



CLOUDBREAK LIFE OF MINE ENVIRONMENTAL MANAGEMENT PROGRAM

April 2011



Fortescue
The New Force in Iron Ore

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1. INTRODUCTION

1.1 BACKGROUND

The Proponent, Fortescue Metals Group Pty Ltd (Fortescue), proposes to expand mining at the Cloudbreak iron ore mine (Cloudbreak) located in the Pilbara region of Western Australia. Changes proposed under the expansion process include an increase in ore production, development of new mine infrastructure and substantial additional dewatering and water disposal activities over the life of mine. A detailed description of the Proposal is included in Section 3.0 of the Public Environmental Review (PER).

The Proponent has committed to the development and implementation of an operational Environmental Management Plan (EMP) to address potential impacts on the environment as a result of construction and operational activities related to the Proposal. A Conceptual Mine Closure Plan (CMCP) is also included within Appendix A, addressing the decommissioning, decontamination and rehabilitation measures required to support closure of the Proposal. The CMCP will be further refined during the closure planning process and finalised prior to decommissioning and closure.

1.2 PURPOSE AND SCOPE OF DOCUMENT

This EMP has been prepared as a supporting document to the Public Environmental Review (PER) of the Proposal as assessed by the Office of Environmental Protection Authority in accordance with the Environmental Protection Act 1986 (EP Act). This EMP has also been prepared to address concerns raised by stakeholders during consultation.

The purpose of this EMP is to document environmental management objectives and strategies in relation to this Proposal including:

- measures to prevent, minimise and mitigate potential environmental impacts of the Proposal
- details of the timing and persons responsible for implementation of these measures
- monitoring and reporting procedures.

The EMP provides an overview of the environmental initiatives to be undertaken during the Proposal to support the impact assessment presented in the PER. Specifically, this EMP addresses the key environmental factors identified in the environmental impact assessment of the expansion Proposal and the key management considerations associated with the Proposal. The potential impacts associated with fire, weed hygiene and noise remain unchanged from the existing project and therefore existing management is considered to be adequate. This EMP contains the following environmental management plans:

- groundwater management (Section 4.1)
- surface water management (Section 4.2)
- biodiversity management (Section 4.3)
- Fortescue Marsh management (Section 4.4)
- cultural heritage management (Section 4.5).

As stated in Section 1.2, mine closure is addressed in a separate Conceptual Mine Closure Plan, included in Appendix A.

1.3 RELATIONSHIP TO EXISTING MANAGEMENT PLANS

This EMP is consistent with the existing operational environmental management plans at Cloudbreak and other Fortescue operations and relevant environmental approval requirements, where applicable. Publicly available environmental management plans (for example, dust, weed and fire management) are kept up to date and published on the Fortescue website at www.fmgl.com.au.

1.4 FORTESCUE ENVIRONMENTAL POLICY AND COMMITMENT

Fortescue's Environment Policy emphasises Fortescue's commitment to protecting the natural environment:

Fortescue is committed to maintaining sound environment management practices and meeting our responsibilities.

We recognise the importance of minimising environmental impacts as it is important to ensuring the company's longevity, success, growth and positioning in the domestic and global markets.

Our decision making process will incorporate sustainability principles and the implementation of new and better technologies where feasible. Fortescue aims to inspire an ethic and attitude that strives for continuous improvement and ongoing learning.

We encourage employees to engage in positive attitudes and behaviour concerning respect for the environment. We recognise that sustainability cannot be achieved without the contribution and action of the entire team.

1.5 FORTESCUE ENVIRONMENTAL MANAGEMENT SYSTEM

Fortescue currently operates within an Environmental Management System (EMS) for all its operations in the Pilbara. Fortescue is proactively working to ensure that the environmental impact from its activities is minimal and approval obligations are met or exceeded. The activities undertaken by the Proponent is supported by the EMS which covers the environmental approvals, environmental management plans, incident management systems and awareness and training programs for its Pilbara operations.

Fortescue's focus is on continuous improvement in the management of potential environmental impacts throughout construction and operation of its Pilbara operations. The EMS has been established to assist the Proponent to audit environmental performance, identify areas for improvement and the implementation of appropriate corrective actions.

Fortescue is committed to ensuring that its employees and contractors are made aware of their environmental obligations through a proactive environmental awareness and training program.

2. IMPLEMENTATION

2.1 RESPONSIBILITIES

All Fortescue personnel are responsible for the environmental performance of their activities and for complying with their general environmental “duty of care.” All contractors involved with the Proposal will be under a contractual agreement to abide by Fortescue’s environmental obligations. The Cloudbreak mine is owner operated; therefore Fortescue will be responsible for the implementation, maintenance and evaluation of compliance with this EMP. Key personnel (Project Manager, Construction Manager, Superintendents and the Site Environmental Officer) will be made responsible for communicating environmental matters and ensuring management practices and procedures are being implemented.

Operating contractors working with Fortescue will be responsible for following the environmental specifications contained within their contract, and develop policies and procedures compliant with this EMP. Table 1 describes the roles and responsibilities of personnel responsible for this EMP. Contractor responsibilities will be outlined within contract documents.

Table 1: Roles and Responsibilities

| Position | Responsibility |
|--|--|
| Manager, Governance and Sustainability | <ul style="list-style-type: none"> • Provide the tools necessary (such as this EMP) to ensure that site personnel are able to meet Fortescue’s corporate and legislative requirements. • Implement and review this EMP in accordance with the stipulated review schedule (Section 3.3). |
| Health, Safety, Environment and Security Manager | <ul style="list-style-type: none"> • Provide technical support to site personnel. • Ensure all staff are aware of their environmental obligations. • Ensure contractors are aware of their environmental obligations and compliant with the Fortescue environmental management strategies and procedures. • Co-ordinate and carry out site environmental inductions, inspections and internal audits. • Report results of compliance audits and inspections to the Head of Environment. |
| Project Managers | <ul style="list-style-type: none"> • Ensure this EMP is being adhered to by all staff and contractors. • Participate in compliance audits and inspections. • Report results of compliance audits and inspections to the Manager, Governance and Sustainability. |
| Site Personnel/Contractors | <ul style="list-style-type: none"> • To be aware of all site environmental management strategies and procedures and be able to demonstrate this awareness when required. • Report all known breaches of the environmental management strategies and procedures to their Project Manager. |

2.1.1 Environmental Induction

Objectives

All personnel working on site will be inducted to ensure they are aware of environmental expectations, requirements of the EMP, environmental sensitivities in and around the Proposal area and tasks and procedures to be followed and complied with to minimise environmental impacts.

The objectives of the Environmental Induction Program are:

- to ensure all personnel are aware of environmental sensitivities in and around the Proposal area, as well as the environmental issues and appropriate management measures
- to ensure all personnel are aware of their environmental responsibilities
- to ensure compliance with Fortescue's Corporate Environmental Policy, regulatory requirements, legal obligations and environmental management commitments.

Components Addressed

The Environmental Induction Program will address the relevant key environmental issues from the following:

- relevant environmental legislative obligations
- Fortescue's Corporate Environmental Policy
- this EMP
- all existing environmental management plans that apply to the Cloudbreak operations
- hazardous materials management.

Basic fire training, conducted separately to the induction, provides instruction in relation to the following issues:

- basic fire fighting training
- fire restrictions
- fire vehicle access and maintenance
- fire fighting equipment location and use.

Personnel will be required to sign an attendance record and complete a competency assessment on environmental aspects and management of the project. Visitors to the site will be informed of the relevant environmental policy-related and site-specific requirements. They will be advised that conformance to these requirements is a condition for entry to the site.

2.2 COMMUNITY COMPLAINTS

All community complaints will be recorded on a complaints register and investigated. A summary of the complaint and the subsequent investigation, including any monitoring results and corrective action will be prepared and reported in the Annual Environmental Report (Section 3.3).

2.3 INCIDENTS AND CORRECTIVE ACTIONS

All environmental incidents and 'near misses' will be recorded on an Environmental Incident Register. Incidents will be recorded by the person who causes or identifies the incident within the shift as soon as practicable within 12 hours of its identification. Incidents and 'near misses' will be investigated and appropriate measures implemented to prevent recurrence. Environmental incidents will be reported to the relevant government agency by the Environmental Superintendent where required by legislation or otherwise committed to in management plans. The Superintendent for the area in which the incident occurred is responsible for ensuring that the cause of the incident is determined and the appropriate remedial and/or preventative action taken. The Environmental Incident Register will be reviewed regularly by the Site Environmental Officer to ensure any trends are identified and to assess the effectiveness of preventative measures.

2.4 EMERGENCY RESPONSE

Fortescue is responsible for developing an emergency preparedness and response procedure that suits the needs of the project. To this end, Fortescue has developed a corporate emergency management plan and an Emergency Response Procedure applicable to its Pilbara operations. These documents provide the basis for developing site specific emergency response plans for a range of potential emergency scenarios (including hazardous materials, mineral waste, residue storage facilities, failure of flood retention structures and unplanned discharges).

The emergency response plan details:

- roles and responsibilities
- incident management team structure
- incident levels
- communication procedures and emergency contact details.

Basic emergency response training will be provided to all personnel, and selected dedicated personnel will undergo further training to form an Emergency Response Team. Appropriate emergency response equipment will be available on-site.

Emergency events will be reported in accordance with the requirements of relevant licences (e.g. Department of Water (DoW), and Department of Environment and Conservation (DEC)). Fortescue will be responsible for ensuring that:

- reports are completed in a timely manner
- the content and presentation of reports is to the satisfaction of the relevant agencies.

2.5 STAKEHOLDER CONSULTATION

Fortescue has undertaken an extensive stakeholder consultation program in association with the planning and design of the Cloudbreak mine site. This program has encompassed landowners, regulators and other relevant parties. The DEC will be consulted regarding the final content of this EMP.

The stakeholder consultation process assists in identifying stakeholders, developing individual stakeholder consultation plans and managing issues that might arise with stakeholders from the development of the project. Stakeholder consultation on the Cloudbreak Expansion Proposal has formed part of an ongoing and extensive stakeholder engagement program for Fortescue projects undergoing environmental approvals. The overarching objectives of the program are:

- to disclose the Cloudbreak Expansion Proposal to all interested parties with sufficient detail such that they are able to raise issues and concerns and obtain feedback at the project development stage
- to establish relationships with key stakeholders that enable ongoing dialogue through implementation and regulation of the Proposal.

The Fortescue stakeholder engagement program for the Cloudbreak expansion Proposal is described in Section 4 of the PER.

The key topics raised by stakeholders to date are outlined in Table 2.

Table 2: Key Topics raised during Stakeholder Consultation regarding the Proposal

| Stakeholder | Topics Raised |
|--|---|
| Department of Environment and Conservation | Borrow pit design, placement and rehabilitation, especially along the first 120 km of the rail and the need to now remediate the legacy left after construction. (The construction footprint post Rail Camp 2 to the Cloud Break mine was very good in comparison to areas further north). |
| | The Cloud Break access road and issues principally associated with road design, borrow pit design and placement, and topsoil/vegetation management and the need to strategically address and mitigate these impacts while being cognisant of the footprint of future mine/pit developments (Christmas Creek). |
| | Concerns about potential impacts on the flora and vegetation communities on the north side of the Fortescue Marsh. |
| Department of Water | Potential impacts on ecological assets and nearby pastoral leases arising from groundwater abstraction, and management measures for minimising these impacts. |
| | Consideration of water sharing options with nearby sites as a component of strategic water management. |
| Department of State Development and Department of Minerals and Petroleum | Potential impacts and management measures of water abstraction on ecological assets and nearby pastoral leases |

3. PERFORMANCE REVIEW PLAN

Performance reviews will be undertaken by Fortescue to satisfy internal management review processes and to meet environmental reporting and compliance reporting obligations to regulatory authorities. The outcomes of these reviews will be used to ensure continual improvement of existing environmental systems and operational management processes. The Performance Review Plan will include the following elements:

- monitoring
- auditing
- reporting
- communication procedures.

3.1 MONITORING

Monitoring will be undertaken to verify compliance with environmental conditions and commitments, satisfy regulatory and reporting requirements, track environmental performance and measure the effectiveness of environmental management measures. Fortescue will prepare and implement a Performance Review Plan that will outline the environmental monitoring requirements for the Proposal including those in this EMP. The Performance Review Plan will include, but not be limited to, the following:

- specification of the Proposal compliance requirements
- definition of the intent and the scope of the monitoring program
- specification of the parameters to be measured and appropriate units, including the rationale for the selection of these parameters
- a description of the monitoring methods to be used, including specification of the frequency of the monitoring and analysis of results
- a description of record keeping and reporting requirements.

The plan will be updated as required to account for changes in monitoring requirements throughout the Proposal, including those associated with rehabilitation and closure. Monitoring will be completed in a manner that ensures completeness, comparability, representativeness, accuracy and precision.

3.2 AUDITING

Auditing forms an important part of the Proposal implementation. The objective of environmental audits is to ensure that environmental objectives and performance criteria are met, assess the effectiveness of management measures and verify environmental compliance with the EMP, environmental policies, legal requirements, conditions and commitments.

Auditing will include, but not be limited to:

- compliance with Ministerial Conditions
- ensuring that land disturbance does not encroach outside the approved Proposal boundaries
- impacts to flora and fauna
- rehabilitation
- any aspects of the Proposal that result in potential contamination
- effluent or wastes
- compliance with permits/licences
- impacts to Aboriginal heritage
- management systems to identify, control and monitor environmental risks arising during the Proposal
- contractor compliance with all relevant environmental requirements
- reviewing the effectiveness of the EMP.

Environmental Compliance Audits will be conducted by a qualified environmental auditor in accordance with the requirements of licences and Ministerial Statements. Where non-conformances are identified, corrective actions will be identified, allocated to specific personnel for actioning and tracked.

3.3 REVIEW AND REPORTING OF ENVIRONMENTAL PERFORMANCE

Relevant monitoring outcomes will be included in an internal Monthly Environmental Report and will contribute to an Annual Environmental Report that will report the environmental performance of the Proposal against its legislative requirements and the management objectives and targets in accordance with the Performance Review Plan.

Reporting of monitoring will include, but not be limited to, the following:

- assumptions made in monitoring
- calibration requirements and records
- monitoring results
- details of any instances of non-compliance or exceedance of targets and the measures taken to avoid recurrence.

In addition to the above, the Annual Environmental Report will include:

- an outline of the status of the Proposal
- trends in monitoring results
- achievement (or otherwise) of outcomes predicted in the PER, the success (or otherwise) of mitigation measures in achieving these outcomes
- proposed or implemented changes to mitigation measures to ensure desired outcomes are achieved
- progress, results and modification to the Performance Review Plan.

4. ENVIRONMENTAL MANAGEMENT PLAN

4.1 GROUNDWATER MANAGEMENT PLAN (DEWATERING AND INJECTION)

The Cloudbreak orebody is within the Nammuldi member of the Marra Mamba formation which extends below the groundwater level and therefore requires dewatering to access the majority of the ore.

The activities or aspects of the Cloudbreak Expansion Proposal that may potentially affect groundwater include:

- dewatering of mine pits will reduce groundwater levels
- injection of dewatering water that may increase groundwater levels
- changes in groundwater salinity due to injection of saline dewatering product.

4.1.1 Potential Impacts to be Managed

The potential impacts of groundwater drawdown resulting from dewatering of the ore body aquifer include:

- decrease in the water available to groundwater dependent ecosystems (including subterranean fauna) in surrounding areas
- loss of water supply to station supply bores in the vicinity of the mine
- dewatering of subterranean voids, possibly leading to the formation of sinkholes
- formation of acid mine drainage if potentially acid forming (PAF) materials (Roy Hill Shale) are dewatered
- exposure of potentially acid sulphate soils (PASS) to oxidation and acidification.

The potential impacts of groundwater mounding that may result from injection activities include:

- saturation of the root-zone of vegetation communities sensitive to waterlogging
- mobilisation of salt into the root-zone of vegetation communities sensitive to salinity
- surface discharge of injected groundwater, if the aquifer at the injection zone is unable to receive the total quantity of dewater being injected
- alteration of groundwater quality as a result of the injection of higher salinity water into fresh water zones of the aquifer.

4.1.2 Performance Objectives

The environmental performance objectives and indicators for biodiversity are detailed in Table 3 below.

Table 3: Groundwater Performance Objectives and Indicators

| Performance Objective | Performance Indicators |
|---|---|
| To maintain the quantity of water so that existing and potential environmental values, including ecosystem maintenance, are protected. | <p>Health of groundwater dependent ecosystems within the potential groundwater drawdown footprint is maintained at a level commensurate with that of similar groundwater dependent ecosystems outside the potential groundwater drawdown footprint.</p> <p>Health of Mulga within the potential groundwater mounding footprint is maintained at a level commensurate with that of similar Mulga communities outside the potential groundwater mounding footprint.</p> |
| To ensure that emissions do not adversely affect environmental values or the health, welfare or amenity of people and land uses by meeting statutory requirements and acceptable standards. | <p>Compliance with <i>Rights in Water and Irrigation Act 1914</i> licence conditions.</p> <p>Health of groundwater dependent ecosystems within the potential groundwater drawdown and mounding footprints is maintained at a level commensurate with that of similar groundwater dependent ecosystems outside the potential groundwater footprint.</p> <p>Water supply for pastoral land use is not significantly disrupted.</p> |

4.1.3 Management

Management measures have been identified to assist in achieving the groundwater management objectives (Table 4). The potential impacts of the Proposal have been avoided and minimised as far as possible through the investigations, modelling, dewatering system design and injection system configuration planning. During operations the management of groundwater abstraction and injection will be undertaken using an adaptive management approach¹, informed by a monitoring program and actioned through a response plan as detailed in Section 4.1.4.

¹ Adaptive management is a cyclical process of continuous improvement, relying on the results of prior learning to inform future actions (adapted from Allan & Stankey 2009).

Table 4: Management Measures for Groundwater

| Parameter | Management Actions | Timing |
|--|--|--|
| Watertable level | Monitor water levels prior to and during mining and post-closure in accordance with the program set out in Table 5. | Duration of dewatering operations |
| | Develop trigger criteria for groundwater levels. | Prior to commencement of dewatering operations |
| | Implement investigations and/or contingencies set out in Table 6 should groundwater level trigger criteria be breached. | Duration of dewatering operations |
| | Review the adequacy of trigger criteria for groundwater levels and revise as required to ensure achievement of management objectives set out in Table 4. | Duration of dewatering operations |
| Groundwater quality | Monitor groundwater quality prior to and during mining and post-closure in accordance with the program set out in Table 5. | Duration of dewatering operations |
| | Develop trigger criteria for groundwater quality and undertake an investigation program should these criteria be breached. | Prior to commencement of dewatering operations |
| | Implement investigations and/or contingencies set out in Table 6 should groundwater quality trigger criteria be breached. | Duration of dewatering operations |
| | Review the adequacy of trigger criteria for groundwater quality and revise as required to ensure achievement of management objectives set out in Table 4. | Duration of dewatering operations |
| | Manage dewater product injection such that saline water is injected into saline aquifers, and fresh water is injected into fresh aquifers, in accordance with the receiving water quality criteria set out in Department of Water, <i>Water Quality Protection Guidelines No. 11: Mining and Mineral Processing Mine Dewatering 2000</i> . | Duration of dewatering operations |
| Groundwater dependent vegetation health | Monitor groundwater dependent vegetation health in potential drawdown areas prior to and during mining and post-closure in accordance with the program set out in Table 5. | Duration of dewatering operations |
| | Develop trigger criteria for groundwater dependent vegetation health and undertake an investigation program should these criteria be breached. | Prior to commencement of dewatering operations |
| | Implement investigations and/or contingencies set out in Table 6 should groundwater dependent vegetation health trigger criteria be breached. | Duration of dewatering operations |
| | Review the adequacy of trigger criteria for groundwater dependent vegetation health and revise as required to ensure achievement of management objectives set out in Table 4. | Duration of dewatering operations |
| Mulga health | Monitor Mulga health in potential mounding areas prior to and during mining and post-closure in accordance with the program set out in Table 5. | Duration of dewatering operations |
| | Develop trigger criteria for Mulga health and undertake an investigation program should these criteria be breached. | Prior to commencement of dewatering operations |
| | Implement investigations and/or contingencies set out in Table 6 should Mulga health trigger criteria be breached. | Duration of dewatering operations |
| | Review the adequacy of trigger criteria for Mulga health and revise as required to ensure achievement of management objectives set out in Table 4. | Duration of dewatering operations |

| Parameter | Management Actions | Timing |
|---------------------|---|--|
| Sinkholes | Develop a detection plan for sinkholes, should dolomite, calcrete and/or ferricrete with extensive voids, be encountered. | Prior to commencement of dewatering operations |
| Acid sulphate soils | Monitor water levels in areas potentially exposed to dewatering and containing acid sulphate soils. Prevent any potential for acidification through the manipulation of the injection regime to maintain water levels in these areas. | Duration of dewatering operations |

4.1.4 Implementation

Dewatering of groundwater will be subject to a licence issued by the DoW under the RiWI Act that specifies the maximum dewatering rate and includes conditions for monitoring. As part of the licensing process, an Operating Strategy is required by DoW detailing the monitoring and adaptive management of the dewatering program. An Operating Strategy has been prepared by Fortescue for the management of mine dewatering and disposal at Cloudbreak (Fortescue 2009a). Operations will be consistent with this and the Fortescue *Chichester Operations Groundwater and Bore Management Plan (45-PL-EN-0005)* (Fortescue 2009b). An outline of the adaptive management approach is set out below.

Adaptive Management Approach

If monitoring indicates that unexpected and significant impacts are likely, Fortescue, in consultation with the regulatory agencies, will implement an appropriate contingency action within an adaptive management framework. Key elements of the adaptive management approach that will be applied in the operation of the Cloudbreak expansion Proposal are:

- 1) The monitoring and management approach (including performance indicators and management trigger criteria) will be regularly revisited and, where necessary, revised in agreement with the regulatory agencies.
- 2) System model(s) will be used to interpret measured environmental responses to management actions, and to help identify and evaluate the significance of knowledge gaps.
- 3) The range of possible response choices will be developed and evaluated in terms of the extent to which each choice would be likely to achieve the management objectives, and the extent to which it will generate new information or foreclose future choices.
- 4) Monitoring will focus on significant and detectable indicators of progress toward management objectives. Monitoring will also help distinguish between natural perturbations and perturbations caused by management actions.
- 5) Mechanism(s) for incorporating learning into future decisions.

- 6) The proposed adaptive management approach will enable the potential benefits of the Proposal to be realised, whilst ensuring that the environmental values of the Proposal area influenced by groundwater are protected.

An outline monitoring program is set out in Table 5. Specific groundwater and biological monitoring sites are yet to be determined but will initially be based on ensuring monitoring in all potentially affected areas. These areas are shown on Figure 1 and Figure 2.

Table 5: Groundwater Monitoring Program

| Topic/Issue | Parameters | Purpose | Frequency | Location |
|-------------------------|---|---|---|---|
| Groundwater abstraction | Groundwater abstraction rates and volumes | To provide data on abstraction volumes | Monthly (cumulative flow metering) | All production wells |
| | Groundwater abstraction quality | To provide data on quality of various groundwater abstraction streams | Six monthly chemical analyses ² Monthly field measurement of EC | All production wells |
| Groundwater injection | Groundwater injection rates and volumes | To provide data on injection volumes | Monthly (cumulative flow metering) | All injection wells |
| | Groundwater injection quality | To provide data to ensure injection quality is commensurate with quality of receiving environment | Daily field measurement of EC | Main feed lines |
| Groundwater level | Groundwater level | To provide data on groundwater responses to dewatering and injection | Continuous in critical areas. Monthly at control sites | Monitoring well network in all potentially affected areas and control sites. Specific monitoring sites to be determined |
| Groundwater quality | Groundwater quality | To provide data on changes in groundwater quality as a result of dewatering and injection, including potential acid generation from dewatering of potential acid sulphate soils | Six monthly chemical analyses. Monthly field measurement of EC and pH. | Monitoring well network in all potentially affected areas and control sites. Specific monitoring sites to be determined |

² Undertaken by a recognised analytical laboratory for pH, EC, TDS (gravimetric) and suite of major ionic species including Na, Ca, Mg, K, Cl, SO₄, HCO₃, CO₃ and NO₃.

| Topic/Issue | Parameters | Purpose | Frequency | Location |
|-------------------|--|---|--|--|
| Soil moisture | Soil moisture within the root zone of Samphire in potentially affected areas | To provide data on the soil water available to vegetation | Quarterly | Within all areas expected to be affected by the Proposal, and at control sites. Specific monitoring will be adjacent to vegetation health sites to be determined |
| Vegetation health | Mulga Community health and condition | To provide data on biological responses to dewatering and injection impacts | Monthly for initial 12 months in potentially affected areas and at all control sites Quarterly in areas not expected to be affected (revert to monthly when operations move such that areas may become potentially affected) | Within all areas expected to be affected by the Proposal, and at control sites. Specific monitoring sites to be determined |
| | Fortescue March vegetation health and condition (replicated 10 m wide transects) | To provide data on biological responses to dewatering and injection impacts | Monthly for initial 12 months in potentially affected areas and at all control sites. Quarterly in areas not expected to be affected (revert to monthly when operations move such that areas may become potentially affected) | Within all areas expected to be affected by the Proposal, and at control sites in each mulga and samphire vegetation type potentially affected by the Proposal. Specific monitoring sites to be determined |

Hierarchy of Contingency Actions

Contingency actions will be implemented in the event that management triggers are exceeded, and initial investigations indicate that further management responses are necessary. The proposed contingency measures are hierarchical, ordered by response to impacts of increasing severity as follows:

- 1) The primary contingency measures involve adjustment of dewatering wellfield configurations and dewatering rates or adjustment of the location and injection rates of the injection wellfields.
- 2) Localised mitigation of temporary groundwater level changes through case specific contingencies such as surface irrigation.
- 3) Temporary reduction in dewatering or injection rates while further investigations into potentially unacceptable and unexpected occurrence are undertaken.

- 4) Permanent reduction in dewatering or injection rates where determined to be appropriate in consultation with the Department of Water.
- 5) Cease dewatering or injection and investigate alternative water management options.

Contingency Triggering Process

Monitoring will focus on:

- groundwater drawdown or mounding (hydrologic) responses
- soil moisture responses
- biological responses.

The process for determining the need for triggering contingency actions for each form of response is set out in Figure 3.

Site Specific Contingencies

There are several areas where there is an identified expectation of an observable impact, and if that impact exceeds the limits of expectation, then consideration of contingency actions will be triggered. The primary triggers for taking site specific contingency actions are:

- an observed groundwater response occurs at a rate greater than indicated by the numerical groundwater modelling
- an observed groundwater response occurs or is considered likely to occur in an area of identified acid sulphate soils
- sustained soil moisture change occurs in the unsaturated profile that is inconsistent with control sites
- an observed biological response occurs that is inconsistent with expectations.

Of the areas in which there is potential risk of impact, the areas fringing and within the Fortescue Marsh, and the areas of Mulga vegetation are considered the most sensitive to abstraction effects from the Proposal.

An integrated approach to monitoring both hydrological and biological responses will be undertaken with a process for triggering responses if untoward changes are observed in either, with control sites to provide a basis for decision-making on the potential causes.

The decision process for implementing contingency actions based on monitoring results is set out in Figure 3. As shown in the flow diagram, an unexpected change in any monitoring parameter is sufficient to trigger contingency actions. There is likely to be a time delay between hydrological changes and biological responses, so the monitoring approach is structured to enable the implementation of contingencies even before a biological response is detected.

The monitoring program includes the following components:

- 1) Watertable levels and groundwater quality to monitor aquifer performance against predicted pressure changes. Monitoring of water levels in both the areas of interest and in control areas to enable significant watertable impacts due to groundwater abstraction or injection to be identified.
- 2) Soil moisture monitoring in both areas of potential impact and in control areas to monitor soil moisture available to plants.
- 3) Vegetation health monitoring in areas of potential impact and associated control areas. This is to ensure that no unexplained changes occur in these systems.

The monitoring of watertable levels will act as an early warning system of unexpected changes as a result of the Proposal. Key monitoring wells will have data loggers installed. Rates of drawdown and mounding will be defined for these wells as triggers for contingency actions.

The groundwater modelling used to provide the basis for assessment of environmental impacts has predicted rates of groundwater level change in the watertable. Comparison of the observed and modelled response will be evaluated in accordance with the process in Figure 3.

If required, the process step involving “Investigate prognosis for hydrologic and environmental outcomes and implement contingency actions if considered necessary” will be undertaken in close consultation with the regulatory agencies.

The specific contingency action and triggering process for each of these potential risk areas is set out in Table 6, to be read in conjunction with Figure 3.

Table 6: Trigger Levels and Groundwater Management Contingency Actions

| Feature | Response Trigger | Contingency Action |
|-------------------------------|---|--|
| Watertable monitoring | Watertable levels exceed the criteria rates of rise or decline (1.5 times the predicted rate of change). | <p>Advise DoW, DEC and the EPA of the exceedance.</p> <p>Investigate reasons for the hydrological response by considering water level changes in surrounding bores (including those at associated control sites) and reviewing the Fortescue numerical groundwater model.</p> <p>Assess whether changes require contingency actions (including reviewing soil moisture data to determine water availability to plants and the likelihood of vegetation being affected).</p> <p>Implement the hierarchy of contingencies as required.</p> |
| | Groundwater level monitoring indicates rate of watertable change in excess of modelled prediction at key monitoring sites. | <p>Investigate reasons for the hydrological response by considering water level changes in surrounding bores (including those at associated control sites) and reviewing the Fortescue numerical groundwater model.</p> <p>Increase vegetation monitoring frequency to quarterly to determine if vegetation response in the specific locality(s) is within the expected range, or exceeds acceptable change³. If response is beyond expected range, modify dewatering or injection regime. Continue groundwater and vegetation monitoring to observe response. Develop further response options depending on results.</p> |
| | <p>OR</p> <p>Groundwater levels rise to within 2 mbgl in unexpected areas, where baseline water levels are at greater depth (outside of predicted mounding areas included in Figure 56 of the Cloudbreak PER).</p> <p>OR</p> <p>Groundwater levels in areas where depth to groundwater is less than 5 m experience drawdown for longer periods than indicated on Figure 57 or outside the areas indicated in Figure 57.</p> | <p>If groundwater change rate is more than twice the rate of modelled predictions, dewatering or injection regime to be modified immediately to redress the change and investigated.</p> |
| Acid sulphate soils | Acid sulphate soils are identified in areas of shallow watertables that are considered likely to be affected by groundwater drawdown. | <p>Make an assessment of the extent of the acid sulphate soils, and advise DEC, DoW and the OEPA of their detection.</p> <p>Review and if necessary modify the dewatering or injection regime to maintain the water levels in areas containing acid sulphate soils within the pre-mining water level range. Continue monitoring water levels and water quality.</p> |
| Vegetation in Fortescue Marsh | Monitoring of vegetation changes indicates that change is occurring that is beyond expectations and exceeds limit of acceptable change.* | <p>Determine whether groundwater level has changed relative to controls and therefore whether the vegetation health change is due to Cloudbreak operations.</p> <p>If effect is due to Cloudbreak operations, modify dewatering or injection regime to prevent or minimise further change. Continue groundwater and vegetation monitoring to observe response. Develop further response options depending on results.</p> |

³ Acceptable vegetation change to be characterised by:

- retention of full range of vegetation types (upland to wetland) although areas may change, and
- continuum of vegetation types is maintained without significant areas of vegetation being in poor health, compared to control sites.

| Feature | Response Trigger | Contingency Action |
|--|--|--|
| | Monitoring of vegetation changes indicate water-stress related change is occurring inconsistent with control sites (i.e. greater than 10% outside of identified potential impact areas (Figure 56 in the PER) relative to control sites. | Develop response options in consultation with regulatory agencies if impact prognosis is likely to be unacceptable and changes are clearly attributable to the Proposal. |
| Terrestrial vegetation (Mulga communities) | Groundwater level monitoring indicates rate of watertable change in excess of modelled prediction at key monitoring sites within Mulga. | Investigate monitoring results from control sites and rainfall to determine whether the change is due to groundwater abstraction or injection. Increase vegetation monitoring frequency to quarterly to determine if vegetation response in the specific locality(s) is within the expected range, or exceeds acceptable change ⁴ . If response is beyond expected range, modify dewatering or injection regime. Continue groundwater and vegetation monitoring to observe response. Develop further response options depending on results. If groundwater change rate is more than twice the rate of modelled predictions, dewatering or injection regime to be modified immediately and investigated. |
| | Analysis of groundwater level monitoring indicates any watertable level changes that are attributable to the Proposal. | Modify dewatering or injection regime. Continue monitoring and evaluate to observe effects and determine cause. Develop response options in consultation with regulatory agencies if impact prognosis is likely to be unacceptable. |
| | Monitoring of vegetation changes in identified potential impact areas (Figure 56 in the PER) indicates that change is occurring that is beyond expectations and exceeds limit of acceptable change.* | Modify dewatering or injection regime. Continue groundwater and vegetation monitoring to observe response. Develop further response options depending on results. |
| | Monitoring of vegetation condition declines by greater than 10% outside of identified potential impact areas (Figure 56 in the PER) relative to control areas over three successive monitoring periods. | Review groundwater levels in the vicinity of the vegetation change to determine whether groundwater level change has caused the change in vegetation condition. If vegetation death occurs in >10% of individuals at any monitoring site, agencies will be notified, the cause investigated and mitigation options agreed with the agencies and implemented. |

⁴ Acceptable vegetation change to be characterised by:

- retention of full range of vegetation types (upland to wetland) although areas may change
- continuum of vegetation types is maintained without significant areas of vegetation being in poor health, compared to control sites.

4.2 SURFACE WATER MANAGEMENT PLAN

The Cloudbreak mine lies within the catchment of the Fortescue Marsh, an 1000 km² ephemeral wetland listed in the Directory of Important Wetlands in Australia (the Directory) (Environment Australia 2001). Flooding of the whole Fortescue Marsh occurs as a result of larger rainfall events over the 26 000 km² catchment. Broad scale flooding occurs on a frequency of about one year in ten, with inundation persisting for three to six months (SEWPAC, Australian Heritage Database October 2010). However, more frequent smaller scale events are considered important for the vegetation of the Marsh and the semi-permanent water pools or “yintas” along the northern shoreline.

Surface water flows from the Chichester Range through the Proposal area into the Fortescue Marsh occur via both channel flow and sheet flow:

- channel flow – convergent flow to large creek channels and adjacent floodplains.
- sheet flow – overland flow in a broad shallow front.

Channel Flow zones are associated with large catchments that predominantly drain the steep upland areas. These surface flow areas have large convergent flows, with high velocities in large, well defined channels (Worley Parsons 2011). Small, more frequent flows are generally confined to the channel. Break out into the adjacent floodplains occur during larger and less frequent flood events and supports surface water dependent vegetation including *Eucalyptus victrix* (Coolibah) - *Eucalyptus camaldulensis* (River Red Gum) open woodlands and Scrub to Low Open Woodland dominated by Acacia species (ENV 2010).

Sheet flow occurs where overland flow moves down slope while maintaining a broad shallow front. Sheet flow occurs over extensive areas within and to the south of the Proposal area. These areas do not promote convergence of flows and are relatively flat, causing sheet flow zones to be maintained over large areas (Worley Parsons 2011).

Sheet flow processes are important for the banded Mulga (*Acacia aneura*) communities that are common in the mid to lower slopes of the Chichester Range, including within the Cloudbreak area. Banded Mulga occurs where relatively dense groves of Mulga in low lying areas are interspersed with slightly elevated inter-grove areas that contain grasses or less dense areas of Mulga (Worley Parsons 2011).

4.2.1 Potential Impacts to be Managed

The following activities or aspects of the Proposal may potentially affect surface water quality and quantity:

- physical presence of **mine pits and waste landforms** may cause disruption to channel and sheet flow surface water regimes through the diversion, ponding or capture of surface water flows, and increase sediment loads
- physical presence of **pipelines and other linear infrastructure** may cause disruption to channel and sheet flow surface water regimes through the diversion, ponding or capture of surface water flows, and increase sediment loads
- **surface water discharge as a contingency if dewater injection infrastructure fails** may cause surface water quality impacts and create new flow paths and erosion risk
- **storage and use of chemicals** has the potential to affect surface water quality through the discharge of potentially contaminated stormwater from the mine area
- **earthworks and clearing** may cause sedimentation and deterioration in water quality as a result of erosion
- **changes in surface water regimes** may impact on surface water dependent vegetation communities, including Mulga and Samphire.

4.2.2 Performance Objectives

The environmental performance objectives and indicators for surface water are detailed in Table 7.

Table 7: Surface Water Performance Objectives and Indicators

| Performance Objective | Performance Indicators |
|--|---|
| Prevent and minimise impacts to water quantity reaching downstream areas | Site inspection of culverts, bridges and pipelines Site inspection of flow diversion structures around mine pits and waste landforms |
| Prevent and minimise erosion and sedimentation issues | Inspection of downstream receiving waterways and downstream sheetflow areas |
| Prevent and minimise impacts to water quality reaching downstream areas | Site inspection of sediment control structures, including sedimentation ponds Surface water quality testing for hydrocarbons, turbidity and other contaminants Environmental Incident Reports |

4.2.3 Management

Management measures have been identified to assist in achieving the surface water performance objectives (Table 8).

Table 8: Surface Water Management Actions

| Parameter | Management Actions | Timing |
|-------------------------------------|--|-------------------------|
| Mine pits and waste landforms | Install surface water diversion infrastructure around mines and waste landforms to maintain downstream flows. | Design and construction |
| | Design mine pits to be internally draining. Rainfall to be managed via sumps and potentially directly discharged to the environment. | Ongoing |
| Clearing and earthworks | Rehabilitate temporarily disturbed areas progressively | Ongoing |
| Pipelines and linear infrastructure | Bury or raise pipelines at a maximum of 75 m intervals to allow vehicle access, surface sheet flow and fauna movement. | Design and construction |
| | Construct floodways on roads at depressions and at a maximum of 75 m intervals in sheet flow areas to maintain sheet flow regimes. | Design and construction |
| | Bury pipelines if major sheetflow disruption appears likely. | Design and construction |
| | Construct floodways on roads in preference to culverts in and immediately upstream of areas of Mulga vegetation. | Design and construction |
| | Install flow respreading structures downstream of culverts if used in or immediately upstream of areas of Mulga vegetation. | Design and construction |
| Surface discharge of dewater | No discharge of dewater to surface water, except as a contingency measure during system failures or in exceptional circumstances when major maintenance is being undertaken on the injection system. | Operation |
| Flood Management | Construct buildings and processing infrastructure outside of the 1 in 100 year flood zone or within bunds. | Design and construction |
| Stormwater Management | Keep clean and potentially contaminated stormwater separate. | Ongoing |
| | Contain and appropriately treat potentially contaminated stormwater prior to release to the environment. | Ongoing |
| Management of Chemicals | Store and manage chemicals and hydrocarbons in accordance with chemical management and handling procedures. | Ongoing |
| | Provide hydrocarbons and chemical spill control training and equipment to appropriate Fortescue mine site staff and contractors. | Ongoing |
| Mine closure | At closure, the twelve major creek lines defined by Worley Parsons (2011) will be re-established in their original alignments and rehabilitated. For other drainage lines, natural stream and drainage flows are to be re-established where practicable to approximate original drainage patterns. | Ongoing |
| | Final finished surface levels should as closely as possible match the pre-development levels. | Ongoing |

4.2.4 Implementation

Table 9 provides monitoring actions to enable assessment of the effectiveness of the surface water management actions in place. As discussed in Section 7.5.2 of the PER, the Proposal is unlikely to impact on dissolved oxygen, nitrogen and phosphorus concentrations in surface water, and hence monitoring of these parameters has not been included.

Table 9: Surface Water Monitoring Program

| Topic/Issue | Parameters | Purpose | Frequency | Location |
|---------------------------|---|---|--|---|
| Water quality and levels | Water levels, TDS, TSS, pH, EC and major ions | To ensure that the Proposal is not negatively affecting water quality | Monthly when water is present, for the life of the project | At creek lines downstream of creek diversions |
| Vegetation Health | Monitor health of Mulga, Samphire and River Red Gum vegetation (replicated 10 m wide transects) at specific locations | To assess impacts arising from altered surface water hydrology | Quarterly | At specific locations downstream of diversion structures and linear infrastructure and at control sites |
| Erosion and sedimentation | Inspect erosion, sedimentation and evidence of flow spreading | To ensure that surface water structures do not cause erosion or sedimentation | Following significant rainfall events | Upstream and downstream of culverts, bridges, floodways, diversion structures and adjacent to linear infrastructure |
| Discharge of dewater | Volume, location and quality (pH, EC, TSS, TDS and major ions) of any discharges of dewater to surface water bodies | To ensure that discharge of dewater does not cause unnecessary impacts | Daily when dewater is discharged to surface water bodies | At the point of discharge |

Table 10 identifies the appropriate contingency actions to be initiated in the event that the performance objectives for surface water management are not met.

Table 10: Surface Water Contingency Actions

| Trigger | Action |
|--|--|
| Measurable changes in water quality downstream of mine or mine infrastructure | <ol style="list-style-type: none"> 1) Notify DoW and the DEC in the event of a major increase in hydrocarbon concentrations or turbidity. 2) Investigate cause. 3) Implement remedial action, which may include installation of sediment management systems or changes to chemical management procedures. |
| Measurable changes in water quality in yintas | <ol style="list-style-type: none"> 1) Investigate cause. 2) Notify DoW and the DEC if the change is considered to be due to Fortescue's actions. 3) Implement remedial action, which may include installation of sediment management systems or changes to chemical management procedures. |
| Monitoring of vegetation condition declines by greater than 10% outside of identified potential impact areas (Figure 50 in the PER) relative to control areas over three successive monitoring periods | <ol style="list-style-type: none"> 1) Investigate potential causes. 2) If discharge of dewater is considered to be the cause of the decline, consider ceasing discharge or change location of discharge. 3) If impact is due to other matters related to Fortescue's operations (such as disruption of sheet flow), determine remedial actions (such as surface irrigation) in consultation with DEC. 4) Implement remedial actions if required. |
| Visible erosion or sedimentation | <ol style="list-style-type: none"> 1) Notify DoW and the DEC in the event of a major sediment or erosion issue. 2) Investigate cause. 3) Implement remedial actions which may include: erosion control and bank stabilisation, repair of any erosion and scouring areas and/or construction of improved water control infrastructure. |

4.3 BIODIVERSITY MANAGEMENT PLAN

Vegetation and Flora

Vegetation at Cloudbreak is a mosaic of low woodland with Mulga in valleys and hummock grasslands, low open tree steppe with Snappy Gum (*Eucalyptus leucophloia*) over *Triodia wiseana*, and Kanji (*Acacia pyrifolia*) over soft spinifex and *Triodia wiseana* hummock grasslands. The condition of the vegetation communities in the area is variable and depends largely on the frequency of fires and the extent of grazing pressure from cattle (Mattiske 2005). However, in general the vegetation within the Proposal area is in 'degraded to good' condition, as defined by Keighery (1994).

No vegetation types observed or described by flora and vegetation assessments conducted in the area are representative of any of the Threatened Ecological Communities (TEC) listed by the DEC (ENV 2010), however one Priority 1 Priority Ecological Community (PEC) does occur, namely the Fortescue Marsh (Samphire vegetation). Mulga (*Acacia aneura*) vegetation in the Proposal area is also considered significant by DEC, and partially phreatophytic (groundwater dependent) *Eucalyptus camaldulensis* and *Eucalyptus victrix* occur in open woodland around creek lines entering the Marsh to the north. No Threatened Species or Declared Rare Flora pursuant to the EPBC Act and WC Act were located within the survey area; however four Priority Flora species were recorded (Mattiske 2005, 2007).

A more detailed description of vegetation and flora of the Proposal area is contained in Section 8 of the PER.

Fauna

The Proposal area has a range of habitats that represent a transition from the Samphire flats surrounding the Fortescue Marsh on the southern boundary to the Spinifex covered foothills of the Chichester Range to the north, with creek and drainage lines supporting either acacia shrubland or eucalypt woodland.

A total of 238 species including birds, mammals, reptile and amphibians may potentially occur or have previously been recorded in the surveyed area. There is the potential for 23 species of conservation significance to occur in the area. Twelve of these species have been recorded within the survey area (either directly or through secondary evidence). Seven potential Short Range Endemic (SRE) species have also been previously recorded in the Proposal area.

A more detailed description of the terrestrial fauna of the Proposal area is included in Section 9 of the PER.

4.3.1 Potential Impacts to be Managed

The following activities or aspects of the Proposal may potentially affect biodiversity values:

- **vegetation clearing** for development within the mining areas and installation of water conveyance infrastructure will directly remove vegetation (potentially affecting Priority flora species) and fauna habitat
- **movement of soil** could potentially increase the risk of spreading weeds

- **trenching for burial** of some pipelines may result in the loss/injury of individual fauna
- **the physical presence** of linear infrastructure such as roads and pipelines may disrupt fauna linkages
- **vehicle movements** during construction and operation may result in the loss of individual fauna, especially less-mobile species, from vehicle strikes
- **increased human presence** may increase fire frequency
- **presence of artificial water bodies** may result in the impact to native fauna through increases in introduced fauna, entrapment, poisoning or alteration of fauna behaviour.

Management of potential impacts from redistribution of surface water flows, dewatering and injection of excess groundwater is outlined in Section 4.1 and 4.2 respectively of this EMP.

Other potential impacts from dust emissions, noise emissions, light pollution and feral animals are not expected to be any greater than that already assessed for the approved Cloudbreak Mine and are currently managed with existing management plans.

4.3.2 Performance Objectives

The environmental performance objectives and indicators for biodiversity are detailed in Table 11 below.

Table 11: Biodiversity Performance Objectives and Indicators

| Performance Objective | Performance Indicators |
|---|--|
| To ensure that clearing is as approved for the Proposal | Visual observations of clearing operations. Adherence to ground disturbance procedure. Environmental Incident Reports. |
| To maintain ecological linkages associated with the Proposal area | Site inspection of pipeline installation (i.e. maximum 75 m gap between below-ground pipeline components). Rehabilitation results for major creeks (including Goman Creek and the major creek line in catchment CRE06). |

4.3.3 Management

Management measures have been identified to assist in achieving the biodiversity management objectives (Table 12).

Table 12: Management Measures for Biodiversity

| Parameter | Management Actions | Timing |
|------------------------|--|--|
| Seed collection | Collect seed from areas to be cleared within the Proposal area; for use in future rehabilitation. | Prior to any clearing or earthworks commencing |
| Induction | Implement an induction program for construction personnel which contains information on: <ul style="list-style-type: none"> the requirement to stay within clearing boundaries and adhere to clearing procedures potential for site activities to affect fauna and fauna habitat avoidance of significant fauna habitat where practicable (e.g. creek lines) the ecological values of the Fortescue Marsh and restrictions on access to this area fauna encounter procedures. | Prior to clearing or earthworks commencing |
| Clearing | Limit total Cloudbreak disturbance area to up to 18 100 ha. | Ongoing |
| | Undertake clearing in accordance with the <i>Fortescue Mulga and Other Flora and Communities Management Plan</i> and associated Ground Disturbance Permit (GDP) procedures. | During clearing and construction activities |
| | Construct road and other access alignments and borrow pit areas to avoid DRF and Priority flora as far as practicable (through implementation of the GDP procedures). | During design stage During construction |
| | Demarcate all DRF locations (if found) on the ground with appropriate fencing, signage and flagging. | Prior to clearing or earthworks commencing |
| | Where clearing of DRF cannot be avoided: <ul style="list-style-type: none"> assess the local/regional conservation significance of the species prior to clearing. consult with DEC regarding the proposed clearing translocate individuals to nearby similar vegetation associations will be attempted if practicable, dependent on research advice from consultant botanists and the DEC collect seed and other propagules of DRF prior to clearing and use for revegetation where practicable. | Prior to clearing or earthworks commencing |
| | Undertake clearing progressively (i.e. not clearing 18 100 ha at one time). | During clearing and construction activities |
| | Prune any overhanging vegetation on the clearing boundaries in preference to removing the trees/shrubs. | During clearing and construction activities |
| Vehicle movements | Implement appropriate speed restrictions within the mine area in accordance with the Chichester Operations Fauna Management Plan. | Ongoing |
| | Installation of speed limit signage. | During Construction |
| | Prohibit off-road driving or driving on restricted access routes, other than for emergency situations. | Ongoing |
| Acid sulphate soils | Areas where drawdown may occur will be monitored throughout the mine life and any potential for acidification will be prevented through the manipulation of the injection regime to maintain water levels. | Duration of dewatering operations |
| Native fauna encounter | Give native animals encountered on-site the opportunity to move on if there is no threat to personnel safety in doing so. | During clearing and construction activities |
| | Train appropriate site representatives in snake handling techniques and provide appropriate equipment to safely handle snakes. | Prior to clearing and construction activities |

| Parameter | Management Actions | Timing |
|---------------------------------|---|---|
| Pipeline occurrence | Raise or bury pipelines at a maximum of 75 m intervals to allow vehicle access, surface sheetwater flow and fauna movement. | Ongoing |
| Entrapment in pipeline trenches | Where practicable to do so, trenches shall be filled on the same day as excavation. | During construction |
| | Where trenches are required to remain open overnight, trench plugs and fauna exit ramps shall be installed at both ends of trenches and ramp slopes are not to exceed 45°, unless alternative arrangements are agreed with DEC. | When trenches are open overnight |
| | Open trenches shall be inspected in the morning and prior to filling, by a fauna inspector who will assist trapped animals to escape, unless alternative arrangements are agreed with DEC. | When trenches are open overnight |
| Surface water storage | Install fauna egress points from all lined surface water storage ponds. | Ongoing |
| Fortescue Marsh | Prevent casual or recreational access to the Marsh by mine personnel. | Ongoing |
| Artificial water bodies | Fence artificial water bodies outside of active mining areas. | Ongoing |
| | Include fauna egress points in artificial water bodies outside of active mining areas. | Ongoing |
| | Prevent overflow of artificial water bodies in dry conditions. | Ongoing |
| | Maintain artificial water bodies with no vegetation within the water body or within 10 m of the water body. | Ongoing |
| | Install fauna deterrent devices on any artificial water bodies observed to be attracting birds. | Ongoing |
| | Remove artificial water bodies once no longer required for mining. | At closure |
| Rehabilitation | Rehabilitate disturbed areas (including pipeline corridors) that are not to be utilised post-construction. | Within three months after the completion of construction activities |
| | Utilise only local native flora species in rehabilitation activities within the Proposal area. | Ongoing |
| | Rehabilitate major creeks (including Goman Creek and the major creek line in catchment CRE06). | Ongoing |

4.3.4 Implementation

Table 13 provides monitoring actions to enable assessment of the effectiveness of the biodiversity management actions in place.

Table 13: Biodiversity Monitoring Program

| Topic/Issue | Parameters | Purpose | Frequency |
|---------------------|--|--|--|
| Vegetation clearing | Flagging tape, signage or fencing | To ensure that clearing boundaries are clearly marked. To ensure no unauthorised clearing/access takes place beyond these boundaries. | Daily throughout clearing and earthworks activities. |
| Rehabilitation | Native flora species (presence/absence, species richness, % cover) Weed species (presence/absence, % cover) | To ensure rehabilitation is undertaken to a condition comparable to the surrounding vegetation. | Annually for 5 years. |

Table 14 identifies the appropriate contingency actions to be initiated in the event that the performance objectives for biodiversity management are not met.

Table 14: Biodiversity Contingency Actions

| Trigger | Action |
|---|---|
| Unauthorised access beyond, or breach of pre-defined clearing boundaries | Investigate cause. |
| | Redefine boundaries if due to inadequate boundary marking. |
| | Re-inform all personnel of access restrictions beyond clearing boundaries. |
| | If disturbance to vegetation requires mitigation, then the area disturbed shall be rehabilitated. |
| | An Environmental Incident Report shall be completed. |

4.4 FORTESCUE MARSH MANAGEMENT PLAN

4.4.1 Potential Impacts to be Managed

The following aspects of the Proposal may affect the conservation areas of the Fortescue Marsh:

- dewatering and injection of groundwater may affect groundwater levels and vegetation health in areas with shallow groundwater such as the edge of the Fortescue Marsh
- installation of linear infrastructure, mine pits and waste landforms may result in interference with natural surface water flow regimes and increased erosion risk.

4.4.2 Management Measures and Implementation

Measures for protecting the biodiversity of the Marsh are outlined in Section 4.3. No clearing is proposed within the Fortescue Marsh. Information on the importance of the Marsh ecology will be provided as part of the induction process. Casual or recreational access to the Marsh will be prohibited.

The issue of groundwater mounding and drawdown in the Marsh is a key issue for groundwater management at Cloudbreak. The groundwater management plan for Cloudbreak therefore focuses on this issue and addresses the need for monitoring of potentially groundwater dependent vegetation within the Marsh and response to any changes in vegetation condition (Section 4.1).

Changes in surface water regimes and surface water movement from the Chichester Range to the Fortescue Marsh may impact upon the period of inundation in the Marsh and the health of surface water dependent vegetation within the Marsh. The surface water management plan for Cloudbreak addresses this issue in terms of the health of Marsh vegetation and response to any changes in vegetation condition (Section 4.2).

Fortescue will undertake ongoing consultation with the DEC, Pastoral Lease holders and Aboriginal Heritage stakeholders with respect to the protection of the values of the Marsh over the life of the project.

The management of the Marsh is considered to be addressed adequately in these sections. Additional management measures are not considered to be required for the Fortescue Marsh.

4.5 CULTURAL HERITAGE MANAGEMENT PLAN

The management of Cultural Heritage for all Chichester project areas including Cloudbreak is described in detail in the document *Cultural Heritage Management Plan for Chichester project areas in the Pilbara region of WA* (CB - PL - HE - 0001 REV5) (Appendix A). The Chichester project area is covered by both the Nyiyaparli and Palyku native title claims, although the majority of operations lie in Nyiyaparli country. The purpose of this management plan is to:

- ensure Fortescue complies with its obligations under Land Access Agreements (LAAs) and the *Aboriginal Heritage Act 1972* (AHA) including all ministerial conditions imposed
- protect Aboriginal cultural heritage and minimise the impact of Fortescue's project operations on cultural heritage, particularly in the Chichester project areas.

It is designed as a guide and resource tool for Fortescue employees and contractors and also as a source of information for Aboriginal people and others who are interested to learn more about how this aspect of Fortescue's business is managed.

4.5.1 Potential Impacts to be Managed

The following aspects of the Proposal have been identified as requiring management to minimise potential impacts on Cultural Heritage sites:

- **physical disturbance of the land surface** during clearing and removal of topsoil and overburden has the potential to disturb heritage sites and affect ethnographic values
- **presence of construction and operational personnel** has the potential to disturb heritage sites and affect ethnographic values.

4.5.2 Performance Objectives

Environmental targets and performance indicators have been developed based on cultural heritage management objectives at Cloudbreak (Table 15).

Table 15: Cultural Heritage Management Objectives, Targets and Performance Indicators

| Performance Objective | Performance Indicators |
|---|--|
| To prevent human-induced impact to Cultural Heritage Sites and site markers | Inspections indicate human-induced damage to Cultural Heritage sites. |
| To prevent environmental impact to Cultural Heritage Sites and site markers | Inspections for damage to sites and site markers following heavy rainfall or fire. |

4.5.3 Management

Specific actions have been identified to assist in achieving Cultural Heritage site management objectives (Table 16).

Table 16: Cultural Heritage Management Actions

| Parameter | Action |
|--|---|
| Minimise ground disturbance at or near Cultural Heritage sites | All new ground disturbances require a Fortescue Ground Disturbance Permit (GDP) prior to works commencing. All areas of proposed ground disturbing activities are subject to both an Archaeological and Ethnographic survey prior to approval of a GDP. Construction works will be monitored to ensure compliance with the <i>Cultural Heritage Management Plan for Chichester project areas in the Pilbara region of WA</i> and protective measures such as fencing will be installed and maintained. |
| Induction | Ensure that all employees and contractors are aware of their responsibilities associated with protecting Cultural Heritage sites and participate in heritage inductions. |

4.5.4 Implementation

Table 17 provides monitoring actions to enable assessment of the effectiveness of the cultural heritage management actions in place.

Table 17: Cultural Heritage Monitoring Program

| Location | Frequency | Parameters | Procedure | Purpose |
|-------------------|---|---|--------------------|---|
| Low Risk sites | As project expansion or development requires | Site condition same as condition from initial recording; standard Pink/Black tape affixed to general vegetation | Visual observation | To monitor for disturbance to site and/or site markers. |
| Medium Risk sites | Prior to any ground disturbance commences | Site condition same as condition from initial recording; standard Pink/Black tape affixed to general vegetation and star pickets with pink/black Heritage flags on pins; pink/black Heritage tape tied to top of Star picket/white cap | Visual observation | To monitor for disturbance to site and/or site markers. |
| High Risk sites | At least monthly in addition to regular communication with local work crews | Site condition same as condition from initial recording; standard Pink/Black tape affixed to general vegetation and star pickets with pink/black Heritage flags on pins; pink/black Heritage tape tied to top of Star picket/white cap. Further additional measures required depending on scope of works (Appendix B). | Visual observation | To monitor for disturbance to site and/or site markers. |

Contingencies

Contingency actions have been developed to be enacted if monitoring indicates that the environmental objectives and targets for Cultural Heritage site management are not being achieved (Table 18).

Table 18: Cultural Heritage Management Contingency Actions

| Trigger | Action |
|--|---|
| Damage, disturbance, alteration, modification, impact or entry to an area within an Aboriginal heritage site without proper authorisation. | All heritage incidents will be investigated by an appointed investigation team according to the Fortescue Incident Event Reporting Procedure, recorded in the Fortescue Business Management System and reported to the relevant Traditional Owners. Any person found to have caused a heritage incident may face penalties. |

5. REFERENCES

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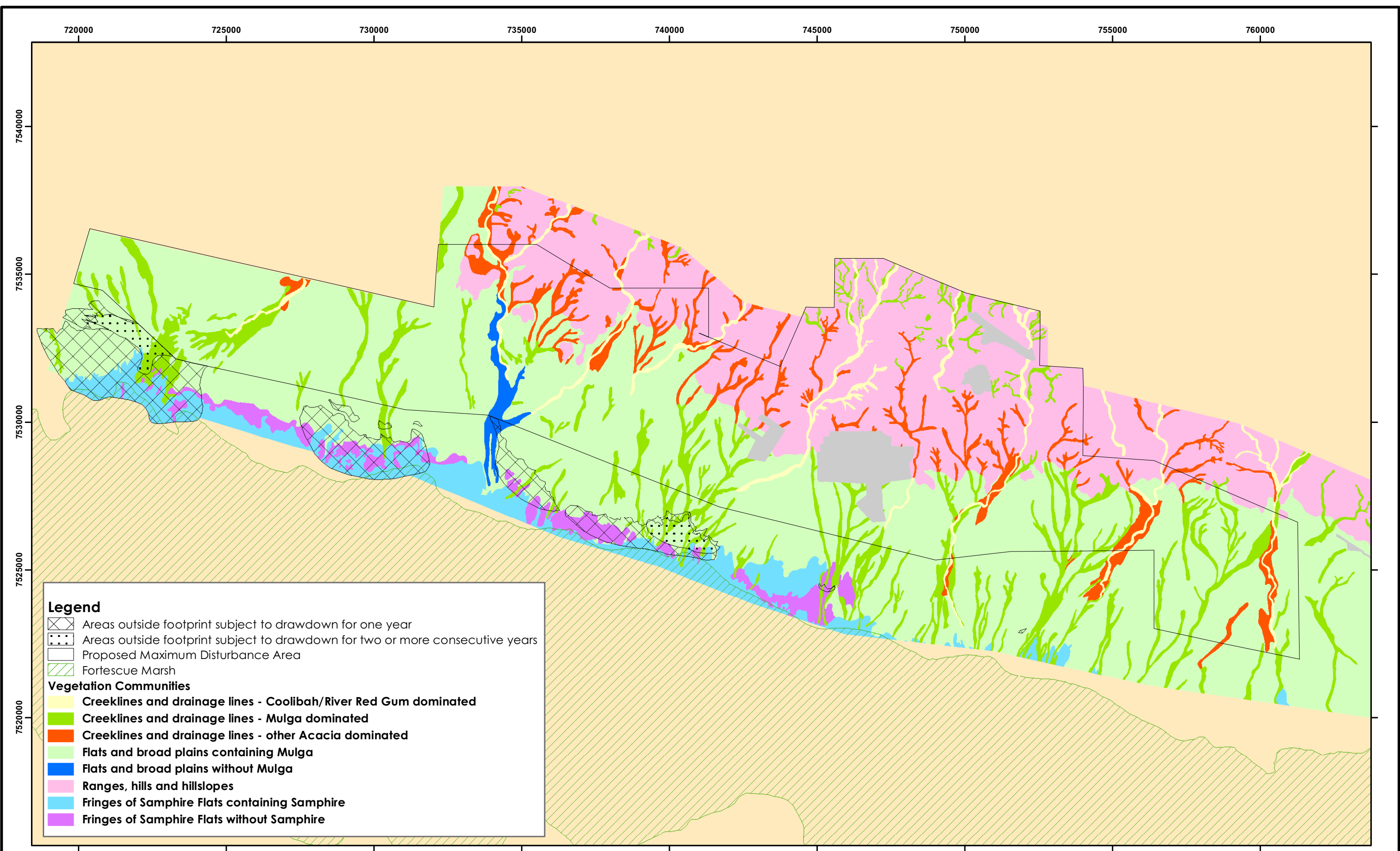
Figures

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Figure 1: Near Surface Groundwater Drawdown for
the Life of the Mine shown over Vegetation Types



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Scale
0 1 2 3 4
Kilometres



Figure 1

Near surface groundwater drawdown for the life of the mine shown over vegetation types

All groundwater drawdowns of more than 1 m that occur within 5 m of the surface are shown (only some of this effect will occur at any one time as mining progresses)

Coordinate System: GDA 1994 MGA Zone 50
Date: 24/11/2010
Prepared By: awilliams
File: ArcMap documents\PER\Figure 57 Groundwater_
drawdown_and_vegetation_A3_RevB.mxd
Original scale: 1:120,000 at A3
Source: FMG 2010
Note that positional errors may occur in some areas

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Figure 2: Near Surface Groundwater Mounding for
the Life of the Mine shown over Vegetation Types



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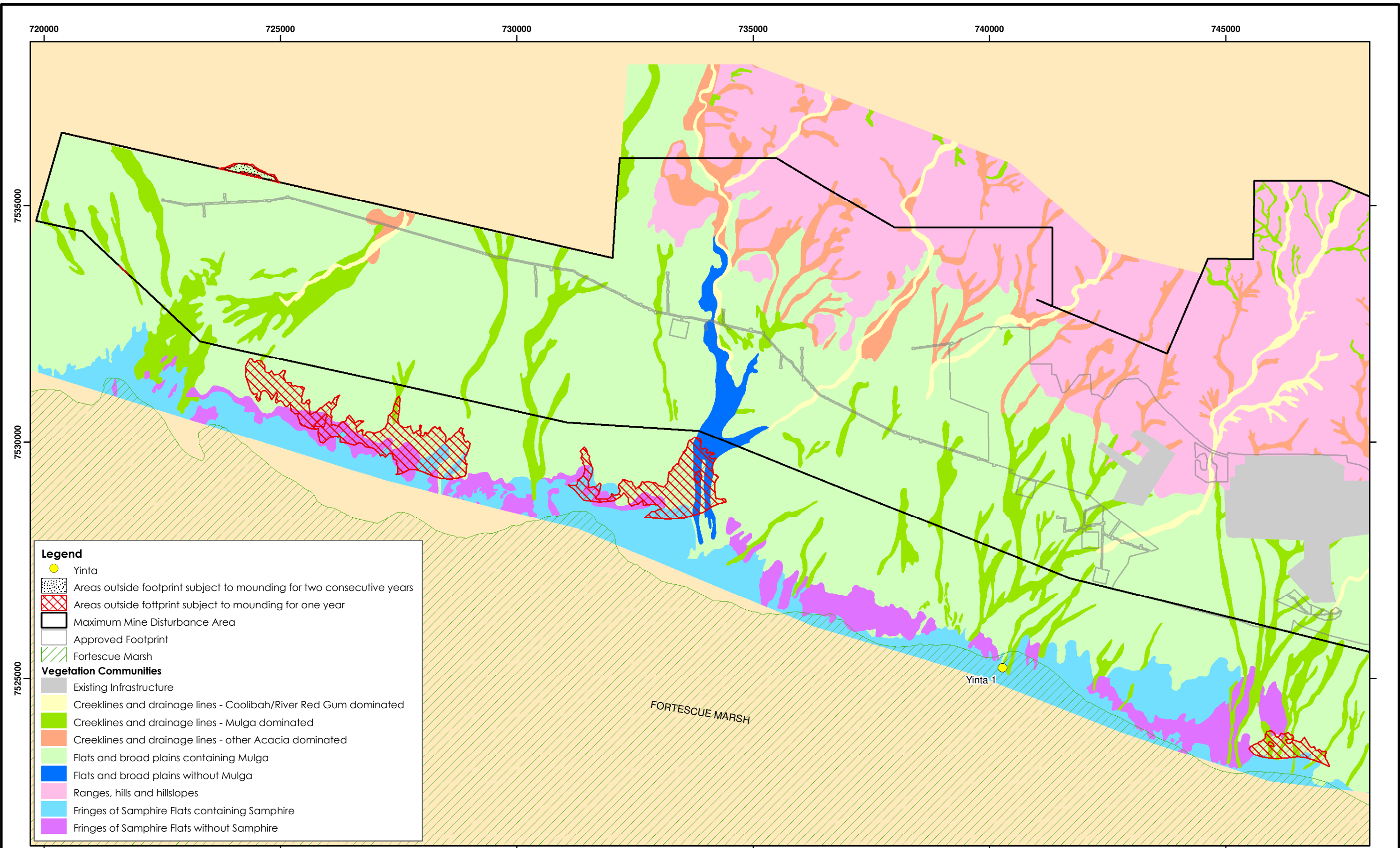


Figure 2 Near surface groundwater mounding for the life of the mine shown over vegetation types

All mounding resulting in a depth to groundwater of less than 2 m, where pre-mining groundwater levels are greater than 2 m are shown (only some of this effect will occur at any one time as mining progresses)

Coordinate System: GDA 1994 MGA Zone 50
 Date: 25/11/2010
 Prepared By: jcrute
 File: ArcMap documents\EMP\Figure 2 Near Surface Groundwater Mounding_A3.mxd
 Original scale: 1:75,000 at A3
 Source: FMG 2010
 Note that positional errors may occur in some areas



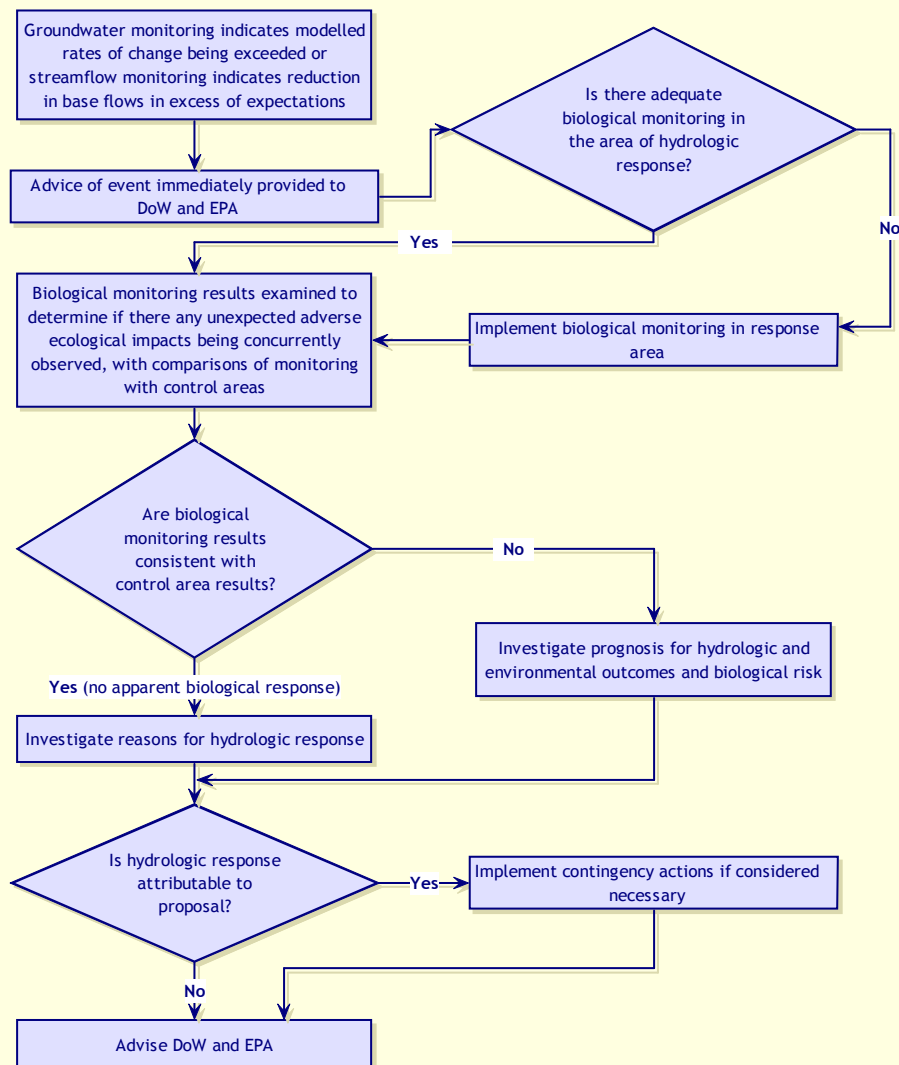
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Figure 3: Flow Charts showing Action Process for
Responding to Hydrological or Biological Monitoring
Triggers

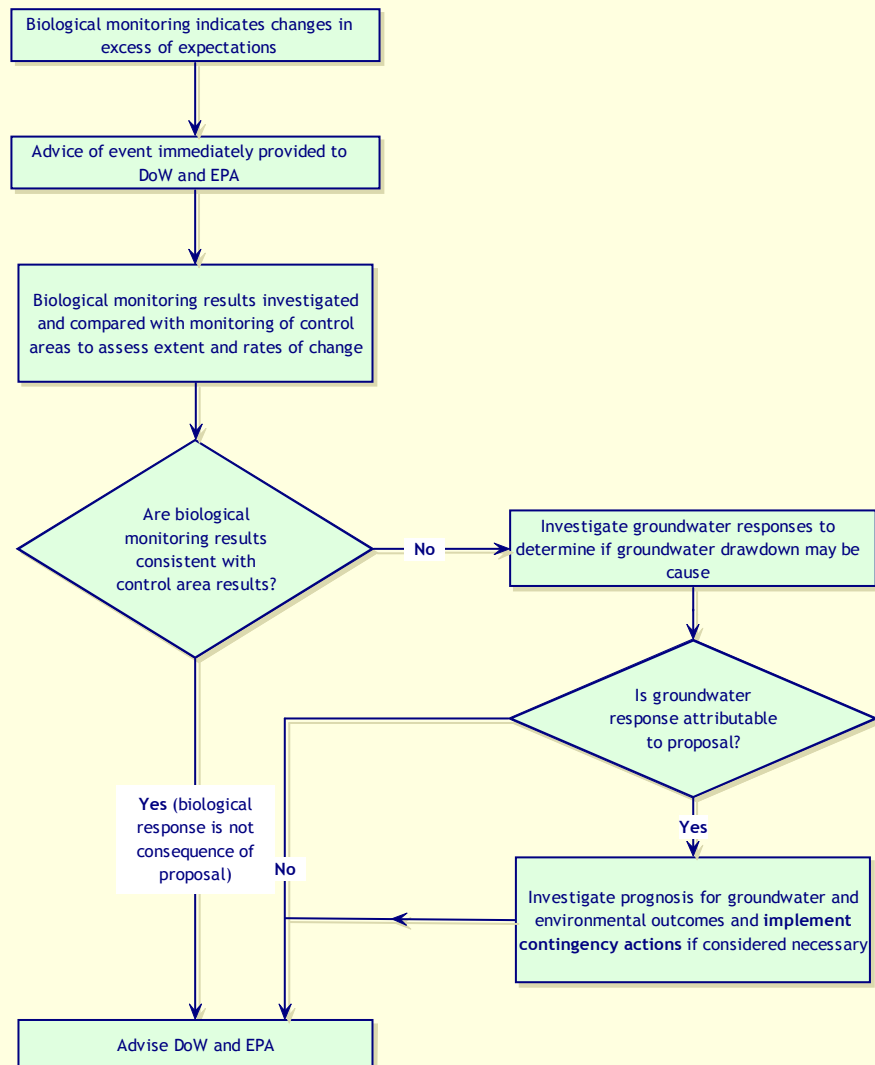


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GROUNDWATER OR STREAMFLOW (HYDROLOGICAL) RESPONSE PROCESS



BIOLOGICAL RESPONSE PROCESS



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