemical changes in groundwater as a result of WRL and/or landfill leaching.

## Groundwater

Groundwater investigations and assessments conducted for the Eliwana Mine include development of a conceptual hydrogeological model for dewatering and water supply (Golder, 2017a), a groundwater model calibration report (Golder 2017b), development of a mine dewatering and water supply model (Golder, 2017c) and a pit lake assessment (Fortescue, 2017c).

Groundwater in the project area is contained within the mineralised Brockman Iron Formation and the Wittenoom aquifer (Golder, 2017c). The aquifers are bounded between aquitards to the north and south and by dolerite dykes to the east and west. Groundwater generally occurs in isolated groundwater sub-catchments with insignificant hydraulic gradients across most of these sub-catchments.

Depth to groundwater is considered by Golder (2017c) to be significant with groundwater levels generally more than 30 m below ground level (mbgl) in the western areas of the MDE. However, groundwater levels can be relatively shallow at generally less than 30 mbgl in valleys between the Marra Mamba Iron Formation and Brockman Iron Formation ridge lines. Areas with groundwater levels of less than 30 mbgl show evidence of groundwater recharge and generally occur in the eastern parts of the MDE, towards the Flying Fish deposit (Golder, 2017a).

Groundwater chemistry data provided by Golder (2017c) indicate some difference between the western (Eliwana) and eastern (Flying Fish) sections of the project area. The eastern areas generally have a more chloride-dominant groundwater which is described by Golder (2017c) as brackish with Total Dissolved Solids (TDS) measuring >1,200 mg/L. In contrast, the western portion of the Eliwana Mine is described by Golder (2017a) as being of a magnesium-bicarbonate type and generally fresh, although still above the Australian Drinking Water Guideline for human consumption for aesthetics (taste) at between 500 and 800 mg/L TDS. Overall, the alkaline earth metals (calcium/magnesium) are more dominant than sodium/potassium (Golder, 2017a).

The difference in groundwater quality between the western and eastern areas may be related to the shallower groundwater levels in the eastern areas potentially having greater evapotranspiration.

*Implications for Closure*

The mine plan provided at the time that this Closure-related Management Plan was prepared indicates that nine of the 24 pits currently proposed for development will reach depths below the pre-mining water table (Fortescue, 2017c).

The formation of groundwater and surface water recharged pit lakes is expected to occur once mining and pit dewatering ceases at these pits. The characterisation and behaviour of these predicted pit lakes at closure in terms of hydrological flow, hydrogeological flow, salinity enrichment and metals concentrations are not yet fully understood. However, the factors that are likely to influence the development of any pit lakes include groundwater inflow and outflow rates, the volume of rainfall and surface run-off, evaporation rates, the extent of dewatering and aquifer recharge associated with adjacent mining operations, effectiveness of PAF encapsulation within WRLs, potential exposure of PAF material in pit walls and the need for any groundwater injection at/or following closure. Further investigation and modelling need to be undertaken in order to predict the development and long-term behaviour of pit lakes once mining ceases. These investigations will become part of Fortescue's ongoing water modelling with the MCP being updated to incorporate new information and study outcomes.

## Surface Water

Fortescue (2017b) has conducted a surface water assessment of the Eliwana Mine which outlines the current hydrological regime in a regional and local context, presents modelling undertaken for present conditions and quantifies the impacts to surface water as a result of the proposed Mine. The study outlines the regional catchment mapping and the sub-catchments of the Eliwana Mine. In addition, a geomorphology characterisation and impact assessment has been completed by Tetra Tech (2017a and 2017b) to understand sediment transport processes and likely impacts of the Eliwana Mine. These also inform closure planning for the Mine.

Eliwana is located within the Duck Creek catchment, within the regional Ashburton River basin. The Duck Creek catchment area covers approximately 6,800 $km^2$ at the confluence with the Ashburton River. The Ashburton River basin has a total area of 78,777 $km^2$.

Streamflow in the ephemeral creeks in the sub-catchments (and wider Pilbara) is typically fresh, but is generally highly turbid due to the rapid rise of creek levels when flooding occurs following significant rainfall events. The high turbidity levels indicate that the ephemeral creeks have high colloidal fractions that remain in suspension in their natural state, with many instances of significant erosion on existing stream banks and notable areas of instability in the natural

environment highlighting that a high level of erosion is a naturally occurring process (Fortescue, 2017b).

Stream flow ceases rapidly days after rainfall episodes. However, ephemeral pools formed in streambed depressions may remain for some weeks. Water quality in naturally occurring pools can be highly variable due in part to the individual characteristics of each pool; its dominant water supply (rainfall, creek flow, groundwater structures), local climate and vegetation and interaction with livestock (Fortescue, 2017b).

*Implications for Closure*

The Eliwana mine plan available at the time that this Closure-related Management Plan was prepared indicated that some of the proposed open pits are to be located on the valley floors and may cause termination of creek lines, reduction in surface and subsurface flows, and direct and indirect impacts to riparian ecosystems and other surface water receptors. Where drainage lines terminate at open pits, the water inflow from these may contribute to the formation of pit lakes.

As indicated above, further investigation and modelling need to be undertaken in order to establish the development and behaviour of pit lakes once mining ceases. These investigations will become part of the ongoing hydrological modelling with MCP updates occurring where relevant to incorporate new information and study outcomes.

Surface water closure implications for other infrastructure and related disturbance resulting from the proposed Eliwana mine include potential downstream flooding/drying resulting from altered flow regimes (both channel and sheet flow) and creek diversions from WRL or other landform locations.

## Waste Rock

A waste rock characterisation (including geochemical and geophysical characterisation) of the potential mining areas and possible sources of construction materials in the project area has been undertaken by Fortescue (2017a). This study identified that certain geologies within the Mount McRae Shale, the Dales Gorge Member of the Brockman Iron Formation and the West Angela Member of the Wittenoom Formation that may produce acid drainage and/or leach metals/metalloids such as arsenic, selenium, chromium, copper, manganese and nickel.

The waste characterisation (Fortescue, 2017a) identified that most of the material (~60%) is likely to be of moderate erodibility. Consequently, a relatively conservative approach to WRL design will be required to manage erosion. However, around 20% of the waste rock is likely to be of low erodibility and suitable for rock armouring, should it be required.

*Implications for Closure*

The Eliwana mine plan available at the time that this Closure-related Management Plan was prepared indicates that mining operations will excavate or expose geological material that has the potential to produce acid and/or metalliferous drainage (Fortescue, 2017a). Acid and/or metalliferous drainage could affect water quality and ecosystem health in the vicinity of the Eliwana Mine. Around 10% of all waste rock is currently classified as deleterious. The deleterious units will need to be encapsulated within benign material.

### Fibrous Material

Through geological studies (Fortescue, 2017a) and exploration programs it has been identified that there is potential for fibrous materials to be encountered during the operation of the Mine. Where fibrous minerals are encountered, airborne asbestos fibres may appear as a contaminant in the dust. This poses a risk to environmental health as well as the health of mine workers and post closure visitors. When excavated or otherwise brought to the surface, the fibrous materials will be kept moist to minimise airborne fibres then buried or otherwise encapsulated within WRL stockpiles.

*Implications for Closure*

Excavated materials that have been encapsulated effectively during the mining activities are unlikely to require further management unless the materials are rehandled on closure. However, exposure of hazardous fibrous materials in the pit walls may pose a risk to environmental health, the health of mine workers and the health of any post-closure visitors. Further investigation is required to clarify this risk and determine if management measures are required as part of the mine closure. These investigations will become part of the ongoing mine planning and geological modelling. A mine geological register will be developed to help manage risk involved with fibrous material.

## 1.4.2 Key Assumptions and Uncertainties

Key assumptions and uncertainties associated with the surveys and studies outlined in Section 1.4.1 are as follows:

- Revegetation requirements are still to be fully investigated. Progressive rehabilitation trials will inform revegetation characteristics and will be used to develop seed lists, confirm seed treatments and identify any site-specific rehabilitation requirements.
- Further analysis of terrestrial field data and camera data collected in the 2017 terrestrial fauna surveys needs to be conducted to appropriately define the terrestrial fauna values of the Eliwana Mine.

- The formation and behaviour of pit lakes post closure is not well understood. Developing and refining predictive and numerical pit lake models will ensure that the long term performance of pit lakes and their potential impacts post-closure are better understood and actions are taken to manage these environmental and social impacts.

- Surface water discharge characteristics from closed landforms (including pit lakes and WRLs) and their potential harm to receiving downstream environments are currently not well documented. Through ongoing environmental monitoring and detailed closure designs, these risks will be further defined and management actions assigned accordingly.

- Surface erodibility of WRLs and the waste/soil characterisation that informs this is not well understood as yet. Further investigations are required to inform appropriate closure landform designs.

- Quantifying the volume and chemistry of potentially acid and/or metalliferous drainage and fibrous material likely to be encountered during mining is required and will become part of the ongoing mine planning and geological modelling.

Processes to address these uncertainties have been included in the management provisions described in Section 2. The Eliwana MCP will be updated to include the outcomes of these processes.

### 1.4.3 Management Approach

This section describes the key features of Fortescue's closure management approach. In summary, the company has adopted an approach to planning and implementing closure that:

- is risk-based, to build resilience in closure management;

- uses existing Fortescue processes, procedures and management plans to ensure consistency in the way in which the company plans and implements closure across all of its operations;

- encourages integration between mine planning and closure planning;

- is activity-based to facilitate implementation of the management provisions by company personnel;

- allows for adaptive environmental management so that Fortescue can modify its approach to closure planning and implementation as the project evolves and more information becomes available; and

- needs to consider a range of closure scenarios, and uses decision trees to reduce uncertainty and guide closure decision-making.

These features are discussed below.

### Risk-based Approach

Fortescue has adopted a risk-based management approach to achieve the environmental closure outcomes proposed for the Eliwana Mine and to allow the proposed pastoral post-mining land use to be implemented. This approach comprises a systematic analysis of the risks associated with mine closure in a strategic, but also practical, manner. As discussed in the current *Guidelines for Preparing Mine Closure Plans* developed by the former Department of Mines (DMP) and the EPA (DMP & EPA, 2015), the benefits of a risk-based mine closure process can include:

- Identifying a range of closure scenarios commensurate with risk.
- Early identification of potential risks to successful closure.
- Development of acceptable and realistic criteria to measure performance.
- Orderly, timely and cost-effective closure outcomes.
- Reduced uncertainty in closure costs.
- Continual improvement in rehabilitation and closure standards.

In developing this version of the Closure-related Management Plan, Fortescue conducted a preliminary closure risk assessment workshop in October 2017. This workshop was attended by Fortescue personnel involved in different aspects of the company's operations and project planning, and comprised discussion of a number of closure hazard scenarios related to safety, infrastructure, landform, water, vegetation, heritage and stakeholders. The causes and risks associated with these hazard scenarios were identified and scores were allocated in relation to the likelihood of these occurring and the consequences of occurrence. These scores were used to calculate the inherent risks associated with closure of the Eliwana mine.

Once the inherent closure risks had been identified, the risk workshop team identified the controls that could be implemented during operation of the Eliwana Mine and during its closure. These controls were used to revise the likelihood and consequence scores and to calculate the residual risks associated with closure of the Eliwana Mine. The closure risk workshop outcomes were consolidated into a preliminary closure risk register and were used in preparing the summary of closure activities and potential impacts provided in Table 2.

Fortescue recognises that the management of closure risks is an iterative process utilised throughout the life of the mine. Consequently, the closure risk register will be reviewed and updated on a regular basis to incorporate changes in mine design and operations, environmental monitoring and other data, stakeholder input including changes to the regulatory framework and industry standards, and information relating to other factors influencing mine closure planning and implementation.

## Use of Existing Fortescue Processes, Procedures and Management Plans

To ensure consistency in the way in which Fortescue plans and implements closure across all of its operations, the company has developed internal management plans, guidelines and procedures. A number of these documents have been utilised to inform closure strategies, develop planning processes and implement management actions. These include, but are not limited to, the documents listed in Table 4 and Section 5.

**Table 4: Fortescue's Internal Management Plans, Procedures and Guidelines**

| Internal Doc # | Fortescue Internal Documentation |
|---|---|
| 100-PL-EN-1017 | *Weed Management Plan*. August 2016 |
| 100-PL-EN-1016 | *Acid and/or Metalliferous Drainage Management Plan*. December 2014 |
| 100-PL-EN-1015 | *Surface Water Management Plan*. December 2014 |
| 100-PL-EN-1009 | *Groundwater Management Plan*. July 2014 |
| 45-GU-EN-0010 | *Guideline - Defining Closure Objectives and Completion Criteria* (Rev 1). July 2017 |
| 100-GU-EN-0018 | *Guideline - Characterisation of Mineral Waste Rock and Soils.* November 2011. |
| 45-GU-EN-0007 | Guideline - *Seed Collection and Management Guidelines*. July 2017. |
| 100-PR-TA-0001 | Procedure - *Land Use Certification*. July 2017 |
| 100-PR-EN-1042 | Procedure – *Ground Disturbance and Topsoil Management*. December 2017 |
| 100-PR-SA-1060 | Procedure - *Fibrous Minerals Management*. December 2016 |
| 100-PR-EN-1017 | Draft Procedure – *Waste Rock Landform Design Management Plan.* Draft 2017 |
| 100-PL-EN-1014 | *Life of Mine Geochemistry Programme (Acid and Metalliferous Drainage Sampling Plan) Chichester and Solomon Operations*. July 2014 |

## Integration of Mine Planning and Closure Planning

The integrated mine closure toolkit developed by the International Council on Mining and Metals (ICMM) recognises that planning for closure is about how to design a mine operation in order to facilitate its closure (ICMM, 2008). Fortescue considers closure planning to be a core part of its business and recognises that integration of its mine planning and closure planning is important

if a mine is going to create lasting value. The benefits of integrating mine planning and closure planning include:

- More consistent and transparent stakeholder engagement.
- Enabling communities to participate in planning and implementing actions that underpin successful closure.
- Better support of closure decisions by stakeholders.
- Streamlining closure planning processes.
- Improving accuracy of closure cost estimates and provision of adequate closure funding.
- Reducing risk of regulatory non-compliance.
- Identifying and addressing potential problems in a timely manner.
- Progressively reducting of closure liabilities.

Fortescue integrates its mine planning and closure planning processes in a number of ways. These include conducting closure risk assessments attended by the company's operational personnel and closure specialists (see above). In addition, closure planning meetings and workshops are attended by Fortescue technical staff as well as mine closure specialists.

During preparation of this Plan, a series of closure planning meetings/workshops were held by Fortescue and attended by inhouse personnel as well as mine closure specialists from Bioscope Environmental, Mine Earth and Mine Lakes Consulting. The objective of these workshops was to ensure that the closure strategies and management measures documented in this Plan considered site-specific characteristics, legal and other requirements, industry practices, and were practical and achievable.

This Closure-related Management Plan will be integrated in the Eliwana MCP if approval for the proposal is issued by the Minister for the Environment following the PER process. The MCP will be revised on an as-needs basis to ensure that it remains up to date.

## Activity-based Approach

When assessing a proposal through the PER process, the EPA uses environmental factors and objectives to organise and systemise environmental impact assessment and reporting. This means that a factor-based structure is adopted in the documentation produced for the PER process, including the Environmental Review Document produced by Fortescue for public review, the EPA's report to the Minister for the Environment on the outcomes of its assessment

of the proposal, and the Ministerial Statement that will be issued if the proposal is approved by the Minister for the Environment. This structure allows regulators and other stakeholders to easily find and review information relevant to the environmental factor in which they are interested. For the Eliwana Mine, information will be provided through the PER process in relation to Flora and Vegetation, Subterranean Fauna, Terrestrial Fauna, Hydrological Processes, Inland Waters Environmental Quality, Social Surroundings and Air Quality (see Section 1.2).

Adopting a factor-based approach facilitates the environmental impact assessment process as it allows regulators and other stakeholders to easily locate and focus on the information pertinent only to the environmental factors that fall within their jurisdiction or interest. However, on a mine site, companies organise and manage their operations according to the activities conducted by the organisation rather than the environmental factors that can be affected by these activities. Experience has shown that an activity-based approach is a more effective way in which to reduce environmental risks as it allows environmental management to be incorporated into day-to-day site operations rather than managed separately to these.

In preparing this Closure-related Management Plan, it was recognised that the EPA is adopting a factor-based assessment process for the Eliwana Mine, while Fortescue takes an activity-based approach to mine rehabilitation and closure. Consequently, the management actions included in this Plan have been structured according to closure processes rather than environmental factors. Table 5 shows which rehabilitation and closure management actions are relevant to the preliminary key environmental factors identified for this proposal by the EPA.

**Table 5: Eliwana Management Actions Relevant to Key Environmental Factors**

| Management Actions | Preliminary Key Environmental Factors | | | | | | |
|---|---|---|---|---|---|---|---|
| | Hydrological Processes | Inland Waters Environmental Quality | Flora and Vegetation | Terrestrial Fauna | Subterranean Fauna | Air Quality | Social Surroundings |
| Define topsoil and subsoil resources needed to adequately rehabilitate closure landforms and project areas | | | X | X | | | X |
| Identify and collect adequate soil resources and other rehabilitation materials in accordance with Fortescue's *Ground Disturbance and Topsoil Management Procedure* (100-PR-EN-1042) | | | X | X | | | X |
| Stockpiled rehabilitation material and soil resources to be managed in accordance with Fortescue's *Ground Disturbance and Topsoil Management Procedure* (100-PR-EN-1042) | | X | X | X | | X | X |
| Perform revegetation trials to inform seeding and seed treatment requirements and species lists for revegetation activities and topsoil stockpile management | | | X | X | | | X |
| Develop and implement a soil farming procedure for topsoil stockpile management to increase the success of progressive rehabilitation | | X | X | X | | X | X |

| Management Actions | Preliminary Key Environmental Factors | | | | | | |
|---|---|---|---|---|---|---|---|
| | Hydrological Processes | Inland Waters Environmental Quality | Flora and Vegetation | Terrestrial Fauna | Subterranean Fauna | Air Quality | Social Surroundings |
| Conduct weed management activities as per Fortescue's *Ground Disturbance and Topsoil Management Procedure* (100-PR-EN-1042) and *Weed Management Plan* (100-PL-EN-1017) | | | X | X | | | X |
| Ensure that topsoil and cleared vegetation are respread and seed/fertiliser (if required) are spread in revegetation areas | | X | X | X | | X | X |
| Develop a site conceptual model of source-path-receivers to identify key risks from pit lakes post-closure | X | X | | | X | | X |
| Develop and refine pit lake scenarios at closure as per the Pit Lake Modelling Process to ensure key risks are manageable, including:<br>• Adequate stakeholder engagement to define post mining land use and closure objectives<br>• Geotechnical stability assessments<br>• Geochemical characteristic assessments<br>• Pit lake water balance assessments | X | X | | | X | | X |

| Management Actions | Preliminary Key Environmental Factors | | | | | | |
|---|---|---|---|---|---|---|---|
| | Hydrological Processes | Inland Waters Environmental Quality | Flora and Vegetation | Terrestrial Fauna | Subterranean Fauna | Air Quality | Social Surroundings |
| Validate pit lake modelling through progressive closure of the Eliwana Mine pits | X | X | | | X | | X |
| Develop and implement a specific Eliwana Surface Water Management Plan that outlines potential impacts to and mitigation measure for:<br>• Surface water runoff quality (both sediment loads and other contaminants)<br>• Upstream flows and incidental rainfall on WRL and adjacent areas<br>• Upstream flows that are intercepted by pits, linear infrastructure and general disturbance<br>• Surface water design criteria considerations for closure landforms | X | X | X | X | | | X |
| Ensure implemented closure landforms and associated surface water management controls perform as predicted over time | X | X | X | X | | | X |

| Management Actions | Preliminary Key Environmental Factors | | | | | | |
|---|---|---|---|---|---|---|---|
| | Hydrological Processes | Inland Waters Environmental Quality | Flora and Vegetation | Terrestrial Fauna | Subterranean Fauna | Air Quality | Social Surroundings |
| Update the *Waste Rock Landform Design Management Plan* (100-PR-EN-1017) for the Eliwana Mine to:<br>• Develop waste encapsulation parameters for at-risk material encountered at Eliwana (i.e. material with acid and/or metalliferous drainage potential and/or fibrous material)<br>• Ensure that disposal of waste rock follows the defined encapsulation process as well as documenting all waste sources and dump locations<br>• Incorporate closure design considerations into operational WRL construction | | X | X | X | | | X |
| Geotechnical evaluation of WRL foundation and design based on ongoing waste rock characterisation and operational planning | | X | X | X | | | X |
| Develop an Eliwana Geotechnical Ground Control Management Plan to outline a process to identify landform instability risks to expose acid and/or metalliferous drainage material or any other harmful material | | X | X | X | X | | X |

| Management Actions | Preliminary Key Environmental Factors | | | | | | |
|---|---|---|---|---|---|---|---|
| | Hydrological Processes | Inland Waters Environmental Quality | Flora and Vegetation | Terrestrial Fauna | Subterranean Fauna | Air Quality | Social Surroundings |
| Develop a life-of-mine geochemistry programme to:<br>• Comprehensively characterise potentially acid forming and metalliferous drainage geologies<br>• Identify potentially acid or metalliferous drainage material within geological and mine block models for construction and operational planning<br>Develop a validation process to validate geochemical testing processes and ground control procedures | | X | X | X | X | | X |
| Develop a Fibrous Material Management Plan for Eliwana incorporating construction, operations and closure. This should be developed in reference to the Fortescue *Fibrous Minerals Management Procedure* (100-PR-SA-1060) and the *Waste Rock Landform Design Management Plan* (100-PR-EN-1017). | | | | | | | X |

## Adaptive Environmental Management

Adaptive environmental management is defined and discussed in Section 3. As the development of the Eliwana Mine progresses, ongoing adaptive management and continual improvement in environmental management and closure planning will continue to be an integral part of Fortescue's management framework. Ongoing environmental monitoring, data collection, stakeholder engagement, revegetation trials and progressive rehabilitation will inform closure planning and allow Fortescue to refine its closure objectives and processes. An adaptive management approach to closure planning will also allow Fortescue the flexibility to incorporate key learnings from its other operations and continual stakeholder feedback, and build confidence that the stated environmental outcomes can be achieved.

## Use of Decision Trees to Support Closure Decision-making

At this time that this Plan was prepared, development of the Eliwana mine plan and associated documents was still in progress and a number of environmental and other studies that will inform closure planning for the Eliwana Mine were ongoing. Consequently, Fortescue considered a range of closure scenarios and the conditions under which these scenarios could arise, specifically for higher risk closure of pit lakes. For example, a Stage 1 – Conceptual Mine Void Water Assessment (750WH-5700-RP-HY-0010) conducted by the company in late 2017 considered the way in which pit lakes could form following cessation of mining operations, and explored the factors that could affect the long-term performance of mine void water. Four categories of closed mine voids were identified (Table 6), but it was recognised by Fortescue that development of any pit lakes was highly dependent on the mine void depth and geometry, and that the way in which these developed would depend on a range of factors including hydrological, hydrogeological and geochemical factors.

**Table 6: Conceptual Mine Void Closure Categories**

| Category | Scenario | Description |
|---|---|---|
| 1 | No groundwater inflow, above floodplain | Baseline groundwater level is below the base of the pit so no significant groundwater inflow to the mine void is expected. Catchment only includes lower order drainage lines in hillslope areas so the only water inputs to the void will only comprise rainfall and surface runoff. Shallow pit lakes may form in the pit following significant rainfall events and will reduce in depth with evaporation over time.<br><br>It is expected that minor volumes of salt will accumulate in the base of the Category 1 voids, but are unlikely to constitute a source of downstream contamination. Some PAF material may occur in the pit walls. This will be managed in accordance with Fortescue's *Acid and/or Metalliferous Drainage Management Plan* (100-PL-EN-1016). |

| Category | Scenario | Description |
|---|---|---|
| 2 | No groundwater inflow, within floodplain | Natural groundwater level is below the base of the pit so no groundwater inflow to the mine void is expected, but there will be surface water inflow from higher order drainage lines intersected by mine voids. A pit lake could be present on an episodic to semi-permanent basis depending on the volume of surface water and rainfall reporting to the pit as well as evaporation rates, and whether infiltration through the pit base/walls occurs. It is possible that pit water will be discharged to the downstream portion of the intersected drainage lines following significant rainfall events that fill the voids.<br><br>It is expected that minor volumes of salt will accumulate in the base of the Category 2 voids through evapoconcentration, but are unlikely to constitute a source of downstream contamination. Some PAF material may occur in the pit walls, but will be managed in accordance with Fortescue's *Acid and/or Metalliferous Drainage Management Plan* (100-PL-EN-1016). |
| 3 | Groundwater inflow – above floodplain | Mining below the water table will occur and groundwater inflow to the pit is expected following cessation of mining and pit dewatering. Catchment only includes lower order drainage lines in hillslope areas so the only other water inputs to the void will comprise rainfall and surface runoff.<br><br>It is expected that an evaporative groundwater sink will form in the Category 3 voids and that eventual hypersalinisation of the pit lakes will occur. Some metalliferous drainage may be generated where the pit lake is in contact with Mount McRae Shale, however there does not appear to be a high enough sulphide concentration to generate significant acid. If this occurs, it will be managed in accordance with Fortescue's *Acid and/or Metalliferous Drainage Management Plan* (100-PL-EN-1016). |

| Category | Scenario | Description |
|---|---|---|
| 4 | Groundwater inflow – within floodplain | Mining below the water table will occur and groundwater inflow to a number of pit to the north of the valley is expected following cessation of mining and pit dewatering. Further, surface water inflow is expected from higher order drainage lines intersected by mine voids as well as water input from rainfall. A pit lake is expected to develop in the Category 4 mine voids on a temporary to permanent basis depending on the volume of groundwater inflow, surface water inflow and rainfall reporting to the pit as well as evaporation rates and whether there are any water losses through the pit base/walls occurs. It is likely that pit water will resume creek flow to the downstream portion of the intersected drainage lines following significant rainfall events that fill the voids.<br><br>Water quality of the pit lake will be highly influenced by the final mine void geometry, climate influences, characteristics of groundwater inflows, catchment size and characteristics of surface water inflows, presence of any PAF material and other factors. It is possible that the pit lakes that form in Category 4 voids may become hypersaline over time, but it is unlikely that these will become acidic as abundant neutralising material is available. |

Based on the Stage 1 – Conceptual Mine Void Water Assessment (Fortescue, 2017c) and the mine plan available at the time that this Closure-related Management Plan was prepared, it is understood that 10 of the 24 pits currently proposed for mining at Eliwana will likely be classified as Category 1 voids. Four of the expected pits are currently included in Category 3, only one pit has been included in Category 2 and no pits have been included in Category 4. However, three pits were identified as being either Category 1 or Category 2 voids, and five pits has been identified as being either Category 2 or 4 voids.

Based on the information provided above, it is expected a range of closure scenarios for pit lakes will eventuate across the Eliwana Mine. Further work is required to further develop these scenarios, so some of the management actions required to rehabilitate and close the Eliwana Mine cannot be defined at this stage of project planning. To reduce uncertainty regarding closure outcomes and guide closure decision-making, Fortescue has developed decision trees to document what information and processes will be utilised to refine the proposed management actions. See Section 2 for further information.

The outcomes of Fortescue's closure decision-making process will be used to refine the Eliwana MCP as part of the company's commitment to continual improvement.

### 1.4.4 Rationale for Choice of Provisions

The rehabilitation management actions and provisions discussed in Section 2 were developed based on Fortescue's understanding of relevant environmental legislation, regulations, guidelines and standards along with its knowledge of the Eliwana environment, stakeholder expectations and standard mining practices. Fortescue recognises that the management provisions are the key component of this plan and that the company is obliged to implement these in planning and conducting closure works for the Eliwana Mine.

The EPA Instructions on how to prepare *Environmental Protection Act 1986* Part IV Environmental Management Plans (EPA, 2017) state that the provisions contained in such a plan can be outcome-based or management-based provisions. For this Closure-related Management Plan, Fortescue has developed management-based provisions.

Management-based provisions comprise management actions that will be implemented to meet the environmental objectives of a proposal. The provisional closure objectives developed by Fortescue for the Eliwana Mine are based on a proposed pastoral post-mining land use and are as follows:

1. Infrastructure is removed or retained in line with agreements reached with future land users and managing authorities.
2. Waste rock landforms are safe to people and animals and geotechnically stable.
3. Rehabilitated areas support local native, self-sustaining vegetation and native fauna foraging.
4. Sediment movement within and downstream of rehabilitated areas does not adversely impact environmental or heritage values.
5. Water quality does not adversely impact downstream environmental or heritage values.
6. Pit lakes do not present a significant risk to human health or a significant ecological threat.
7. Changes to hydrological regimes do not adversely impact downstream environmental or heritage values.

In developing management-based provisions to achieve these objectives, Fortescue considered the way in which a range of factors would influence the success of the closure program. These include the way in which the intensity, duration, magnitude and geographic footprint of the environmental impacts resulting from the Eliwana Mine will change during the construction, operation and closure of the mine. The way in which mine closure could affect the preliminary key environmental factors identified for the proposed Mine has been assessed through a preliminary closure risk assessment (see Section 1.4.3) and summarised in Table 2.

In conducting its preliminary closure risk assessment, Fortescue recognised that the Eliwana mine plan on which the assessment was based was still in development. Further, it was recognised that changes to the mine plan are likely to occur during construction and operation of the Eliwana Mine. Consequently, the company is cognisant that it needs to consider a range of closure scenarios and ensure that its closure management provisions are sufficiently adaptable to encompass these scenarios without compromising the company's ability to fulfil its closure objectives.

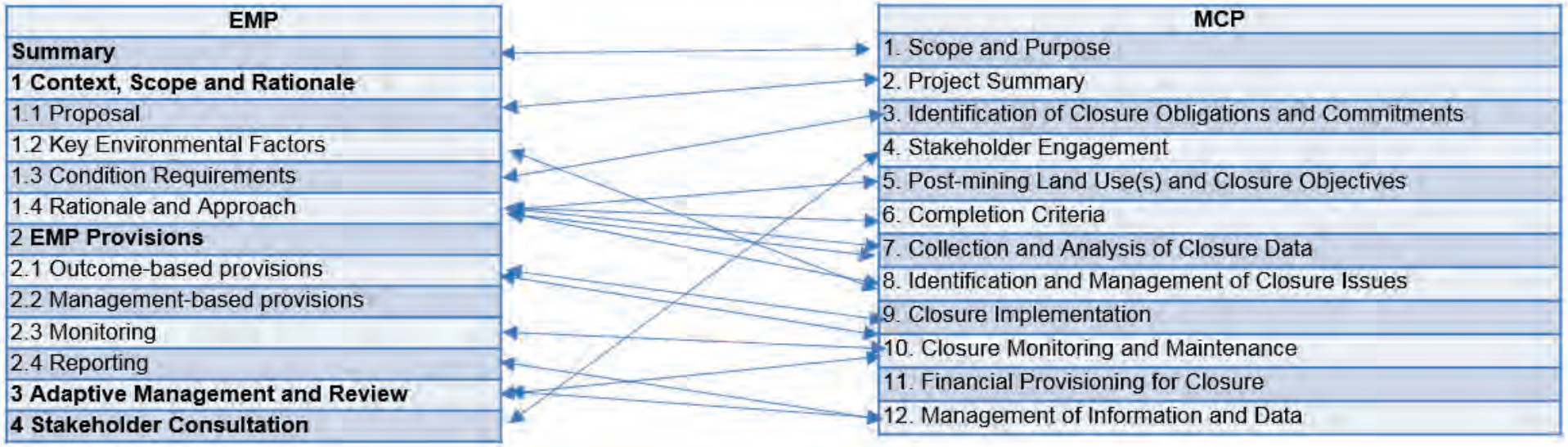
### 1.4.5 Relationship between the Closure-related Management Plan and the Eliwana Mine Closure Plan

In preparing this Closure-related Management Plan, Fortescue recognises that this document also meets many of the requirements for a MCP. Indeed, the content of this Plan and a MCP are very similar (Figure 3). However, there are some differences including:

- The structure of a MCP defined by the DMP/EPA guidelines for MCP preparation (DMP/EPA, 2015) is different to the Environmental Management Plan (EMP) structure defined by the EPA's instructions for preparing Part IV Environmental Management Plans (EPA, 2017).
- EMPs (and therefore this Plan) are "factor-based" in that they focus on the management of the preliminary key environmental factors identified for this Project by the EPA. In contrast, a MCP is "activity-based".
- There is reference to Closure Cost Estimates and financial provisioning in MCPs, but not in EMPs.

The management-based provisions proposed by Fortescue for the Eliwana Mine are outlined in Section 2. These provisions form the basis for closure planning and management at Eliwana, and will be refined as a result of additional data and other information, improved rehabilitation and closure practices, changes in the regulatory framework and technological advances. These changes will be incorporated into the Eliwana MCP (rather than this Closure-related Management Plan) to ensure that it remains up to date (see Section 3).

**Figure 3: Comparison Between an EPA Environmental Management Plan and a MCP**



# 2. EMP PROVISIONS

The management provisions outlined in this chapter are key components of this Plan. It is recognised that these become legal provisions to be met by Fortescue in implementing the Eliwana Mine proposal once the proposal has obtained Ministerial approval and will be incorporated into the Eliwana MCP once this approval has been issued.

As discussed in Section 1.4.4, Fortescue has developed management-based provisions to form the basis of this Plan. These comprise actions to be implemented to meet the closure objectives defined for the Eliwana Mine (see Section 1.4.4) and have been developed for the following:

- Overarching management actions:
    - Engaging with stakeholders.
    - Defining the post-closure land use.
    - Managing custodial transfer of assets and liability.
    - Adaptive management through the MCP.
- Rehabilitation management actions:
    - Managing topsoil/subsoil and vegetation stripping/collection.
    - Managing topsoil stockpiles.
    - Progressive revegetation and fauna habitat development.
- Water management actions
    - Managing pit lakes.
    - Managing surface water regimes.
- Landform management actions:
    - Managing landform stability.
    - Managing material that could generate acid and/or metalliferous drainage
    - Managing fibrous material.

The management-based provisions are outlined in Section 2.1 – 2.4, along with relevant management actions and targets, monitoring and reporting.

## 2.1 Overarching Management Provisions

The management-based provisions identified in Table 7 are overarching provisions relevant to all EPA Factors and Objectives identified for the Eliwana Mine proposal.

**Table 7: Overarching Management-based Provisions**

| # | Management Actions | Management Targets | Monitoring | Reporting |
|---|---|---|---|---|
| 1.1 | Develop and implement a targeted stakeholder engagement strategy that allows for consultation with identified closure stakeholders and incorporation of input from these parties into closure planning for the Eliwana Mine | No complaints in relation to processes adopted by Fortescue in engaging with stakeholders during closure planning | Measure stakeholder satisfaction in engagement processes associated with closure planning | Annual Reports and/or MCP updates |
| 1.2 | Confirm post-mining land use and closure objectives with relevant stakeholders | Acceptance of the proposed post-mining land use and closure objectives by relevant stakeholders | Level of acceptance of the proposed post-mining land use and closure objectives by relevant stakeholders | Annual Reports and MCP updates |
| 1.3 | Where infrastructure is planned to remain in-situ after closure, obtain written approval from relevant authorities including the relevant vested authority in relation to Crown Land or reserves, and the Department of Planning, Lands and Heritage for a pastoral lease | Signed agreements for custodial transfer of infrastructure following cessation of mining | Measure progress made in relation to development and signing of custodial transfer agreements | Annual Reports and MCP updates |
| 1.4 | Update the Eliwana MCP in accordance with the *Guidelines for Preparing Mine Closure Plans* (DMP/EPA, 2015) to define/refine and integrate closure-related management actions | Regular updates of the Eliwana MCP including progress on the forward work plans | Progress monitoring of closure forward work plan and timing of MCP updates | Annual Reports and MCP updates |

## 2.2 Rehabilitation Management Provisions

### Land Clearing and Vegetation Stripping

The soil resources of the project area indicate that two major soil groups have been identified:

- Soil Group One: Soils of the Boolgeeda and Platform Land Systems.
- Soil Group Two: Soils of the Newman, Rocklea and Robe Land Systems.

Topsoils from both soil groups will be stripped for use in rehabilitation processes. Soil Group One is of limited extent and is generally located on the valley floor in the project mine area. This soil group has a defined fine-grained subsoil in a deep profile which may be used as an alternative growth medium if there is topsoil deficit and if the waste rock properties prove to be unfavourable for plant growth.

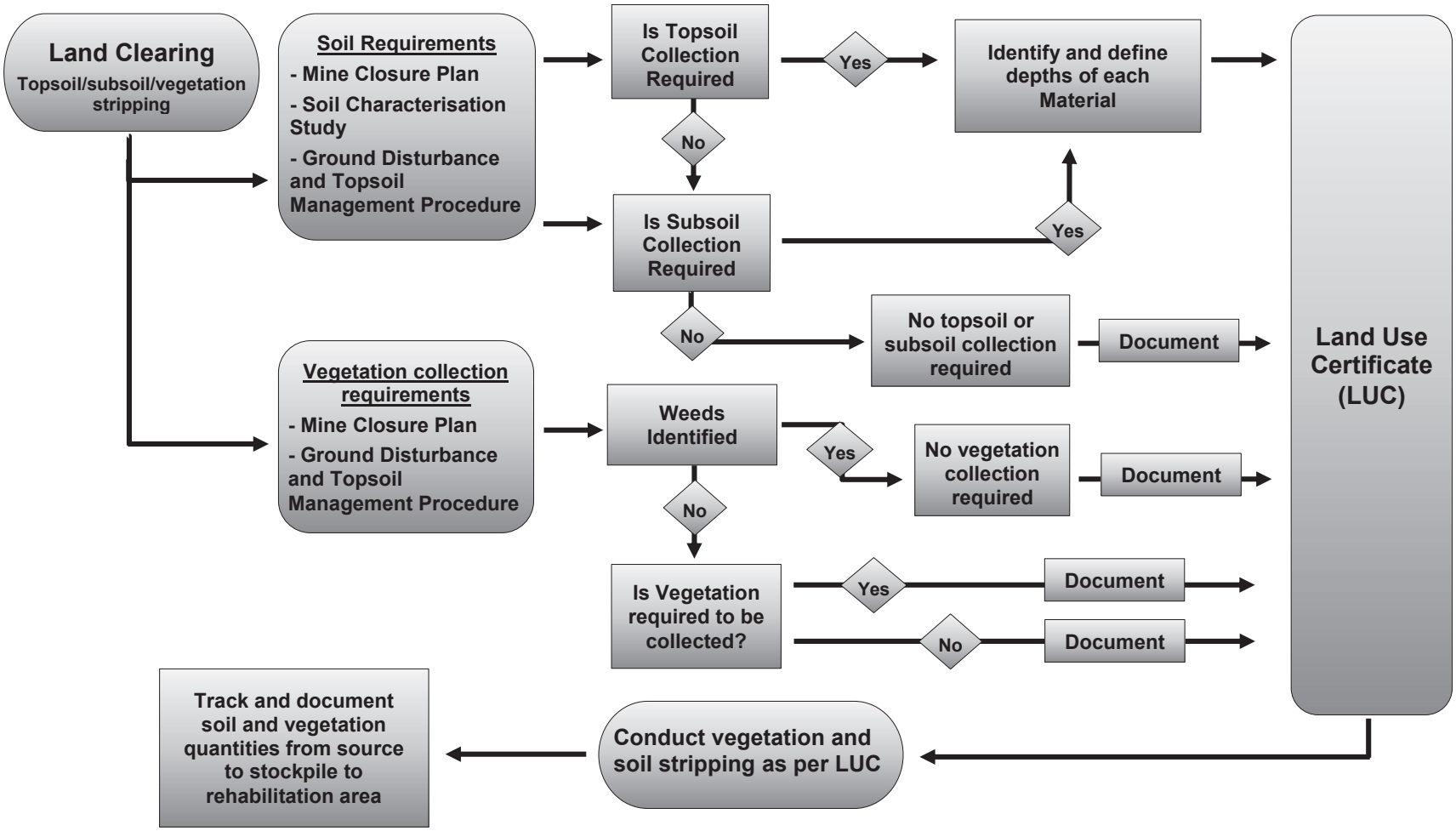
The soil and vegetation stripping process will:

- Maximise topsoil collection quality by segregating and stockpiling the top 10 cm of soil (which contains the seedbank and nutrient availability) separately from any subsoil.
- Where vegetation resource volumes are high, strip and collect the vegetation separately to the soil resources and segregate into storage.
- Collect and store subsoil from the valley areas for use as an alternative fine soil growth media, if required.

Collection and management of soil resources as part of the land clearing process will be an integral part of revegetation and will be managed as per Fortescue's *Ground Disturbance and Topsoil Management Procedure* (100-PR-EN-1042) and Fortescue's *Land Use Certification* procedure (100-PR-TA-0001).

Figure 4 provides a process for the collection of soil, vegetation and growth medium resources during the established land clearing process. Table 8 outlines the management provisions relating to the rehabilitation of the Eliwana mine.

**Figure 4: Decision Tree: Land Clearing and Soil/Vegetation Collection**



## Introduced Flora

Weeds present during clearing for construction and operations can adversely affect vegetation and soil stripping and storage for closure resource management as per Fortescue's procedure *Ground Disturbance and Topsoil Management* (100-PR-EN-1042). Weeds will be managed in accordance with Fortescue's *Weed Management Plan* (100-PL-EN-1017). The main objectives for managing weed species are:

- to minimise the introduction and spread of weeds established within and adjacent to Fortescue's operations; and
- to encourage native flora and vegetation regrowth in rehabilitation areas.

### Stockpiling and Management of Rehabilitation Material

Managing the collection and storage of rehabilitation material is an important process throughout the life of the mine from construction to closure to ensure successful rehabilitation. Fortescue recognises the importance of progressive rehabilitation and closure, and the implications this has on the management of soil and vegetation storage. Soil and vegetation resources will be collected through Fortescue's *Land Use Certification* (100-PR-TA-0001) process and Fortescue's *Ground Disturbance and Topsoil Management* (100-PR-EN-1042) procedure and stored in specific stockpiles according to the Eliwana mine plan. Vegetation, topsoil and subsoil (where required) will be collected separately and segregated for storage where benefits can be demonstrated (Figure 4).

Storing topsoil in stockpiles for extended periods of time can induce changes in soil chemistry due to redox potential and reduce seed viability. To ensure viability of stockpiled soil resources for plant nutrient and seed stocks, active management is proposed along with progressive rehabilitation. Active management of topsoil stockpiles by topsoil farming is a new process Fortescue will develop that will be closely aligned with the standards already established within the *Ground Disturbance and Topsoil Management* procedure (100-PR-EN-1042).

Seed germination rates are expected to decline with extended storage timeframes, so "soil farming" of the upper layers of soil storage is proposed by actively seeding and maintaining the top layer of soil for use in progressive rehabilitation. Active management of the top two meters of soil stockpiles will encourage air permeability and allow natural wetting and drying cycles to occur during rainfall events.

Where progressive rehabilitation occurs, soil farming will enable the biologically active layers of soil and vegetation resources to be selectively harvested to ensure the best viability for rehabilitation characteristics are present. The freshly-exposed soil within the stockpiles will then be managed to encourage plant regrowth to improve soil rehabilitation viability for the next stage of progressive rehabilitation.

Figure 5 provides a process for progressive rehabilitation and how stockpiled rehabilitation material will be managed to sustain the viability and increase the success of revegetation activities. Table 8 outlines the management provisions related to rehabilitation stockpiles for the Eliwana mine.

### Seed Collection and Progressive Rehabilitation

Pilbara flora has evolved to thrive under the extreme climatic variability experienced in the northern parts of Australia. Fortescue opportunistically collects and stores local provenance seed for use in progressive rehabilitation activities in accordance with its *Seed Collection and Management Guidelines (45-GU-EN-0007).* This guideline addresses issues related to timing of seed collection, quality and viability of seed, seed dormancy release and seed storage including:

- Options to burn or dry capsules, pods and cones to release seeds and, when required, treating seed with insecticide and fungicide prior to storage.
- Storing clean seed in dry, insect and vermin proof containers, labelled with details of the species, date collected and collection location.
- Applying pre-sowing treatment, including scarification, heat and/or smoke.

Seed selection will be based on those dominant species of the surrounding plant communities. The common species found in each land unit will be the focus of any supplementary seeding required, along with any significant vegetation community requirements. However, local provenance seed is not commercially available in sufficient quantities to support large scale rehabilitation activities so additional resources will need to be sourced.

Progressive revegetation trials will be conducted to inform success rates, seed and species lists and give an indication of natural variation.

Figure 5 outlines the processes involved in topsoil stockpile management and progressive rehabilitation. Table 8 outlines the management provisions related to seed collection and progressive rehabilitation for the Eliwana mine.

**Figure 5: Soil/Vegetation Stockpile Management and Progressive Rehabilitation Process**

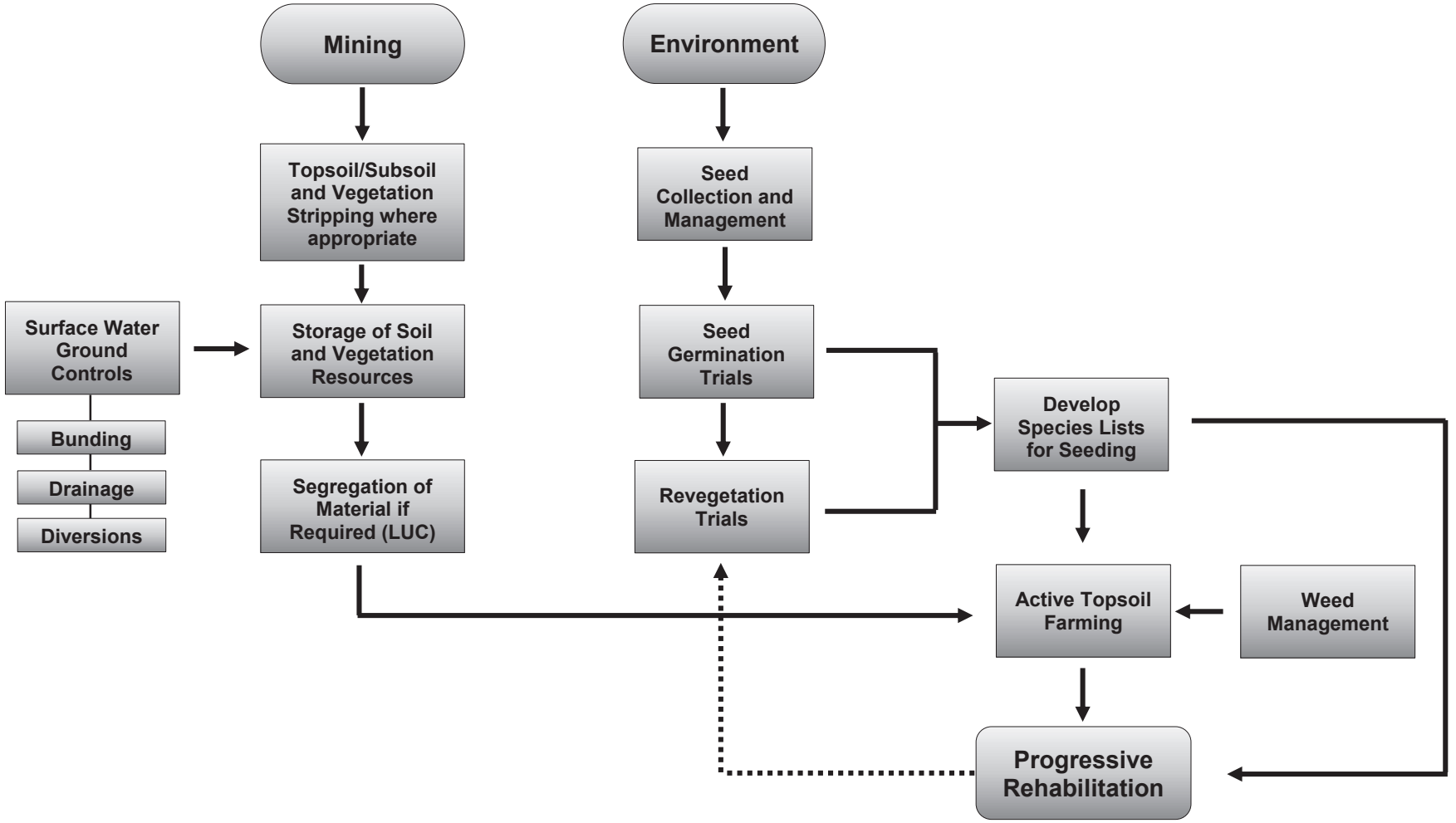


**Table 8: Rehabilitation Management Provisions**

**EPA Factors:** Flora and Vegetation, Inland Waters Environmental Quality, Terrestrial Fauna, Air Quality and Social Surroundings
**Key Environmental Values:** Conservation significant vegetation communities, fauna and flora (functioning ecosystem return)
**Key Environmental Impacts and Risks:** Unsuccessful revegetation, erosion, poor fauna habitat development

| # | Management Actions | Management Targets | Monitoring | Reporting |
|---|---|---|---|---|
| 2.1 | Define topsoil and subsoil resources needed to adequately rehabilitate closure landforms and project areas | A topsoil/subsoil inventory and allocation plan that defines the type and volume of rehabilitation resources required for each rehabilitation area have been prepared | Progress made in developing a topsoil/subsoil inventory and allocation plan for each rehabilitation area | Annual Reports and/or MCP updates |
| 2.2 | Identify and collect adequate soil resources and other rehabilitation materials in accordance with Fortescue's *Ground Disturbance and Topsoil Management Procedure* (100-PR-EN-1042) | All soil resources and other materials required for rehabilitation have been identified and collected during vegetation clearing and topsoil stripping | Compliance with *Ground Disturbance and Topsoil Management Procedure* (100-PR-EN-1042) | Internal reporting |
| 2.3 | Stockpiled rehabilitation material and soil resources to be managed in accordance with Fortescue's *Ground Disturbance and Topsoil Management Procedure* (100-PR-EN-1042) | Minimal loss or reduction of condition of rehabilitation resources through erosion or other processes | Compliance *with Ground Disturbance and Topsoil Management Procedure* (100-PR-EN-1042) | Internal reporting |

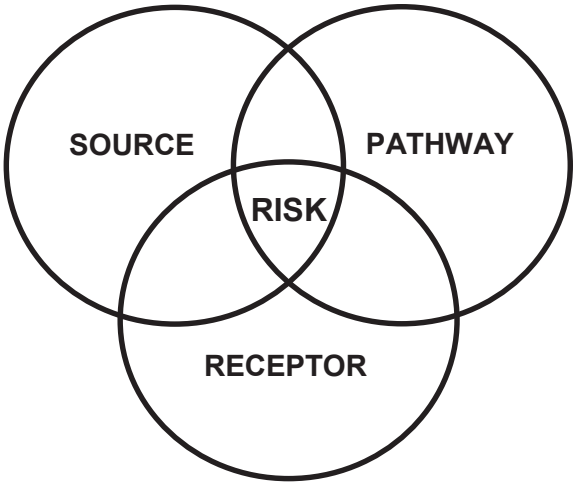
| # | Management Actions | Management Targets | Monitoring | Reporting |
|---|---|---|---|---|
| 2.4 | Perform revegetation trials to inform seeding and seed treatment requirements and species lists for revegetation activities and topsoil stockpile management | Improved topsoil stockpile management and revegetation outcomes | Topsoil stockpile revegetation status<br>Revegetation outcomes | Annual Reports and/or MCP updates |
| 2.5 | Develop and implement a soil farming procedure for topsoil stockpile management to increase the success of progressive rehabilitation | Develop new procedure for soil farming with the objectives to improve rehabilitation success | Progress made in developing new topsoil farming procedure<br>Compliance with topsoil farming procedure | Internal reporting |
| 2.6 | Conduct weed management activities as per Fortescue's *Ground Disturbance and Topsoil Management Procedure* (100-PR-EN-1042) and *Weed Management Plan* (100-PL-EN-1017) | Introduction and spread of weeds in topsoil stockpiles and rehabilitation areas has been minimised | Compliance with *Ground Disturbance and Topsoil Management Procedure* (100-PR-EN-1042) and *Weed Management Plan* (100-PL-EN-1017) | Annual Reports and/or MCP updates |
| 2.7 | Ensure that topsoil and cleared vegetation are respread and seed/fertiliser (if required) are spread in revegetation areas | To be defined following development of the topsoil inventory and seed lists | Revegetation monitoring | Annual Reports and/or MCP updates |

## 2.3 Water Management Provisions

### Pit Lakes

The principles of assessing the risks of pit lakes generally follow the model used for contamination assessments of characterising the source, pathway and receptor to determine risk as per Figure 6. However, Fortescue recognises that there are risks separate to contamination that need to be addressed and sit outside of this model. See below.

**Figure 6: Risk-based Conceptual Site Model**

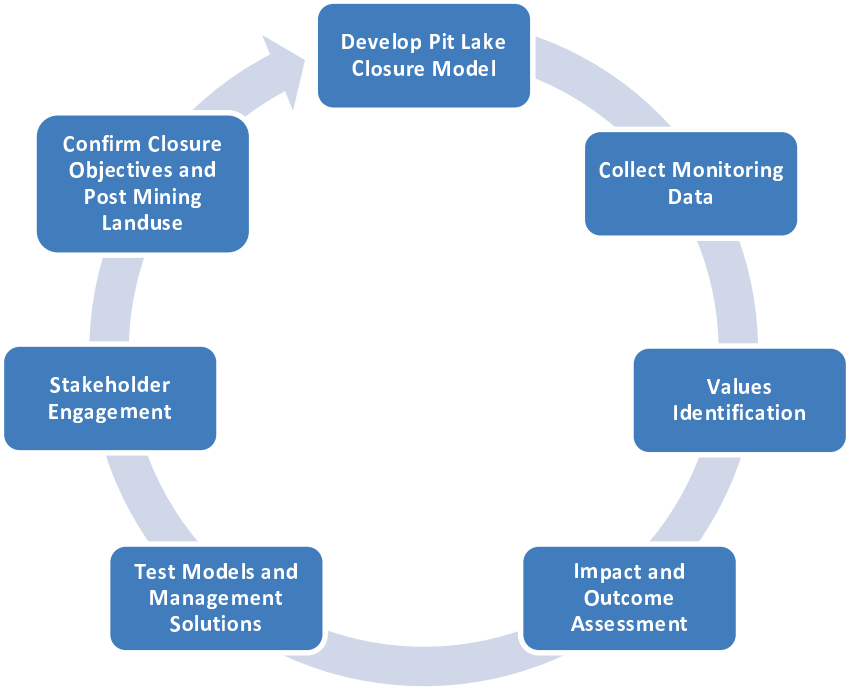



The Eliwana Mine will consist of a number of pits with different geological, geometry and morphological characteristics. Pit lake development post mining is likely to vary across the Eliwana project area. Initial conceptual models are developed from the basis of the four closure scenarios for pit lakes outlined in Table 6. These comprise:

- Category 1: No groundwater inflow – above flood plain.
- Category 2: No groundwater inflow – within flood plain.
- Category 3: Groundwater inflow – above flood plain.
- Category 4: Groundwater inflow – within flood plain.

The management framework for developing conceptual models and predictive numerical models for pit lake development is outlined in Figure 7. The closure of a pit and the development of a pit lake will allow for additional data collection, on-ground validation and will reduce the number of conceptual models by refining the range of impacts and increasing the detail in the mitigation strategies into more numerical and predictive modelling.

**Figure 7: Framework for Developing and Refining Pit Lake Scenarios at Closure**




Fortescue proposes to manage the environmental risks associated with pit lake development through adaptive environmental management (Section 3) to reach the desired closure objectives, being:

- Water quality does not adversely impact downstream environmental or heritage values.
- Pit lakes do not present a significant risk to human health or a significant ecological threat.
- Changes to hydrological regimes do not adversely impact downstream environmental or heritage values.

A cycle of risk assessment, planning, implementation, monitoring, validation and adjustment/re-evaluation will be utilised to ensure risks are identified and management strategies are effective. The selection of mitigation strategies is part of the adaptive management process; that is, the mitigation strategy will be informed by ongoing monitoring, modelling and risk assessments. The mitigation strategies outlined in Table 9 available for use in one or all of the closure pit lake scenarios.

**Table 9: List of Mitigation Strategies Available for each Pit Lake Category**

| Mitigation Measures | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Redesign mine void geometry to reduce potential negative impacts | ✓ | ✓ | ✓ | ✓ |
| Remove deleterious material from wall rock by back excavating | ✓ | ✓ | ✓ | ✓ |
| Utilise full backfill for some mine voids to reduce risk | | ✓ | ✓ | |
| Utilise partial backfill:<br>• to reduce runoff from deleterious wall rock | ✓ | ✓ | ✓ | ✓ |
| • to reduce contact between deleterious wall rock and permanent mine void water (pit lake) | | ✓ | ✓ | ✓ |
| • to reduce groundwater inflow | | | ✓ | ✓ |
| • with geochemically specific material (e.g. dolomite, organic matter) to induce neutralisation and precipitation of potentially elevated metals and oxyanions/metalloids | | | ✓ | ✓ |
| • to reduce stratification | | ✓ | ✓ | ✓ |
| • to reduce pit lake area and reduce evapoconcentration | | ✓ | ✓ | ✓ |
| • to reduce mine void depth and encourage outflow to reduce evapoconcentration | | ✓ | | |
| Increase depth of mine void to increase water storage volume so that potential for outflow is further reduced | | ✓ | | ✓ |
| Creek diversion where practicable, to reduce surface water inflow | | ✓ | | ✓ |
| Streamflow capture to control the salinisation and acidification of mine void water by constant dilution through seasonal outflow from the lake | | ✓ | | ✓ |
| Increase drawdown in a zero-recharge compartment in order to reduce groundwater inflow and prevent formation of permanent water | | | ✓ | ✓ |
| Passive wetland treatment systems and increase of environmental value | ✓ | ✓ | ✓ | ✓ |

Source: Fortescue (2017c) *Western Hub Stage 1 – Conceptual Mine Void Water Assessment*

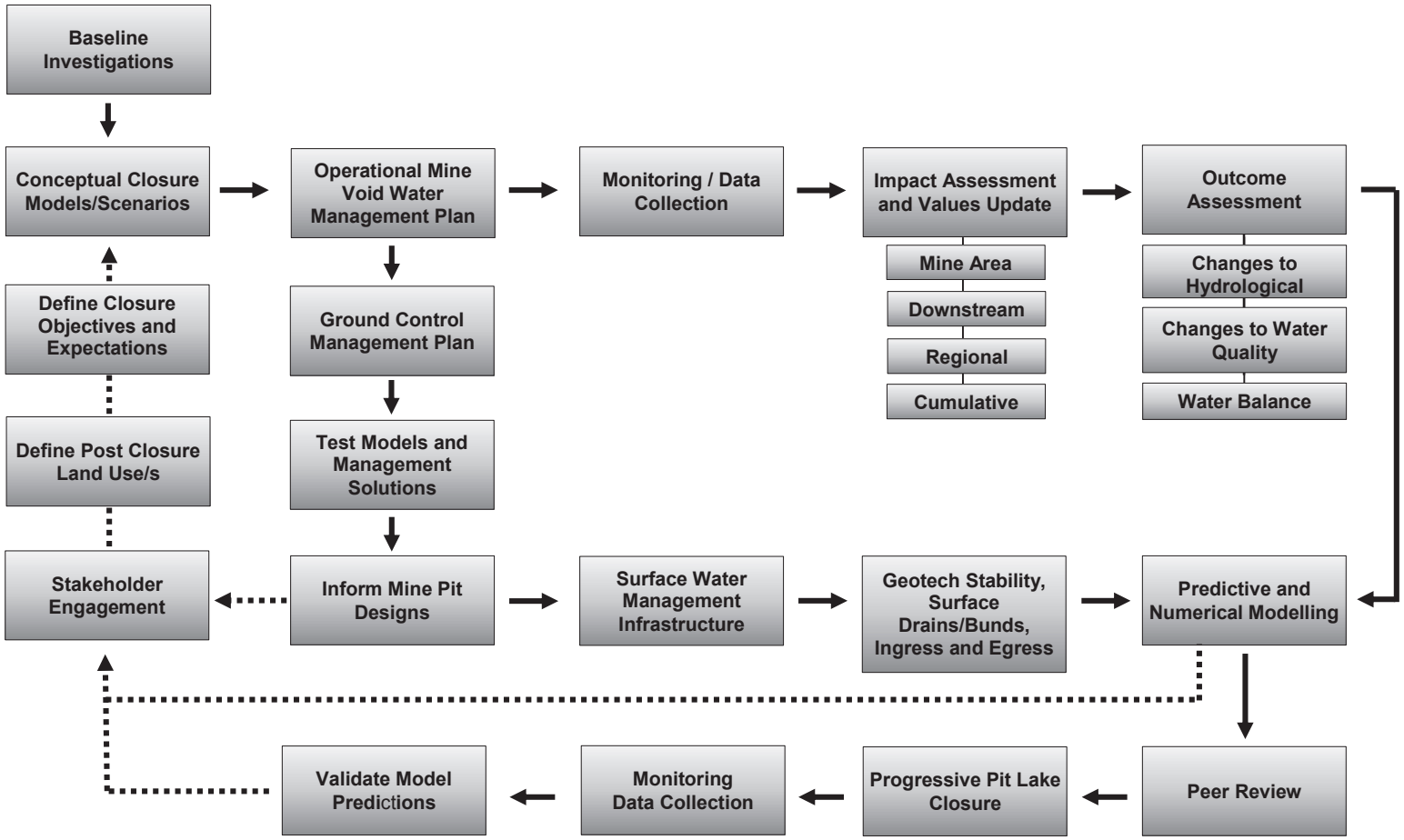
The Eliwana Mine will be developed in stages and will be opening and closing pits as mining progresses. Developing conceptual pit lake scenarios into predictive modelling will be important for progressive closure of the Mine. Pit lake models will be used to identify pit lake characteristics such as:

- Water Quality Characteristics:
    - Salinity loading in pit lakes and downstream environments.
    - Acid and/or metals loading in pit lakes and downstream environments.
    - Sediment loading in pit lakes and downstream environments.

- Water Quantity/Flow Characteristics
    - Surface water inputs into pit voids.
    - Groundwater sinks or flow-through systems.
    - Water balance.
    - Pit lake capacity and overtopping potential.
- Post Mining Landusers
    - Pit water users and potential risks.
    - Native flora and fauna risks.

Figure 8 outlines the process for developing pit lake conceptual models, testing these with stakeholders and ground control mechanisms, and then refining these models with ongoing data collection and validation to develop more predictive, numerical and analytical models. Table 10 outlines the management provisions relevant to pit lake management.

**Figure 8: Decision Tree: Developing and Refining Pit Lake Scenarios at Closure**



## Surface Water Drainage

As per the current Eliwana mine plan, operations will likely terminate stream flow to certain catchments. When the Mine moves to closure, these catchment changes will be permanent and reductions in downstream surface water flows will persist. Modelling is required on closed landforms (including mine voids and WRLs) to determine the long-term effects of final closure landforms on surface water patterns. Surface water management will be required at closure to protect final landforms from erosion risks and manage sediment discharge to downstream environments. Table 10 outlines the management provisions relevant to surface water risks for the closure of the Eliwana mine.

Considerations when designing for surface water conditions at closure include:

- Diversion structure designs around mine voids to not only prevent pit access post-closure, but also adequately control drainage to mitigate risks of pit wall failure.
- Manage surface water runoff quality including but not limited to minimising sediment loading to downstream environments in line with natural stream flow characteristics.
- Landforms that are designed or appropriately armoured such that they require little to no active management post-mining.
- Management of upstream flows and incidental rainfall on or adjacent to WRLs.
- Management of upstream flows that are intercepted by upstream pits, linear infrastructure and general disturbance.

**Table 10: Water Management Provisions**

**EPA Factors:** Inland Waters Environmental Quality, Hydrological Processes, Flora and Vegetation, Terrestrial Fauna and Social Surroundings
**Key Environmental Values:** Groundwater dependent vegetation, riparian ecosystems, flora and fauna values and landform stability safety
**Key Environmental Impacts and Risks:** Landform stability, erosion, sediment mobilisation and exposure to potentially harmful encapsulated geologies.

| # | Management Actions | Management Targets | Monitoring | Reporting |
|---|---|---|---|---|
| 3.1 | Develop a site conceptual model of source-path-receivers to identify key risks from pit lakes post-closure | A site conceptual model of source-path-receivers has been developed and key closure risks from pit lakes have been identified | N/A | Annual Reports and/or MCP updates |
| 3.2 | Develop and refine pit lake scenarios at closure as per the Pit Lake Modelling Process (Figure 8) including:<br>• Adequate stakeholder engagement to define post mining land use and closure objectives<br>• Geotechnical stability assessments<br>• Geochemical characteristics assessments<br>• Pit lake water balance assessments | Predictive and numerical pit lake models for pit lake scenarios at the cessation of mining have been developed<br>Regulator acceptance of pit lake model outcomes | Regular revisions of pit lake models with ongoing inputs from monitoring data and stakeholder feedback | Annual Reports and/or MCP updates |

| # | Management Actions | Management Targets | Monitoring | Reporting |
|---|---|---|---|---|
| 3.3 | Validate pit lake modelling through progressive closure of the Eliwana mine pits | Validation of pit lake model assumptions and outcomes | Incorporate data from progressive pit lake closure into modelling<br><br>Hydrological monitoring data | Annual Reports and/or MCP updates |
| 3.4 | Develop and implement a specific Eliwana Surface Water Management Plan that outlines potential impacts to and mitigation measure for:<br>• Surface water runoff quality (both sediment loads and other contaminants)<br>• Upstream flows and incidental rainfall on WRL and adjacent areas<br>• Upstream flows that are intercepted by pits, linear infrastructure and general disturbance<br>• Surface water design criteria considerations for closure landforms | Environmental impacts associated with surface water drainage and sediment at closure and during the post-closure period do not adversely impact the value of downstream receptors beyond natural effects | Compliance with the developed Eliwana Surface Water Management Plan<br><br>Ongoing condition monitoring of downstream receptors vs reference conditions at monitoring sites | Internal reporting and External Annual Reports |
| 3.6 | Ensure implemented closure landforms and associated surface water management controls perform as predicted over time | Validation of predicted surface water modelling | Post-mining environmental monitoring | Annual Reports and/or MCP updates |

## 2.4 Landform Management Provisions

### Landform Stability

This section refers to any constructed landform including WRLs, pit voids, constructed transport corridors and Run of Mine or infrastructure pads. Constructed landforms pose a long term financial liability to the business and have the potential to be one of the most significant environmental liabilities during both operations and post closure. To limit Fortescue's (and the States) long-term exposure and ensure that closure objectives are fulfilled, it is essential that careful site-specific planning is undertaken before construction of those landforms to achieve safe, stable, non-polluting and aesthetically acceptable landforms that can support a self-sustaining vegetation and do not require ongoing repair and maintenance.

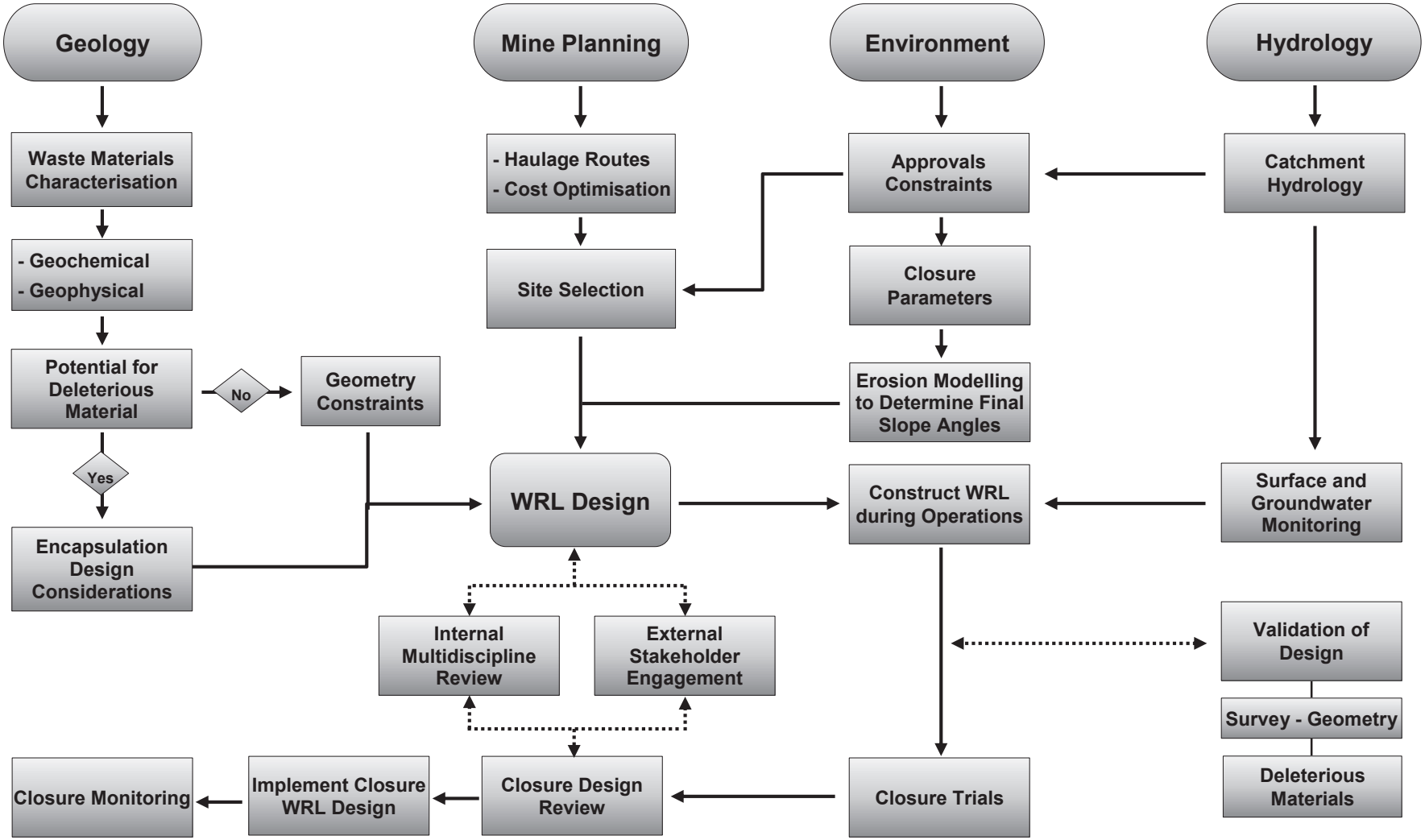
The long-term stability of constructed landforms is important to mitigate potential issues such as:

- Increased (above the norm) sediment deposition that can smother plants and adversely affect surface water drainage.
- Increased (above the norm) erosion and/or exposure of acid and/or metalliferous materials that can result in unstable ground and poor vegetation growth.
- Unstable ground and/or release of hazardous fibrous material that can expose the public to unsafe air quality or landforms.

Fortescue has developed the draft *Waste Rock Landform Design Management Plan* (100-PR-EN-1017) to assist in the management of risks associated with the design, construction and operation of WRL. The aim of this procedure is to achieve successful and cost-effective closure and rehabilitation of WRL by incorporating closure requirements into the project feasibility and mine planning stages.

The steps involved in designing and planning for constructed landforms are outlined in Figure 9. The management provisions related to WRL stability and design are outlined in Table 11.

Figure 9: Constructed Landform Design Process



## Acid and/or Metalliferous Drainage

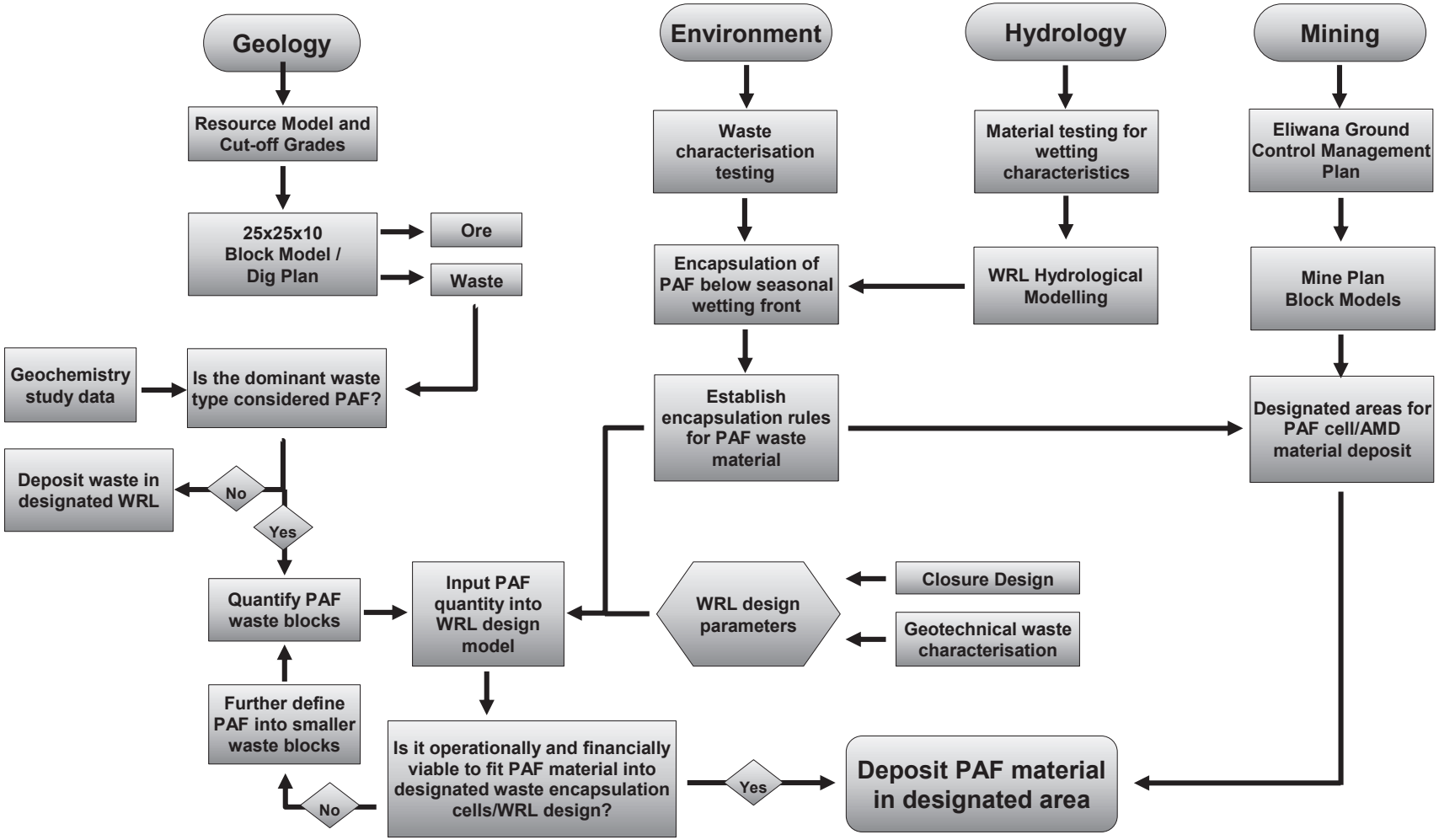
The principles of assessing the risks of acid and/or metalliferous drainage follow the model used for contamination assessments of characterising the source, pathway and receptor to determine risk (Figure 6). Only when a source is in contact with a pathway (such as air or water) that can transport potentially harmful substances to an environmental receptor is there a risk of harm.

Fortescue has developed the *Acid and/or Metalliferous Drainage Management Plan* (100-PL-EN-1016) to assess the risk to the environment from the disturbance and exposure of rock through mining and construction activities. Fortescue has also developed the *Life of Mine Geochemistry Programme (Acid and Metalliferous Drainage Sampling Plan)* for the Chichester and Solomon Operations which can be drawn upon to assess and manage the risks from the Eliwana Mine. This plan will be updated to include specific risks of the Eliwana Mine.

In order to prevent the long term generation of acid and/or metalliferous drainage from mining activities, the lithologies most at risk must be disposed of carefully to minimise the ingress of oxygen and/or water. The position of potentially harmful lithotypes must be determined and the mine schedule must include planning to store and dispose of these wastes appropriately as they are excavated. Encapsulation of potentially harmful wastes in WRLs is one of the methods used to prevent environmentally harmful drainage. Figure 10 describes the process for establishing encapsulation as a mechanism of managing acid and/or metalliferous drainage material. Reference to the *Acid and/or Metalliferous Drainage Management* Plan (100-PL-EN-1016) will be made when designing the encapsulation process.

Fortescue will conduct further geological, hydrogeological and environmental studies to inform mine planning to effectively manage the risk of acid and/or metalliferous drainage. Table 11 outlines the management provisions related to acid and/or metalliferous drainage risks of the Eliwana Mine at closure.

**Figure 10: Decision Tree: Acid and/or Metalliferous Drainage Encapsulation**



## Fibrous Material

Fortescue has developed a *Fibrous Minerals Management Procedure* (100-PR-SA-1060) to provide information to assist employees and contractors in minimising their exposure to fibrous minerals at any Fortescue sites where fibrous minerals may pose a health concern.

Fibrous material can pose a risk to human health at the closure of a mine if any material is left exposed or becomes exposed due to unstable landforms or other means. To manage fibrous materials during operations, Fortescue's *Fibrous Minerals Management Procedure* (100-PR-SA-1060) will be implemented and used to inform mine planning and closure planning. To manage the risks of fibrous material during closure and post closure, a number of steps will occur throughout the mine life, including:

- Appropriate geological identification of fibrous material.
- Adequate encapsulation controls to stockpile fibrous material in WRLs.
- Detailed investigations of waste materials characterisation to inform waste rock landform stability (both geotechnically and surface erodibility).
- Validation processes to ensure fibrous material management is adequate.

**Table 11: Landform Management Provisions**

**EPA Factors:** Inland Water Environmental Quality, Hydrological Processes, Flora and Vegetation, Terrestrial Fauna, Air Quality and Social Surroundings

**Key Environmental Values:** Flora and vegetation values, stream flow values, hydrological process values and fauna habitat values.

**Key Environmental Impacts and Risks:** Landform stability, erosion, acid and/or metalliferous drainage, fibrous material mobilisation and social expectations.

| # | Management Actions | Management Targets | Monitoring | Reporting |
|---|---|---|---|---|
| 4.1 | Update the *Waste Rock Landform Design Management Plan* (100-PR-EN-1017) for the Eliwana Mine to:<br>• Develop waste encapsulation parameters for at-risk material encountered at Eliwana (i.e. material with acid and/or metalliferous drainage potential and fibrous material)<br>• Ensure that disposal of waste rock follows the defined encapsulation process as well as documenting all waste sources and dump locations.<br>• Incorporate closure design considerations into operational WRL construction | The *Waste Rock Landform Design Management Plan* (100-PR-EN-1017) has been updated and finalised<br>WRLs have been designed with controls for effectively managing WRL closure risks | Completion of the finalised *Waste Rock Landform Design Management Plan* (100-PR-EN-1017).<br>Compliance with the *Waste Rock Landform Design Management Plan* (100-PR-EN-1017) | Internal reporting |
| 4.2 | Geotechnical evaluation of WRL foundation and design based on ongoing waste rock characterisation and operational planning | Geotechnically stable WRL designs | Validation testing of WRLs | Internal reporting |

| # | Management Actions | Management Targets | Monitoring | Reporting |
|---|---|---|---|---|
| 4.3 | Develop an Eliwana Geotechnical Ground Control Management Plan to outline a process to identify landform instability risks to expose acid and/or metalliferous drainage material or any other harmful material | An Eliwana Geotechnical Ground Control Management Plan has been developed<br><br>The adverse impacts of constructed landforms post-mining are minimised | Compliance with the developed management plan | Internal reporting<br><br>Annual Reports<br><br>MCP Updates |
| 4.4 | Develop a site conceptual model of source-path-receivers to identify key risks of landforms | A site conceptual model of source-path-receivers to identify key risks of landforms to sensitive receptors has been developed<br><br>The site conceptual model has been used to develop/refine management actions | Progress made in development of the site conceptual model<br><br>Progress made in use of the site conceptual model to develop/refine management actions | Internal reporting<br><br>Annual Reports<br><br>MCP Updates |

| # | Management Actions | Management Targets | Monitoring | Reporting |
|---|---|---|---|---|
| 4.5 | Develop a life-of-mine geochemistry programme to:<br>• Comprehensively characterise potentially acid forming and metalliferous drainage geologies<br>• Identify potentially acid or metalliferous drainage material within geological and mine block models for construction and operational planning<br>• Develop a validation process to validate geochemical testing processes and ground control procedures | A life -of-mine geochemistry programme has been developed<br>Likelihood of acid and/or metalliferous drainage has been minimised<br>Impacts as a result of acid and/or metalliferous drainage have been minimised | Progress made in development of A life -of-mine geochemistry programme<br>Compliance with the geochemistry programme<br>Validation testing to confirm modelling and assumptions | Internal reporting<br>Annual Reports<br>MCP Updates |
| 4.6 | Develop a Fibrous Material Management Plan for Eliwana incorporating construction, operations and closure. This should be developed in reference to the Fortescue *Fibrous Minerals Management Procedure* (100-PR-SA-1060) and the Waste Rock Landform Design Management Plan (100-PR-EN-1017). | A Fibrous Management Plan has been developed<br>Post-closure impacts due to fibrous material have been reduced to as low as reasonably possible | Progress made in developing the internal Eliwana specific Fibrous Materials Management Plan<br>Compliance with the Eliwana Fibrous Materials Management Plan | Internal reporting<br>Annual Reports<br>MCP updates |

# 3. ADAPTIVE MANAGEMENT AND REVIEW

Adaptive environmental management is “the recommended means for continuing ecosystem management and use of natural resources, especially in the context of ‘integrated natural resource management’. Conceptually, adaptive management is simply learning from past management actions to improve future planning and management” (Allan and Stankey, 2009). It is a structured and iterative process that allows uncertainty to be reduced over time via system monitoring. Consequently, it is an important tool in achieving continual improvement in environmental management.

It is reasonable to expect that changes will be made to the Proposal and its environmental management over time. These changes could occur due to range of factors including application of new survey and study data, evaluation of monitoring data, re-evaluation of risk assessments, changes to the regulatory framework, changes to Fortescue’s policies and procedures, and stakeholder feedback. The Eliwana MCP (rather than this Closure-related Management Plan) will be revised as these changes occur and on an as-needs basis to ensure that it remains up to date.

# 4. STAKEHOLDER ENGAGEMENT

Fortescue's stakeholder engagement strategy aims to establish open dialogue between key stakeholders, using face-to-face modes of engagement wherever practicable. For engagement on closure planning and closure related aspects, this strategy includes:

- Transparency in disclosure of project characteristics and closure processes.
- Awareness of, and responsiveness to, stakeholder views and concerns.
- Seeking agreement on closure objectives and closure criteria.
- Understanding stakeholder visions on post-mining land use.

The views of Fortescue's internal stakeholders have been tested through discussions used to facilitate project planning. Internal perspectives will be provided by Fortescue's corporate, financial and mine planning functional areas while external stakeholder perspectives are obtained through Fortescue's environmental approval, heritage and community liaison functional areas.

# 5. REFERENCES


Cristescu, R.H., Frère, C. and Banks, P.B. (2012) *A review of fauna in mine rehabilitation in Australia: current state and future directions*. Biological Conservation 149: 60-72.

Department of Mines and Petroleum and Environmental Protection Authority (2015). *Guidelines for Preparing Mine Closure Plans*.

Environmental Protection Authority (2017) *Instructions on how to prepare Environmental Protection Act 1986 Part IV Environmental Management Plans.*

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

Stankey, G.H. and Allan, C. (2009) *Adaptive Environmental Management: A Practitioner's Guide*.


**Fortescue Internal Documents**


100-GU-EN-0018 - Fortescue Metals Group Pty Ltd (2011) *Guideline - Characterisation of Mineral Waste Rock and Soils,* November 2011.

100-PL-EN-1014 - Fortescue Metals Group Pty Ltd (2014) *Life of Mine Geochemistry Programme (Acid and Metalliferous Drainage Sampling Plan) Chichester and Solomon Operations,* July 2014.

100-PL-EN-1009 - Fortescue Metals Group Pty Ltd (2014) *Groundwater Management Plan, July 2014.*

100-PL-EN-1015 - Fortescue Metals Group Pty Ltd (2014) *Surface Water Management Plan, December 2014.*

100-PL-EN-1016 - Fortescue Metals Group Pty Ltd (2014) *Acid and/or Metalliferous Drainage Management Plan,* December 2014.

45-GU-EN-0007 - Fortescue Metals Group Pty Ltd (2016) *Seed Collection and Management Guidelines,* July 2016.

100-PL-EN-1017 - Fortescue Metals Group Pty Ltd (2016) *Weed Management Plan*, August 2016.

100-PR-SA-1060 - Fortescue Metals Group Pty Ltd (2016) *Fibrous Minerals Management Procedure,* December 2016.

100-PR-TA-0001 - Fortescue Metals Group Pty Ltd (2017) *Land Use Certification Procedure,* July 2017.

45-GU-EN-0010 - Fortescue Metals Group Pty Ltd (2017) *Guideline - Defining Closure Objectives and Completion Criteria (Rev 1),* July 2017.

100-PR-EN-1042 - Fortescue Metals Group Pty Ltd (2017) *Ground Disturbance and Topsoil Management Procedure*, draft procedure - December 2017.

100-PR-EN-1017 - Fortescue Metals Group Pty Ltd (2017) *Waste Rock Landform Design Management Plan,* Draft 2017.

**Baseline Investigations for the Eliwana Project**

Bennelongia Environmental Consultants (2015) *Western Hub Baseline Subterranean Fauna Assessment,* February 2015.

Biologic (2017) *Interim Report – Eliwana Subterranean Fauna Assessment,* June 2017.

Biota Environmental (2017) *Eliwana Consolidated Detailed Flora and Vegetation Phase 2, Revision B Draft,* November 2017.

Ecologia Environmental (2015) *Western Hub Project – Eliwana and Flying Fish Terrestrial Vertebrate Fauna Assessment,* January 2015.

Ecoscape (2012a) *Vegetation, Flora and Fauna Assessment, and Targeted Conservation Significant Flora and Fauna Survey: Eliwana*, June 2012.

Ecoscape (2012b) *Eliwana and Flying Fish Level 2 Flora and Vegetation Survey,* October 2012.

Ecoscape (2015) *Eliwana and Flying Fish Level 2 Flora and Vegetation Survey (Phase 2) Volume 1,* January 2015.

Ecoscape (2016) *Eliwana Targeted Flora Survey*, December 2016.

Ecoscape (2017a) *Eliwana Consolidated Terrestrial Fauna Survey – Phase 1 Field Summary Report*, June 2017.

Ecoscape (2017b) *Eliwana Targeted Pilbara Leaf-nose Bat and Ghost Bat Survey,* July 2017.

Ecoscape (2017c) *Eliwana Consolidated Terrestrial Fauna Survey – Targeted Fauna Field Trip Summary Report,* August 2017.

Fortescue Metals Group Pty Ltd (2017a) *Western Hub – Stage 1 Eliwana and Flying Fish – Subsurface Materials Characterisation*, December 2017.

Fortescue Metals Group Pty Ltd (2017b) *Surface Water Impact Assessment – Eliwana Mine Project*, Draft Revision A, October 2017.

Fortescue Metals Group Pty Ltd (2017c) *Western Hub - Stage 1 - Mine Void Water Assessment,* December 2017.

Golder Associates (2017a) *Western Hub – Dewatering and Water Supply Assessment – Hydrogeological Conceptual Model Report,* March 2017.

Golder Associates (2017b) *Western Hub Hydrogeological Assessment – Groundwater Model Development and Calibration Report*, September 2017.

Golder Associates (2017c) *Western Hub Hydrogeological Assessment – Mine Dewatering and Water Supply Modelling,* September 2017.

Soilwater Group (2017) *Eliwana Project – Soil Characterisation Study,* November 2017.

Tetra Tech (2017a) *Baseline Geomorphology Assessment for Eliwana and Flying Fish Deposits Fortescue Western Hub,* August 2017.

Tetra Tech (2017b) *Baseline Geomorphology Assessment for Eliwana and Flying Fish Deposits Fortescue Western Hub: Potential Impacts Assessment,* September 2017.