



# Environmental Management and Monitoring Program

Gwindinup Project

FINAL

Prepared for  
Bemax Resources Pty Ltd  
by Strategen

December 2006



# **Environmental Management and Monitoring Program**

Gwindinup Project

## **FINAL**

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December 2006

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## **1. OVERVIEW**

### **1.1 PURPOSE**

The purpose of this Environmental Management and Monitoring Program (EMMP) is to describe the management actions to be implemented prior to and during the mining phase, as well as during rehabilitation, that have been identified as necessary to avoid, minimise and/or mitigate the effects of mining and related activities on the surrounding environment.

This EMMP includes a monitoring program to assess the effectiveness of the management actions and to ensure that determinable changes to the surrounding environment are detected, reported and, if appropriate, acted upon.

### **1.2 SCOPE**

This EMMP applies to the Gwindinup mining project during the phases of mine planning, commissioning, operation and rehabilitation.

### **1.3 CONTENT**

This EMMP includes the following management components:

- mine noise
- traffic management
- dust and smoke (particulates)
- greenhouse gas emissions
- surface water quality
- fauna
- heritage and culture
- radiation
- visual amenity
- decommissioning and closure

### **1.4 RELATIONSHIP TO OTHER DOCUMENTS**

Significant environmental factors are managed through specific site Environmental Management Plans (EMPs). These EMPs are:

- Gwindinup North Integrated Mining and Rehabilitation Plan
- Groundwater Management and Monitoring – Gwindinup. Vegetation Health
- Groundwater Management and Monitoring – Gwindinup. Local Users

Management of common procedures and mine activities are generally defined within Work Instructions and System Procedures that form part of the Companys Environmental Management System as described in Section 2 below. Relevant Procedures and Instructions are referenced in this Plan but not appended.

## **1.5 LEGAL STATUS**

The EMMP is a requirement of Ministerial Statement No. 718, issued by the Minister for the Environment and pursuant to the *Environmental Protection Act 1986*. Once this EMMP is in final form and has been prepared to the satisfaction of the Minister for the Environment, changes to this document cannot be made without approval from the Minister.

All measures and actions contained in this EMMP must be implemented as prescribed. Implementation of this EMP is auditable under Condition 5 of Statement No. 718. Failure to implement this EMMP, as approved, may constitute a breach of the *Environmental Protection Act 1986*.

**Table 1 Summary of risk management and monitoring actions**

<b>Aspect</b>	<b>Hazard</b>	<b>Management</b>	<b>Monitoring</b>	<b>Contingency</b>
Noise emissions	The use of heavy equipment may cause or contribute to excessive noise emissions.	Limit heavy vehicle use during after-hours operations. Ensure vehicles are maintained and drivers are adequately trained.	Monitor noise emissions at least four times a year.	Reduce speed limits. Reschedule after-hours operations.
	The operation of site plant may cause or contribute to excessive noise emissions.	Consider noise emissions and relative location of neighbours when siting plant. Soundproof key sources such as wet plant and trommels. Construct bunds around operations.	Monitor noise emissions at least four times a year.	Investigate source of excessive noise and make appropriate repairs/replacement.
Road traffic	Heavy vehicles (trucks) on secondary roads could cause noise and/or vibration impacts to residences.	Identify sensitive areas. Restrict trucking times and speeds in these areas.	Consult with residences on regular basis. Monitor compliance with transport restrictions.	Reduce speeds and/or trucking times further.
Particulate emissions	Dust and/or smoke from mine operations could cause or contribute to excessive emissions; impact on neighbourhood amenity and/or reduce visibility to road users.	Implement controls during clearing and stockpile construction. Water down internal roads. Seal heavy-use/high risk areas. Vegetate stockpiles.	Monitor dust levels in accordance with Australian Standards at least twice per year during summer.	Implement additional management measures, such as dust suppression. Reschedule activities, if incident is weather-related.
Surface water quality	Water quality could be affected by suspended solids resulting from erosion of the mining/post-mining landscape or from mining processes.	Divert surface water flows around disturbed areas until rehabilitation is sufficiently established. Ensure water discharges from the mine site are sufficiently treated to meet discharge criteria.	Monitor discharges on a daily basis. Monitor receiving environment on a monthly basis, or daily when discharging.	Cease discharging until cause for poor water quality has been remedied.
Fauna	Threatened fauna have been identified in the Gwindinup area. Habitat could be lost as a result of clearing.	Rehabilitation will focus on creating new habitat and connectivity between systems.	Rehabilitated areas will be monitored for colonisation.	Relocation program/s may be required if numbers are high.
Heritage and culture	Landscape disturbances could destroy items or sites of cultural or heritage significance.	Measures are in place to ensure work is stopped if such features are identified.	Archaeologist and/or Aboriginal representative to monitor clearing and topsoil stripping of high risk areas	If items or sites of importance are identified further advice will be sought from the archaeologist and appointed Aboriginal representatives to determine whether the monitoring program should be amended.
Radiation	Return of process tailings could result in localised increases in radiation.	Any dry mill tailings will be disposed of in accordance to approved plan and covered by no less than 4 m of soil	Routine surveys and a final surface gamma survey will be conducted to ensure compliance with and effectiveness of plan.	Recover material or increase cover, as appropriate and to the approval of the regulating authority.
Visual amenity	The operations will be visible to users of local roads. Mining is relatively low profile and temporary.	Bunds along roadside will be vegetated and provide a visual screen. Night-time light will be managed to reduce impacts.	Routine visual assessment by Site Manager and Environmental Staff.	Work in consultation with complainant to address issue, if possible.

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Environmental Management and Monitoring Program

<b>Aspect</b>	<b>Hazard</b>	<b>Management</b>	<b>Monitoring</b>	<b>Contingency</b>
Decommissioning and closure	Environmental or social legacy remains after completion	Co-ordinated and early closure planning to meet agreed end-land use objectives	Assessment against procedures defined in Decommissioning and closure plan	Contingency planning a component of decommissioning plan.

## 2. ENVIRONMENTAL MANAGEMENT SYSTEM

### 2.1 POLICY

Bemax operates a certified ISO 14001 Environmental Management System (EMS). The core of the EMS is the company's Environmental Policy, which has been approved and signed by the Operations Manager.

The Environmental Policy requires that Bemax monitors its performance and aims to continually improve both environmental performance and management.

### 2.2 RESPONSIBILITIES

The EMS designates the following responsibilities to the various staff positions and/or levels.

**Table 2 Responsibilities prescribed by the EMS**

Party	Responsibility
Operations Manager	Responsibilities include ensuring that all Cable Sands' activities conform to the Environmental Policy.
Group OH&S Manager	Responsibilities include taking immediate action where necessary on the receipt of communications and/or complaints regarding environmental issues.
Senior Environmental Officer – Operations & Compliance	Responsibilities include ensuring compliance with relevant environmental legislation and regulations, managing the EMS, maintaining documents and records to demonstrate conformance, and identification of non-conformances with the EMS.
All employees	Responsibilities include ensuring that all operations are carried out in accordance with specified procedures and work practices.

### 2.3 HAZARD IDENTIFICATION

Environmental aspects, which are at risk of being impacted upon by the mining operations, are identified using the procedures set out in SP03 *Identification and Management of Environmental Risk*.

### 2.4 COMMUNICATION

The EMS contains procedures for managing internal and external communications of environmental matters. Environmental hazards and incidents are reported using an incident report (CD018).

All external complaints automatically generate an incident report that is forwarded to and dealt with by the Environment Department<sup>1</sup>.

<sup>1</sup> SP13 Non-Conformance and Preventative Action.

## 2.5 COMMUNITY CONSULTATION AND COMPLAINT PROCEDURES

Bemax has a commitment, under its Environmental Policy, to involve the community in aspects of impact management.

### 2.5.1 Community Consultation

Bemax will continue to liaise with residents and other interested stakeholders with the purpose of informing the community about environmental issues, including noise, or to obtain community feedback and attitudes towards its operations and performance.

### 2.5.2 Complaint Response Procedures

To establish an open line of communication, Bemax has contacted neighbouring residents to discuss environmental issues and continues to liaise with them on a regular basis. These residents are aware of the environmental management requirements of the company and have been informed on whom to contact in the event of an environmental incident.

In addition to the minesite response, environmental complaints will be formally processed through SP13 *Non-Conformance and Preventative Action*. Responsibility for action lies with the Group OS&H Manager. The Environment Department reports complaints and other non-conformances to the appropriate government regulator.

### 2.5.3 Operating Agreements

In the event that effects from the mining operations, despite all attempts at control, continues to have an impact on any neighbouring resident, Bemax will consider actively seeking an agreement with the resident as a means of resolving the issue.

The establishment and content of operating agreements is dependent on a number of factors and will be reviewed as the situation arises. A third party, such as the government regulator, may be consulted with before an offer of agreement is extended, or if agreement cannot be reached.

## 2.6 MONITORING

A monitoring program for each component of the EMMP will be conducted to assess the reliability of risk forecasts and the effectiveness of management measures. Monitoring will be coordinated by the Senior Environmental Officer - Operations & Compliance, and will be conducted in accordance with the appropriate procedures.

Bemax routinely conducts internal audits<sup>2</sup> to assess the compliance with, and effectiveness of the various components of its EMS, including the EMMP. In addition, the entire EMS is audited externally every six months, with a full re-certification audit every three years.

Audit findings are reviewed by the Integrated Management Systems Committee, including the Operations Manager, and acted upon by the Senior Environmental Officer, through the EMS.

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<sup>2</sup> SP15 Internal Audits.

## **2.7 REVIEW AND REPORTING**

Monitoring results and performance and compliance assessments are reported each March to the relevant government agencies and will be made available to relevant stakeholders on request.

### 3. MANAGEMENT COMPONENTS

#### 3.1 NOISE

##### 3.1.1 Management objective

Consistent with the Environmental Policy, the specific objective in managing this aspect for the Gwindinup project is:

- to ensure that noise levels emanating from the project area comply with the *Environmental Protection (Noise) Regulations 1997*.

##### 3.1.2 Risk and risk level

Dry mining requires the use of various types of earth moving equipment, all of which have the potential to be major generators of environmental noise. Mining operations will be 24 hours per day, 7 days per week.

There are a number of potentially noise sensitive premises relatively close to the Gwindinup mine, particularly to the north. The closest of these residences is approximately 500 m from the mine pit.

Factors affecting the transmission and/or intrusiveness of mine noise include climatic conditions (wind speed and direction, temperature inversions), the absence of other noises (road, rail) and personal sensitivity or attitude towards mine noise (Table 3).

The activities that have a high potential to generate or contribute to excessive noise levels include, vehicle use (including heavy equipment, trucking, etc), stockpiling of soil material, removal of soil/vegetation, wet plant operation, and others.

**Table 3 Factors affecting the level and intrusiveness of noise emissions**

Key Variable	Additional Factors
Proximity to residence	<ul style="list-style-type: none"> <li>• Production benefits vs noise control costs</li> <li>• Direction and elevation of residence in relation to the mine</li> <li>• Prevailing weather conditions</li> <li>• Nature of construction and materials of the residence</li> <li>• Sensitivity and/or attitude of the resident(s) towards the mine</li> <li>• Work habits of resident(s) eg shift workers</li> </ul>
Nature of mining activity	<ul style="list-style-type: none"> <li>• Elevation of active area or activity</li> <li>• Hardness of materials being excavated (eg presence of rocks)</li> <li>• Number and nature of mining equipment</li> <li>• Operating hours</li> <li>• Location, elevation and orientation of the primary plant in the pit</li> </ul>
Mine vehicle performance	<ul style="list-style-type: none"> <li>• Changes to mine equipment</li> <li>• Noise reduction measures vs performance reduction</li> <li>• Engine and exhaust noise vs transmission noise</li> <li>• Operator style and awareness/consideration</li> <li>• Frequency and extent of equipment maintenance</li> </ul>

Key Variable	Additional Factors
Background noise	<ul style="list-style-type: none"> <li>• Sensitivity/awareness of traffic and other noise</li> <li>• Interference with performance monitoring</li> </ul>
Weather conditions	<ul style="list-style-type: none"> <li>• Wind speed and direction</li> <li>• Cloud cover and height</li> <li>• Temperature inversions</li> </ul>

### 3.1.3 Management Action

Bemax will seek to operate at all times in a manner that complies with the *Environmental Protection (Noise) Regulations 1997*, with the principle objective of causing no public nuisance or complaint.

Management to reduce the risk of noise impact is split into three components:

- planning,
- control at source
- community relations.

A summary of noise management measures is included in Table 1

#### ***Mine Planning***

Through its planning process, Bemax will identify Noise Sensitive Premises prior to the construction phase. Once identified, a Risk Analysis using the factors listed in Table 3 will be undertaken as required by the EMS.

Following assessment, a selection of the following controls will be used to minimise the risk.

#### **Acoustic Bund Walls.**

The installation of 2 – 4 m earthen bund walls between mining operations and noise sensitive premises is known to effectively reduce noise levels at those locations by redirecting or reflecting noise away from the premises.

Although only a short-term activity, the construction of these walls can result in excessive noise emissions, and residents will be consulted with before the commencement of any such installation. Regulatory advice is that construction of bund walls is governed by Regulation 13 of the *Environmental Protection (Noise) Regulations 1997*. Construction would be limited to daylight hours (7.00 am to 7.00 pm) between Monday and Saturday. Most barriers are usually completed within several working days.

The bund walls themselves are usually stabilised with vegetation or coated to minimise dust and erosion.

#### **Limitations on Work in Early/Late Hours**

During after-hours operations (as defined by the noise regulations) in areas that may affect residents, mobile mining equipment will be limited to front-end loaders working at depth in the mine pit and,

when necessary, water carts. This eliminates any contributions to noise levels by bulldozers and other units. The above limitations will remain in effect until 9.00 am on Sunday and Public Holidays.

The Company reserves the right to utilise any piece of equipment at any time in an appropriate or controlled fashion, including, but not limited to, emergency work. Such a use will still be conducted in accordance with the EMMP and the Environmental Policy.

### Noise Sensitive Zones

Areas of the proposed mine which are at risk of generating excessive noise at neighbouring residences will be designated as “Noise Sensitive Zones”. Extra noise restrictions will be invoked on the site when working in these areas. These include:

- Reduced operating speeds on heavy equipment.
- Restricting the number of units in the area at any one time.
- Sign-posting access routes to the area.
- Limiting operations to day-time activities where possible.
- Sensible placement and orientation of stationary equipment such as trommels and lights.
- Restricting trucking of mineral product to daylight hours.

The use of Noise Sensitive Zones in the past has proven very effective in managing off-site noise impacts.

### ***Control at Source***

Bemax will, in a manner consistent with Best Practice, maintain and operate equipment under its control to ensure that optimum noise performance is achieved. Consideration to noise characteristics is also given during the purchasing of new equipment, as specified in SP19 *Purchasing*.

### Earthmoving Equipment Noise Reduction Engineering

Observations indicate that much of the noise from mobile earth-moving equipment (excluding tracks) operated by Bemax comes from the engine compartment.

Motor noise – managed by enclosing engine housings with sound-absorbing materials and training operators.

Exhaust noise – can be tonal, and is managed by fitting modified manifolds and mufflers to further dissipate noise energy. Rotation of exhaust outlets can direct noise away from sensitive areas based on predominant operating directions.

Fan noise – enclosing the engine bay requires larger cooling fans, and noise from these is managed by placing the fan on the top of the engine to direct noise upwards, or using baffles or louvres.

Noise as a result of the transmission or hydraulic systems is managed through regular maintenance and driver training (see below).

Bemax has adopted benchmarking of noise performance of heavy machinery operating on-site. The process is triggered whenever heavy machinery is replaced.

## Workforce Training and Involvement

Under general environmental training and awareness, noise control issues and the responsibilities of individual employees are discussed via monthly minesite staff meetings. This follows on from initial induction courses where employees and principal contractors are made aware of the importance of their environmental performance

A copy of the site EMMP is kept at the minesite.

### **3.1.4 Monitoring**

Noise emissions from the mining operations will be monitored four times a year and when feedback indicates that noise levels may be increasing or problematic. A noise logger unit can also be deployed to continuously monitor environmental and mine noise levels in various locations as the mine progresses.

Major operating development and rehabilitation events, such as overburden stripping, fines dam construction and plant relocation are monitored more closely as these short term events are recognised as having high noise potential.

### **3.1.5 Contingency**

Due to the staged manner of noise controls, any indication that existing controls are insufficient to meet the management objective, additional management measures will be implemented, as described in that section.

## **3.2 HAULAGE (ROAD TRAFFIC)**

### **3.2.1 Management objective**

Consistent with the Environmental Policy, the specific objectives in managing this aspect for the Gwindinup project are:

- to ensure that increases in traffic activities resulting from the project do not adversely impact on the social surroundings
- to ensure that roads are maintained or improved and road traffic managed to meet an adequate standard of level of service and safety and Main Roads (MRWA) requirements

### **3.2.2 Description**

Transport of the Heavy Mineral Concentrate (HMC) from the Gwindinup minesite to the North Shore processing plant in Bunbury will be undertaken by a heavy haulage contractor. Subject to final approval from MRWA this will include an internal haulage route leaving the minesite through Lots 3287 (Cable Sands) and Lot 3 (WA Planning Commission) onto gazetted heavy haulage routes, South Western Highway, Robertson Drive and Koombana Drive. Entry to the minesite will be via SW Highway & Lowrie Rd.

Trucking typically occurs in batch runs, usually in between 7 am and 8 pm Monday through to Saturday, however it may need to occur on Sunday and public holidays between 9 am and 8 pm.

Transportation is conducted via road trains hauling up to 42 - 59 tonnes at an average rate of 6 - 12 return journeys per day. At times trucking will be carried out in batch runs with trucking rates during these times increasing up to a maximum frequency of 24 return journeys per day.

### 3.2.3 Risk and risk level

Haulage has the potential to impact on environmental aspects including noise, greenhouse emissions, dust, surface water, groundwater, and fauna. Safety of other road users is also considered. An overall indication of risk is provide in Table 3.

Road	Manager	Risk
Internal Road	Designed and constructed to Australian Standards by BEMAX. Intersection with SW Highway requiring approval from MRWA.	Average heavy haulage of approximately 6-12 truckloads per day, increasing to a maximum of 24 per day during batch runs. No public traffic to utilise this road.
Lowrie Rd	Intersection with SW Highway requiring approval from MRWA . Heavy Haulage on Lowrie Rd requiring approval from Shire of Capel. Heavy earthmoving equipment require licence from MRWA and Capel Shire to cross Lowrie Rd when exiting minesite.	Increase in average heavy haulage of approximately 6-12 truckloads per day, increasing to a maximum of 24 per day during batch runs. Small volume of mostly local traffic currently utilises this road.
South West Highway/Robertson Drive/Koombana Drive.	These are MRWA approved heavy haulage routes that currently receive heavy traffic from a number of sources, including the mineral sands industry.	Additional traffic to these roads from the proposal will be relatively small and any additional impacts are considered to be minimal.

### 3.2.4 Management Actions

Management practices are listed below:

- Upgrading of roads to meet requirements of the vested agency, if necessary, will ensure a road surface suitable for heavy haulage.
- Internal haulage road will be watered down during drier months to prevent the generation of excessive dust.
- A sealed apron will be installed on the internal road as it intersects SW Highway to prevent soil material from being tracked onto the highway.
- Heavy haulage will be avoided during Sundays and public holidays, unless necessary. This will also reduce the traffic hazard resulting from increased recreational traffic flow.
- Safety awareness training will be provided to truck operators travelling between Gwindinup and Bunbury with particularly emphasis placed on the location of school bus routes and vehicle entry points of local traffic.
- Trucks carting HMC must have their loads covered before leaving the mine site as per WI037 Bulk Haulage by Contractor.
- Impacts on fauna, dust and noise will be reduced by a internal speed limit of 30km/h.

### 3.2.5 Monitoring

Noise levels at selected residences along the trucking route will be routinely monitored. Results will be provided to the resident and will be reported in the Annual Environmental Review.

## 3.3 AIR QUALITY - PARTICULATES

### 3.3.1 Management objective

Consistent with the Environmental Policy, the specific objectives in managing this aspect for the Gwindinup project are:

- to ensure that particulate emissions, both individually and cumulatively, meet appropriate criteria and do not cause an environmental or health problem
- to use all reasonable and practicable measures to minimise the discharge of particulate wastes

#### Criteria and Targets

The following criteria and targets apply to the Gwindinup minesite:

- Cable Sands will not cause an increase in the level of dust across the boundary of the premises, greater than 1000 micrograms per cubic metre<sup>3</sup>.
- Cable Sands will prevent visible dust attributable to its operations from crossing the premises boundary by taking the dust control measures specified in this plan.

In this document, 'dust' refers to total suspended particulate matter (TSP), as defined by AS/NZS3580.9.3:2003.

### 3.3.2 Description

Construction and operational mining activities involve the disturbance of large amounts of soil, often over a wide area and in exposed locations. Consequently the risk of excessive dust generation is very high.

Dust from mine sites is termed "Course Particulate Matter" (CPM), predominantly having a diameter larger than 10 microns<sup>4</sup>. Particles over this size range are not considered to pose a significant health or environmental threat, but are viewed mainly as a nuisance and an aesthetical problem. Excessive dust generation also has the potential to affect the marketability of nearby horticultural produce.

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<sup>3</sup> This emission limit has been imposed by the DEC on past and current Cable Sands minesites.

<sup>4</sup> NSW Minerals Council Technical Paper – Particulate Matter and Mining (undated)

Ambient levels of total suspended particulates (TSP) at Gwindinup are strongly influenced by the following:

- adsorption of particulates by leafy vegetation
- neighbouring farming activities eg ploughing
- unsealed roads
- smoke from burns/fires

At Gwindinup, winter storms bring squally winds from the north-west to south-west. Summer afternoon sea breezes of moderate to high strength are from the south west. Hot dry easterly winds of moderate strength occur at night and early in the day during summer.

### 3.3.3 Risk and risk level

Previous mine experience suggests the greatest potential for dust generation is during the removal of vegetation and removal and replacement of topsoil and overburden. Vehicle movements on unsealed internal mine roads also pose a high risk. Removal of the ore is not expected to generate problematic quantities of dust due to restricted airflow in the pit and higher soil moisture levels. Other potential problems may be associated with the burning of felled timber, controlled burning during rehabilitation, and unstabilised stockpiles.

As the minesite is located in a rural setting, approximately 3km from the nearest town, sensitive receptors are limited to several farm residences located predominantly to the northwest, west and southwest of the Gwindinup North project area. (see Figure 1 below). During the drier months it is winds from the east which pose the biggest risk to excessive dust generation at these premises.

### 3.3.4 Management Action

A number of work instructions apply to management of activities that may result in dust or smoke emissions. These include:

- *WI225 Management of Clearing and Burning*
- *WI223 Top Soil Stripping and Management*
- *WI232 Conditions to Operate a Water Cart.*

Where possible soil (particularly topsoil) is stripped outside of summer months or wetted down prior to movement to ensure an adequate level of moisture is present to bind particles. Similarly climatic conditions including wind direction and speed is considered before any burning takes place.

Other management includes stabilising stockpiles, including HMC stockpiles, by either keeping them moist, vegetating or surface treatment (such as clay fines or commercial treatment). To control dust from rehabilitated areas, windbreaks and/or mulch will be used until sufficient vegetated ground cover has been established.

Internal roads are routinely wetted down during dry conditions using a mine water cart.













380000

381000

382000

### Legend

#### Proposed Mine Layout

-  Buildings
-  Discharge Point
-  Diverted Drain
-  HMC Plant Site
-  Mine Haulage Road
-  Orebody
-  Overburden Stockpile
-  Road Deviation
-  Slime Dam
-  Topsoil Stockpile
-  Water Dam
-  Sensitive Residences

6291000

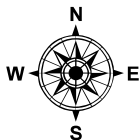
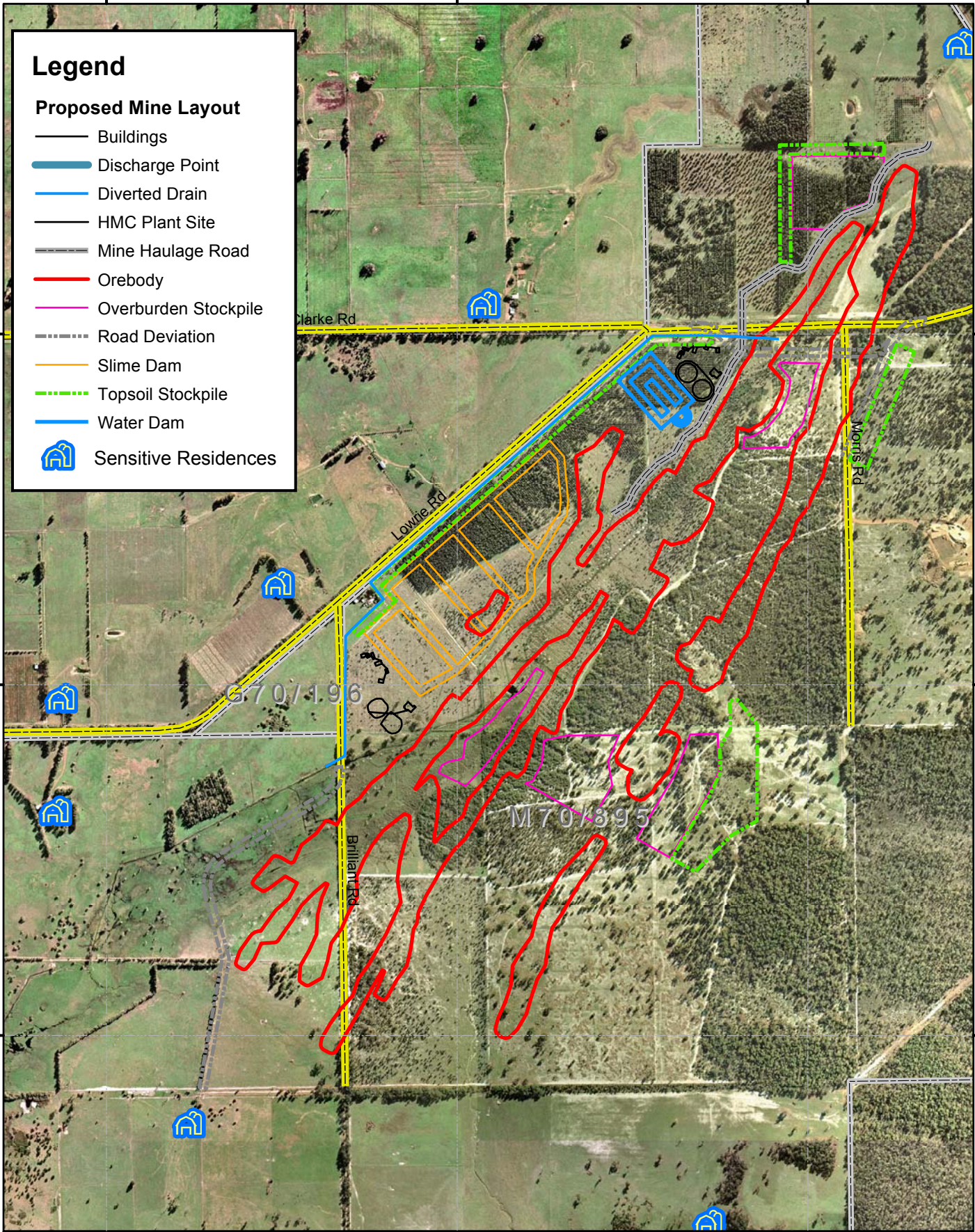
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**Fig 1**  
**Gwindinup North**  
**Location of Sensitive Residences**



Drawn : B Edwards

Originator : BE

File Name :

Date : 24 July 2006

Version : 1

Datum : GDA Zone 50

### 3.3.5 Monitoring

The site supervisor as an ongoing part of the mine management will assess activities likely to generate dust. Where appropriate, conditions will be assessed which may lead to modification or postponement of dust generating activities.

It is a typical requirement of environmental licenses that dust levels on the minesite boundary are routinely monitored. This will include at least once per month during construction activities (works approval period) and at least four times during the mining phase (licence period) between the period September to May. Monitoring will be undertaken in accordance with AS/NZS 3580.9.3:2003, which provides information and requirements on preparation, calibration, reporting and quality assurance. The sampling period is a minimum of 24 hours. WI046 *Operation of High Volume Sampler* documents these procedures.

Location of the HVA unit is limited by the availability of a suitable and continuous power supply (240V). Several locations will be progressively established close to the site boundary between mine operations and surrounding residences. At least two of these locations will be monitored during each sampling event depending on the location and nature of mine activities at that time.

Monitoring will include construction, operation and rehabilitation phases and will continue until vegetation is re-established following mining.

Public complaints of excessive dust crossing the minesite boundary will be reported as an Environmental Incident under the EMS and investigated immediately.

### 3.3.6 Contingency

In the event that dust or smoke emissions from the site become, or could be expected to become unacceptable or exceed specified levels, immediate action will be taken to suppress the source of the emissions, if beneficial. The causes of the emission will be reviewed and appropriate measures will be implemented to ensure that the likelihood of a repeat of the event is reduced.

Remedial action (such as cleaning premises or produce) may be required if excessive dust impacts on the amenity or livelihood of surrounding landowners.

## 3.4 AIR QUALITY - GREENHOUSE GASES

### 3.4.1 Management objective

Consistent with the Environmental Policy, the specific objectives in managing this aspect for the Gwindinup project are:

- to ensure that greenhouse gas emissions, both individually and cumulatively, meet appropriate criteria and do not cause an environmental or health problem
- to use all reasonable and practicable measures to minimise the discharge of greenhouse gases

### **3.4.2 Description**

The Gwindinup project is expected to generate approximately 10.4 kt/a of carbon dioxide due to electricity use and fuel consumption. This is less than 0.02% of WA's emissions in 1990.

The major sources for emissions are those activities that require the burning of hydrocarbons, such as transport and earthmoving, in particular using heavy machinery. The wet plant, pumps and lights will require electricity and greenhouse emissions created from producing this electricity can be attributed to the operations.

The clearing and burning of vegetation will also contribute to greenhouse emissions.

### **3.4.3 Risk and risk level**

Emissions from the Gwindinup project are expected to be equivalent to emissions from soon to be or recently ceased mining operations, and therefore no net increase in overall carbon dioxide emissions are expected.

### **3.4.4 Management Action**

The main focus of management is the pursuit of gains in energy and fuel efficiency. This objective is also driven by dramatic increases in the cost of both of these commodities. Energy efficiency programs are ongoing as part of Continual Improvement.

Clearing of remnant vegetation will be minimised by detailed mine planning and strict control of clearing activities.

All timber with a commercial value will be provided to local sawmills to reduce burning requirements and provide an additional sink for carbon dioxide.

### **3.4.5 Monitoring**

Minesite fuel consumption figures are provided each year to the Commonwealth and State governments as part of the National Pollutant Inventory

## **3.5 SURFACE WATER QUALITY**

### **3.5.1 Management objective**

Consistent with the Environmental Policy, the specific objective in managing this aspect for the Gwindinup project is:

- to maintain or improve the quality of surface water to ensure that existing and potential uses, including ecosystem maintenance are protected, consistent with the WA Guidelines for Fresh and Marine Waters (EPA 1993)

### **3.5.2 Description**

The project area is situated within the Capel River catchment, and is transected by a number of small streams and agricultural drainage lines that drain into the Gynudup Brook. Most of these drainage

lines and streams are seasonal and only flow during winter. These tributaries also currently receive drainage from agricultural land uses.

Gynudup Brook is a tributary of the Capel River. The adjacent catchment for the Preston River will not receive runoff from the mine site areas.

Water quality data indicates that stream flows typically have a salinity of less than 500mg/L TDS, though on occasion salinities of up to 1 800mg/L TDS have been recorded.

### **3.5.3 Risk and risk level**

The project is located within the Capel River catchment as stated above, therefore any potential impact on surface waters draining into the Gynudup Brook catchment would be transmitted down stream to the Capel River.

The Preston River is not expected to receive runoff from the mine site, consequently there is negligible risk of polluted surface water runoff from minesite areas entering its streams.

The main impacts to surface water include stormwater runoff, inefficient internal drainage systems that may allow the mine site to flood or allowing contaminated and turbid water into streams and drains, and discharges of saline and turbid water from process water circuit.

Other potential sources of surface water contamination are:

- turbid water developed by disturbance of existing streams,
- leachates from sewerage systems or other wastes,
- hydrocarbon spillage associated with fuel storage or machinery operation.

### **3.5.4 Management Action**

The Gwindinup Integrated Mining and Rehabilitation Plan addresses the management of the majority of impacts associated with surface water. Management of other important impacts are as follows.

Stormwater, drains and streams are diverted around and away from disturbed areas (including mining infrastructure such as roads, HMC, soil and vegetation stockpiles, wet plant and others) and into sedimentation ponds if possible. Where possible, water in these ponds will be incorporated into the water circuit.

Discharge from the mine water circuit will only occur if internal safe levels are exceeded or to ensure sufficient flows are maintained in the downstream sumpland feature. Discharge will only consist of clear overflow from water storage dams or decanting of settled water from fines dams. Discharge will be dispersed into existing diffuse flows downstream of the mine site. Any discharge is to be monitored daily.

A domestic sewerage treatment system will be installed in accordance with Shire requirements.

Fuel will be stored in bunded areas conforming to Australian Standards. Spill clean-up kits are maintained on-site and all employees and contractors are briefed on their use under the Company induction program.

All spill incidents are to be reported as an environmental incident and managed through the Company's EMS.

### **3.5.5 Monitoring**

All offsite surface water discharges will be monitored daily for as long as they persist, in accordance with *WI261 Water Sample collection from Water Dam or Surface Water*.

## **3.6 SURFACE WATER QUALITY - FINES MANAGEMENT**

### **3.6.1 Management objective**

Consistent with the Environmental Policy, the specific objective in managing this aspect for the Gwindinup project is:

- to maintain or improve the quality of surface water to ensure that existing and potential uses, including ecosystem maintenance are protected, consistent with the draft WA Guidelines for Fresh and Marine Waters (EPA 1993)

### **3.6.2 Description**

Mining at Gwindinup will involve the construction and maintenance of a series of shallow dams associated with the removal of fine clays (fines) from the mine water circuit, namely the solar drying of the underflow from the thickening tank. These dams will cover a significant area of the mining operation.

The dams are used on a rotational basis. Clarified water is decanted from the settled clay fines and returned to the water supply dam. At the end of the life of the dam (ie when it is full and dry, or mining in the area ceases) the dam and the clays are spread in a layer over the replaced mine overburden and/or tails and reincorporated into the soil profile.

### **3.6.3 Risk and risk level**

Due to the large scale of the fines management procedures, including fines dams, pipelines, and water treatment facilities, there is potential for a number of risks to develop. Major risks include those to surface water incorporating the expected increase in turbidity of water ways should a spill, leakage or burst occur along a pipeline or dam. There is also the threat of a saline discharge from the fines dams/pipeline due to a build up of TDS within the process water.

Spillage of the flocculant/coagulant also needs to be considered as a potential risk even though the chemical is inert. There are potential impacts from fines throughout the mine life, risks from activities such as construction, use and maintenance, and decommissioning (noise, dust and depth of clay respread/rehabilitation, these are dealt with in appropriate sections).

### **3.6.4 Management Action**

Refilling and operation of the coagulant feed tanks for the thickener will be done in accordance with *WI337 Taking Delivery of Optimer and Coagulant Flocculants*.

Startup and shutdown of the thickener will be done in accordance with *WI349 Thickener Start-Up and Shutdown*.

Fines dam construction and management will be undertaken in accordance with *WI220 Dam Construction – Management of Levels and Overflow*.

A minimum setback of 25 metres applies to fines dams constructed adjacent to minor watercourses (ie. not subject to flooding) and 50 metres where a risk of flooding may be present.

Placement, construction and inspection of pipelines and pumps will be undertaken in accordance with *WI210 Laying a Pipeline*

It is a typical permitting condition that there is a minimum distance of 1 metre between the weir overflow level and the clay fines.

### **3.6.5 Monitoring**

To ensure legal requirements are met and to minimise the risk of turbid discharge, levels in the dams are monitored on a regular basis, and the dams used accordingly. The structural integrity of the fines dams is inspected routinely to the requirements of the State Mining Engineer. To ensure that the mine is not impacting on the watercourses that transect the mining operations, water quality is monitored both up and downstream of the minesite on a monthly basis (when flowing) or daily when discharging (if accessible).

Discharge from the water circuit will be sampled daily, according to *WI261 Water Sample collection from Water Dam or Surface Water*.

## **3.7 SPECIALLY-PROTECTED AND PRIORITY FAUNA**

### **3.7.1 Management objective**

Consistent with the Environmental Policy, the specific objective in managing this aspect for the Gwindinup project is:

- to protect Specially Protected (threatened) and Priority Fauna and their habitats on the mine area, consistent with the provisions of the *Wildlife Conservation Act 1950*

### **3.7.2 Description**

Mining lease M70/895 has small areas of high conservation (jarrah) vegetation within its eastern borders, some of which will be cleared. This has the potential to impact on populations of Chuditch *Dasyurus geoffroyi* and Western Ringtail Possum *Pseudocheirus occidentalis* in the area. Both are threatened species. In addition, two threatened species of cockatoo: the Long-billed Black Cockatoo *Calyptorhynchus baudinii* and the Short-billed Black Cockatoo *Calyptorhynchus latirostris* may nest in the area.

No species of amphibians or fish were identified as either protected or listed on CALMs' database of Priority Fauna.

### 3.7.3 Risk and risk level

Impacts from mining will include the need for vegetation clearing, therefore habitat loss, fauna injury or deaths, fauna stress and restrictions to possible migration patterns could occur. Many of these impacts are only relatively short-term and are expected to only occur during the period of mine operations.

Although most impacts are expected to occur due to clearing of native vegetation some species (mainly birds) were found to utilise the Bluegum plantations, and in winter a number of water bird and frog species utilise the areas of waterlogged pasture.

A 2004 survey for significant species (Bamford and Wilcox, 2004) did not trap any Chuditch during the monitoring period (although individuals were trapped during earlier surveys in 1999) and did not observe any Western Ringtail possums during spotlighting. The Quenda *Isoodon obesulus* and Brush-tailed Possum *Trichosurus vulpecula* were trapped but not in areas proposed to be disturbed. Neither of these species are listed as Threatened.

A targeted survey for the Western Ringtail Possum (WRP) was conducted during September 2005 (Harewood, 2005) Five individuals were identified within the Gwindinup North lease over three nights. Three on the NE edge of the proposed mining pit, adjacent to Lowrie Rd and two within remnant vegetation to be retained between the central and eastern mineral strands. A follow-up survey was conducted in November 2006 at the request of the DEC, with a focus on areas of native vegetation adjoining the northeast project area.(Harewood, 2006). The northern mining area adjoining Lowrie Rd was also resurveyed. 30 WRP's were identified over two nights. Two WRP's (possibly the same individual) were located within the proposed mine disturbance area with the remainder located outside the project area. Studies concluded that there was a very low density of WRP within the proposed disturbance area and large areas of suitable habitat supporting a robust WRP population adjacent to the site. The small number of WRP displaced by mining should be adequately relocated to adjoining areas of habitat with no measurable impact on the local population.

### 3.7.4 Management Action

#### **General**

The primary mechanism for the protection of Threatened and Priority Fauna will be the implementation of the *Gwindinup Integrated Mining and Rehabilitation Plan* and the covenanting of vegetated areas not affected by mining. This will ensure suitable habitat for Threatened species is replaced or improved in the longer term. Rehabilitation planning has focussed on reconnecting remnant areas of vegetation wherever possible to improve fauna corridors.

#### **Western Ringtail Possum**

Specific clearing protocols will be implemented to manage any resident WRP in accordance with strategies suggested by DEC and Harewood (2006);

- Mine planning is to ensure as much vegetation as feasible will be retained within the development site in accordance with the Integrated Mining and Rehabilitation Plan.
- Prior to works, trees to be removed will be clearly marked so that no unnecessary clearing is carried out. Areas where no clearing is required will be barricaded/bunted/fenced off to prevent accidental access and damage by machinery.

- A qualified expert or recognised wildlife carer will be engaged to supervise any animal handling and the rescue of injured WRP's. Immediately prior to clearing, vegetation will be searched for individual possums and dreys. If possible all dreys will be removed from trees to be felled the day (or if occupied, during the night when unoccupied) prior to the clearing. This will reduce the chance of possums being present when clearing takes place.
  - Clearing contractors will be inducted by the expert or wildlife carer about trees that need to be retained and about the likely presence of WRP among trees and vegetation that will be cleared prior to clearing.  
The induction and subsequent clearing should incorporate the following:
    - Whether or not a machine operator sees a Western Ringtail Possum in a tree that is about to be cleared, all trees identified by the expert as having potential to contain WRP's should be bumped or shaken firstly.
    - Following this the machine operator should wait and observe the tree for a short time. If present, the shaking of the tree may cause any Western Ringtail Possums and other fauna to move and, therefore, a greater chance that the machine operator will see the animal/s prior to pushing down the tree.
    - In the event that a WRP is observed in a tree that is about to be cleared and there is a tree marked for retention near the tree which is to be cleared then the tree should be gently lowered to the ground to enable the animal opportunity to safely evacuate. The animal/s then need to be encouraged to move towards and occupy the tree that is to be retained.
    - If there are no trees to be retained within proximity of a tree that has a WRP and it needs be cleared, then the qualified expert or recognised wildlife carer should attempt to catch the animal prior to the tree being pushed down. Captured, uninjured animals should be relocated to the nearest area of suitable habitat to be retained.
- Note: Qualified expert or wildlife carer should:
- Have appropriate equipment to administer emergency care to any injured/displaced WRP's (e.g. heat pack, box/cage, blankets).
  - Have a suitable care facility of their own or prior arrangement with a carer who could care for/rehabilitate any injured animals
  - Notify DEC's, Regional Wildlife Officer (Bunbury 9725 4300) of WRPs going into care; and,
  - Be able to recognise suitable WRP habitat adjacent to the clearing.
- Stockpile practices. Contractors need to be made aware that displaced WRP may shelter within stockpiled vegetation. Therefore, to minimise any accidental injury or death WRP, personnel involved in the removal or disposals of stockpiles need to be made aware of and be prepared for the potential presence of Western Ringtail Possums. If Western Ringtail Possums are encountered then the qualified expert or recognised wildlife carer needs to attempt to catch the animal.
  - Rehabilitation will include provisions for habitat logs and harbourage features. Wherever restoration planting is carried out it will include dominant species found in remnant vegetation on site. Planting will as far as practical, aim to ultimately create a continuous link between remnant vegetation in and adjacent to the proposed development in addition to replacing vegetation that will be lost. Fencing design will not impede the movement of fauna.

### **3.7.5 Monitoring**

A qualified specialist will undertake monitoring of the population of WRP adjacent to the project area annually through-out the mining phase of the project. This will commence within 2 months following completion of the first clearing phase that involves native vegetation. Results of this monitoring will be submitted to DEC for review.

A further search for WRP's will be undertaken within the Gwindinup South project area prior to any ground disturbance activities occurring and if encountered the management strategies outlined will be adopted.

### **3.7.6 Reporting**

Within 4 weeks of completion of each annual clearing phase, Bemax will produce a brief report to be submitted to DEC on the outcomes of the implementation of the above commitments with particular emphasis on actual possum encounters and movements.

## **3.8 INDIGENOUS AND NON-INDIGENOUS CULTURES (HERITAGE)**

### **3.8.1 Management objective**

Consistent with the Environmental Policy, the specific objectives in managing this aspect for the Gwindinup project are:

- to ensure that the mine operations comply with the requirements of the *Aboriginal Heritage Act 1972*
- to ensure that changes to the biological and physical environment resulting from the project do not adversely affect cultural associations with the area
- to comply with statutory requirements in relation to areas of cultural and historical significance

### **3.8.2 Description**

An archaeological and ethnographic survey of the project area was completed by consulting specialists (including representatives of the Gnaarla Karla Booja native title claim) in March and April 2001 (McDonald, Hales & Associates, 2001). The survey identified one archaeological site (DIA18900) consisting of a series of five discrete, though connected, artefact exposures located along the northern and western shore of a degraded wetland. The site extended several hundred metres on either side of Lowrie Rd (Lots 3287, 393 & 101) at the northern end of the Gwindinup North deposit.

The ethnographic survey identified that all creek systems within the project area were considered to have spiritual significance due to their association with the Dreaming figure, the Waugal.

No sites of European heritage significance listed with either the Heritage Commission or the National Trust occur within the project area.

### **3.8.3 Risk and risk level**

All ground-disturbing activities have the potential to impact on this aspect although it is considered that near surface disturbance such as vegetation clearing and topsoil removal poses the highest risk of unearthing Aboriginal artefacts or remains.

### 3.8.4 Management Action

A Section 18 permit to disturb the registered site (18900) was granted to Cable Sands on the 5<sup>th</sup> July 2002 subject to several conditions being met. These Conditions form proposed management actions;

- A Section 16 permit to be obtained by a qualified archaeologist to undertake further research with the involvement of the Aboriginal community to include surface recording, archaeological test pitting/analysis of material and radiometric dating (if possible) and storage of artefactual material with the Aboriginal community.

In addition the Company has internal procedures to be followed by all employees and contractors in the event of unearthing potential artefactual or skeletal material. These procedures are communicated to employees and contractors via the site induction program.

As a component of Cable Sands commitment to increasing indigenous awareness amongst employees, the Company periodically employs indigenous people to conduct awareness training for all employees. This practise will continue throughout the life of the Gwindinup mine.

### 3.8.5 Monitoring

- Monitoring by Section 16 permit holder and/or an appointed Aboriginal representative of vegetation clearance and topsoil excavations during the development phase, especially in creek areas.

### 3.8.6 Contingency

- In the event further significant material is identified, the monitoring program may be intensified depending on further advice provided by the archaeologist and Aboriginal representatives.

## 3.9 RADIATION

### 3.9.1 Management objective

Consistent with the Environmental Policy, the specific objectives in managing this aspect for the Gwindinup project are:

- to ensure that radiation levels at neighbouring premises are not affected by the mine
- to ensure that post-mining radiation levels are consistent with, or below, pre-mining (background) levels

### 3.9.2 Description

Mining of heavy mineral concentrate will remove the majority of the elements contributing to the current background levels of gamma radiation. Preliminary gamma radiation surveys indicate surface radiation levels within the project area very low, ranging from 0 to 0.13 µG/hr. These levels are typical of the Swan Coastal Plain and do not represent a safety hazard.

Extensive volumes of overburden that overlie the mineral deposit naturally insulate and reduce natural gamma radiation experienced at ground level.

### 3.9.3 Risk and risk level

The titanium mineral contains a small amount of radioactive elements. The mining and consequent concentrating of this mineral also concentrates these radioactive elements. The predominant risks are those to employee and general public safety. Extensive precautions are in place to minimise risk from spillage or release of dust from the radioactive monazite tailings. The potential risk of increased radiation of the site due to replacement of tails also needs to be considered.

### 3.9.4 Management Action

The Radiation Management Plan (CD 669), which is approved by the Department of Industry and Resources (DOIR), will be fully implemented.

The objective with regard to this environmental factor is to ensure that radiological impacts to the public and the environment are kept As Low As Reasonably Achievable (ALARA principle) and comply with acceptable standards.

### 3.9.5 Monitoring

The area in which radiation levels must be controlled to meet acceptable standards is the total mine site area and the transport haulage routes. Gamma surveys of the project area will be conducted prior to ground disturbing activities in accordance with WI052 *Operation of Gamma Survey Meters*.

Monitoring results will be reported in the Annual Environmental Radiation Report to DoIR.

## 3.10 VISUAL AMENITY

### 3.10.1 Management objective

Consistent with the Environmental Policy, the specific objective in managing this aspect for the Gwindinup project is:

- to ensure that the visual amenity of the area adjacent to the project is not unduly affected by the mining activities

### 3.10.2 Description

The project area has its western border surrounded by farmland, and the town of Boyanup is less than 3km away. The South West Highway runs near the northern reaches of the project area. The eastern border is surrounded by Argyle State Forest block.

### 3.10.3 Risk and risk level

Two types of impacts arise from mining activities that impact on visual amenity. These are light spill and impacts directly on visual amenity (aesthetics) such as loss of vegetation buffers. Light spill from large outdoor lights used to light the pit and infrastructure can impact on nearby residences. If the end land use is inconsistent with expectations then visual amenity may be impacted on.

The proposed mining operations are located on westerly and north-westerly facing slopes of the Whicher Scarp, thus it will be visible to farmland areas in these directions. Local topography and remnant roadside vegetation is expected to obscure the view of Gwindinup. Impacts on the town will therefore be negligible.

The South West Highway is located in the Preston River valley to the east of the project area, hence owing to the topography, the project area will not be visible to users of the Highway, therefore the project will have no impact on its users and, overall a negligible impact on visual amenity.

### **3.10.4 Management Action**

Lighting to be installed as per the Australian Standard AS4282-1997 *Control of the obtrusive effects of outdoor lighting*.

Management of clearing as per WI224 *Native Vegetation Pre-clearing checklist*.

Tree shelter belts have been planted around strategic areas of the Gwindinup South deposit.

Construction of vegetated bunds as a screen in strategic locations, using overburden or topsoil (mine planning phase). Extensive vegetation screening will be left on all sides of the project area.

Staged rehabilitation of mine areas to re-instate aesthetic values as soon as possible following the completion of mining.

### **3.10.5 Monitoring**

Routine visual inspection of the mine area from points of expected impact and regular consultation with adjoining landowners.

### **3.10.6 Contingency**

Additional vegetated soil bunds or shade cloth fencing constructed in strategic areas if required.

## **3.11 DECOMMISSIONING AND CLOSURE**

### **3.11.1 Specific Objectives**

Consistent with the Environmental Policy, the specific objectives in managing this aspect for the Gwindinup mine are:

- to ensure that rehabilitation and decommissioning are carried out in a planned, sequential manner, consistent with best practice; and
- to avoid ongoing liability

### 3.11.2 Final Decommissioning and Closure Plan

BEMAX will progressively develop a Decommissioning and Closure Plan during mining operations with the plan to be finalised at least 6 months prior to closure in consultation with DOE, CALM and DoIR. The Plan will address among other issues;

- 1) removal of, or appropriate retention of, plant and infrastructure in consultation with relevant stakeholders;
- 2) identification of any contaminated areas, including proposed management measures if required to the satisfaction of relevant authorities; and
- 3) re-instatement of original infrastructure where appropriate such as roads, fencing, drainage etc

The *Mining and Rehabilitation Management Plan* will remain as the primary planning document for issues associated with post-mining landuse and post-mining rehabilitation monitoring. These tasks will however be referenced within the *Decommissioning and Closure Plan*.



#### 4. AUDIT SCHEDULE

<b>General Objectives</b>	
<ul style="list-style-type: none"> <li>To operate in compliance with legislation and legal requirements.</li> <li>Sustainable production of Titanium Minerals in a manner that protects the values of the natural and social environments in which the Company operates.</li> </ul>	
<b>Action – BEMAX will:</b>	<b>Evidence</b>
1. Conduct routine monitoring as outlined in the EMMP, Management Plans, and in the various site licences. Report monitoring results and the performance of the controls in the Annual Environmental Report (AER)	AER
2. Formally process complaints through EMS system	Non-conformance register.
<b>NOISE</b>	
<b>Objectives</b> <ul style="list-style-type: none"> <li>to ensure that noise levels emanating from the project area comply with the <i>Environmental Protection (Noise) Regulations 1997</i>.</li> </ul>	
<b>Action – BEMAX will:</b>	<b>Evidence</b>
3. Installation of acoustic bund walls between mining operations and noise sensitive premises	Photographs
4. Limit mine activities in early/ late hours	
5. Establish noise sensitive zones near high risk residences	Site audit
6. Earthmoving equipment to have noise reduction engineering in place	Vehicle inspections
7. Workforce to be informed of noise reduction initiatives	Induction/ toolbox talk minutes
8. Monitor noise at least 4 times per year	Monitoring records

<b>HAULAGE (ROAD TRAFFIC)</b>	
<b>Objectives</b> <ul style="list-style-type: none"> <li>to ensure that increases in traffic activities resulting from the project do not adversely impact on the social surroundings</li> <li>to ensure that roads are maintained or improved and road traffic managed to meet an adequate standard of level of service and safety and Main Roads (MRWA) requirements</li> </ul>	
<b>Action – BEMAX will:</b>	<b>Evidence</b>
9. Upgrade haulage roads to satisfaction of vested authority if required	Letter from Authority
10. Wetting down of unsealed haulage roads as required	Site inspection
11. Install sealed apron to haulage road as it joins SW Highway	Photographs
12. Avoid heavy haulage on Sundays and public holidays unless necessary	Trucking records
13. Safety awareness training provided to truck drivers	Induction records
14. Trucks carting HMC to have loads covered before leaving site	Site inspection
15. Internal speed limit of 30km/hr	Photographs of signage Induction records
16. Routinely monitor noise levels at selected residences along trucking route	Results in AER
<b>AIR QUALITY - PARTICULATES</b>	
<b>Objectives</b> <ul style="list-style-type: none"> <li>to ensure that particulate emissions, both individually and cumulatively, meet appropriate criteria and do not cause an environmental or health problem</li> <li>to use all reasonable and practicable measures to minimise the discharge of particulate wastes</li> </ul>	
<b>Action – BEMAX will:</b>	<b>Evidence</b>
17. Topsoil stripped outside summer months or wetted down prior to removal if material is dry	Mine records, site inspection
18. Consideration of wind direction and speed before burning	Climatic records
19. All stockpiles suitably stabilised	Site inspection
20. Rehabilitation areas suitably stabilised from wind erosion	Audit of MRMP
21. Dust levels routinely monitored	Results in AER

<b>AIR QUALITY – GREENHOUSE GASES</b>	
<b>Objectives</b> <ul style="list-style-type: none"> <li>to ensure that greenhouse gas emissions, both individually and cumulatively, meet appropriate criteria and do not cause an environmental or health problem</li> <li>to use all reasonable and practicable measures to minimise the discharge of greenhouse gases</li> </ul>	
<b>Action – BEMAX will:</b>	<b>Evidence</b>
22. Clearing of native vegetation minimised	Mine plan
23. All commercial grade timber provided to local sawmills	Receipt from sawmill
24. Fuel consumption figures reported in Company's NPI	NPI records
<b>SURFACE WATER QUALITY</b>	
<b>Objectives</b> <ul style="list-style-type: none"> <li>to maintain or improve the quality of surface water to ensure that existing and potential uses, including ecosystem maintenance are protected, consistent with the WA Guidelines for Fresh and Marine Waters (EPA 1993)</li> </ul>	
<b>Action – BEMAX will:</b>	<b>Evidence</b>
25. Surface water features and flows will be maintained in accordance with the Integrated Mining and Rehabilitation Plan and Groundwater Resources Management Plan – Local Users	Audit of plans
26. Surface water features diverted away from mine areas and into sedimentation ponds if possible	Mine plan, site inspection
27. Discharge from mine water circuit to consist of clear overflow	Monitoring records
28. Any discharge to be monitored daily	Monitoring records
29. Domestic sewerage treatment system installed to Shire requirements	Shire approval
30. Fuel stored in bunded areas conforming to Australian Standards	Site inspection
31. Spill clean-up kits available on site	Site inspection
32. Employees and contractors briefed on clean-up procedures	Induction records

<b>SURFACE WATER QUALITY – FINES MANAGEMENT</b>	
<b>Objectives</b> <ul style="list-style-type: none"> <li>To maintain or improve the quality of surface water to ensure that existing and potential uses, including ecosystem maintenance are protected, consistent with the WA Guidelines for Fresh and Marine Waters (EPA, 1993)</li> </ul>	
<b>Action – BEMAX will:</b>	<b>Evidence</b>
33. Refilling and operation of the coagulant feed tanks, start-up and shutdown of the thickener, fines dam construction and management and placement of pipelines and pumps to be conducted in accordance with relevant Work Instructions	Site Audit
34. A minimum fines dam setback of 25m adjacent to minor watercourses and 50m where there is risk of flooding	Site Inspection
35. Water levels in dams and the structural integrity of dams is regularly assessed	Monitoring records
36. Water quality measured up stream and downstream of minesite on a monthly basis (if flowing).	Monitoring records
37. Any discharge from dams to be monitored daily	Monitoring records
<b>SPECIALLY PROTECTED AND PRIORITY FAUNA</b>	
<b>Objectives</b> <ul style="list-style-type: none"> <li>to protect Specially Protected (threatened) and Priority Fauna and their habitats on the mine area, consistent with the provisions of the <i>Wildlife Conservation Act 1950</i></li> </ul>	
<b>Action – BEMAX will:</b>	<b>Evidence</b>
38. Clearing kept to absolute minimum	Audit of IMRMP
39. Specific clearing protocols implemented to manage any resident WRP	Summary report supplied to DEC after each clearing phase.
40. Rehabilitation to include habitat logs and harbourage points	Audit of IMRMP
41. Fencing not to impede movement of fauna	Site inspection
42. Monitor effectiveness of proposed strategies	Annual survey of adjoining WRP population

<b>INDIGENOUS HERITAGE</b>	
<p>Objectives</p> <ul style="list-style-type: none"> <li>to ensure that the mine operations comply with the requirements of the <i>Aboriginal Heritage Act 1972</i></li> <li>to ensure that changes to the biological and physical environment resulting from the project do not adversely affect cultural associations with the area</li> <li>to comply with statutory requirements in relation to areas of cultural and historical significance</li> </ul>	
<b>Action – BEMAX will:</b>	<b>Evidence</b>
43. A Section 16 permit obtained by qualified archaeologist	Section 16 permit
44. Employees and contractors aware of internal procedures in event of unearthing suspected material or remains	Induction records
45. Indigenous awareness training periodically provided to all Company employees	Training records
46. Monitoring of clearing and topsoil stripping activities in high risk areas by archaeologist and/or Aboriginal representative	Monitoring records
<b>RADIATION</b>	
<p>Objectives</p> <ul style="list-style-type: none"> <li>to ensure that radiation levels at neighbouring premises are not affected by the mine</li> <li>to ensure that post-mining radiation levels are consistent with, or below, pre-mining (background) levels</li> </ul>	
<b>Action – BEMAX will:</b>	<b>Evidence</b>
47. Implement the RMP	Audit of RMP
<b>VISUAL AMENITY</b>	
<p>Objectives</p> <ul style="list-style-type: none"> <li>to ensure that the visual amenity of the area adjacent to the project is not unduly affected by the mining activities</li> </ul>	
<b>Action – BEMAX will:</b>	<b>Evidence</b>
48. Lighting to be installed as per Australian Standard AS4282-1997	Site Audit
49. Management of clearing and burning in accordance with WI224	Audit of WI
50. Construct vegetated bunds in strategic areas	Mine plan/ Site inspection

51. Staged rehabilitation of disturbed areas	Audit of IMRP
52. Routine inspection of visual aspects of minesite and in consultation with landowners	Results in AER
<b>DECOMMISSIONING AND CLOSURE</b>	
<p>Objectives</p> <ul style="list-style-type: none"> <li>• to ensure that rehabilitation and decommissioning are carried out in a planned, sequential manner, consistent with best practice; and</li> <li>• to avoid ongoing liability</li> </ul>	
<b>Action – BEMAX will:</b>	<b>Evidence</b>
53. Finalise a decommissioning and closure plan in consultation with key agencies within 6 months of mine closure	DCP

## 4.1 REFERENCES

Bamford , M. J. 2000, *Proposed Gwindinup Mineral Sands Mine – Fauna Survey Winter 1999*. Unpublished report for Cable Sands (WA) Pty Ltd, Western Australia 2000.

Bamford, M. J. and Wilcox, J. A. 2004, *The Use Of The Proposed Sand Mining Area At Gwindinup By Threatened Species*. Unpublished report for Cable Sands (WA) Pty Ltd, Western Australia, 2/12/04.

Harewood, G. 2005. *Western Ringtail Possum Survey. Gwindinup North Mineral Sands Mine*. Unpublished report for Cable Sands (WA) Pty Ltd, Western Australia, October 2005.

McDonald, Hales and Associates Pty Ltd. 2001. *Report of the Aboriginal Heritage Survey of the Proposed Mineral Sands Mining of the Gwindinup Projects, Western Australia*. Unpublished report for Cable Sands (WA) Pty Ltd, Western Australia, October 2001.



## **Appendix 1 Risk Tables**



### Summary of Potential Impacts and Management Associated with Noise

Activity	Potential Impact	Likelihood	Consequence	Risk	Management	Effectiveness	Residual
Heavy Earthmoving normal use	Heavy Earthmoving may increase noise emissions	Almost certain	Moderate	High	Ensure HE noise suppression equipment is functional. Ensure operators are aware of noise controls. Routine noise monitoring and benchmarking.	Very	LOW
Vehicle refueling	Vehicle fueling points may affect noise levels	Unlikely	Minor	Low	Place main vehicle refueling points as far away as possible from noise sensitive premises (NSPs).	Very	LOW
Light vehicle on road use	Light vehicle may affect noise emissions	Unlikely	Minor	Low	Minimise use of light vehicles after hours in proximity to NSPs.	Very	LOW
Light vehicle off road use	Off Road Vehicle may affect noise emissions	Unlikely	Minor	Low	Minimise use of light vehicles after hours in proximity to NSPs.	Very	LOW
Stockpiling of soil material	Construction of stockpiles may affect noise emissions (bunds)	Likely	Moderate	Significant	Build stockpiles during daylight hours when in proximity to NSPs. Consider noise emissions and benefits when placing stockpiles.	Very	LOW
Ground water supply assessment	Pump tests may affect noise emissions	Moderate	Minor	Moderate	Utilised silenced power generators.	Very	LOW
Removal of vegetation	Vegetation removal may affect noise emissions	Almost certain	Moderate	High	Conduct land clearing operations during daylight hours	Very	LOW
Disposal of vegetation	Mulching of residues may affect noise emissions	Likely	Moderate	Significant	Conduct mulching operations during daylight hours	Very	LOW
Screening of oversize material	Screen operation may affect noise emissions	Likely	Moderate	Significant	Operators made aware of NTMP. Screen will be placed within the pit to minimise emissions. Screen chutes fitted with rubber liners to reduce noise.	Very	LOW
Piping feed to wet plant	Wet plant feed pumps may contribute to noise emissions	Moderate	Minor	Moderate	Pumps regularly maintained to ensure emissions are minimal.	Very	LOW
Normal operation of wet plant	Wet plant operations may contribute to noise levels	Moderate	Moderate	Moderate	Wet plant placed approximately 1km from nearest NSP. Wet plant largely enclosed and assessed for noise	Very	LOW

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Activity	Potential Impact	Likelihood	Consequence	Risk	Management	Effectiveness	Residual
					generating potential.		
Normal use of production bore(s)	Groundwater abstraction may contribute to noise emissions	Unlikely	Minor	Low	Pumps regularly maintained to ensure emissions are minimal.	Very	LOW
Facilities	Facilities may contribute to noise emissions	Unlikely	Moderate	Moderate	Key facilities will be placed at least 500m from nearest NSP.	Very	LOW
Vehicle and plant maintenance	Workshop activities may affect noise levels	Unlikely	Insignificant	Low	Workshop entrance will not face towards NSPs. Staff will be made aware of NTMP.	Very	LOW
Fabrication of new plant/equipment	Fabrication of new equipment may affect noise levels	Unlikely	Minor	Low	Fabrication area distant from NSP. Fabrication normally 7am-5pm Mon-Sat, except in emergencies.	Very	LOW

### Summary of Potential Impacts and Management Associated with Haulage

Activity	Potential Impact	Likelihood	Consequence	Risk	Management	Effectiveness	Residual
Bulk transport-off site	Trucks may affect fauna behaviour (stress)	Unlikely	Insignificant	Low	Driver awareness training	Mostly	LOW
Bulk transport-off site	Trucks may kill or injure fauna (road deaths)	Likely	Insignificant	Moderate	Driver awareness training, incident reporting through Environmental Management System (EMS).	Very	LOW
Bulk transport-off site	Material spills into waterways may kill or stress aquatic fauna	Rare	Moderate	Low	Clean up procedures developed		LOW
Bulk transport - off site	BH spills may affect beneficial use of groundwater	Rare	Moderate	Low	HMC loads inert. Emergency Response Procedures.	-	LOW
Bulk transport - off site	BH spills may affect beneficial use of surface waters	Rare	Moderate	Low	HMC loads inert. Emergency Response Procedures	-	LOW
Bulk transport - off site	Trucks may affect dust emissions (from road surface)	Unlikely	Insignificant	Low	Keep internal roads moist, as required as per <u>WI232 Conditions to Operate a Water Cart</u> . Sealed apron on internal road as it links to SW Highway	Very	LOW
Bulk transport - off site	Trucks may affect dust emissions (from load)	Rare	Insignificant	Low	Loads will be covered	Very	LOW
Bulk transport - off site	Trucks may affect greenhouse emissions	Almost certain	Minor	Significant	No net increases in emissions from CSL operations. Energy efficiency programs	Very	LOW
Bulk transport - offsite	Trucks may affect noise emissions (normal operations)	Almost certain	Minor	Significant	Trucking will predominately occur during daylight hours between 7am and 8pm Mon-Sat and 9am and 8pm on Sunday and public holidays. Locking out empty trailers, mounting containers to trailers using rubber blocks. Haulage performed by European designed trucks as they have lower noise emissions than other similarly designed trucks. Trucks must be properly maintained	Very	LOW

### Summary of Potential Impacts and Management Associated with Dust and Particulates.

Activity	Potential Impact	Likelihood	Consequence	Risk	Management	Effectiveness	Residual
HE normal use	HE may increase dust emissions	Almost certain	Minor	Significant	Operator awareness and training. Use water cart to keep area moist, or other measures to stabilize as per <u>WI232 Conditions to Operate a Water Cart</u> .	Very	LOW
LV off road use	ORV may contribute to dust emissions	Unlikely	Insignificant	Low	Operator awareness and training.	-	LOW
Removal of soil material	Removal or disturbance of soil may affect dust emissions	Likely	Moderate	Significant	Minimise disturbed areas. Stabilise disturbed areas. Wet down if required. Consider wind speed and direction prior to and during activity. As per <u>WI223 Top Soil Management</u> .	Mostly	LOW
Stockpiling of soil material	Stockpiles may affect dust emissions	Likely	Minor	Moderate	Stockpiles to be vegetated or sealed using fines or other sealing agents	Very	LOW
Removal of vegetation	Vegetation removal may affect dust emissions	Likely	Moderate	Significant	Minimise disturbed areas. Stabilise disturbed areas. Consider wind speed and direction prior to and during activity. As per <u>WI225 Management of Clearing Operations</u>	Mostly	LOW
Disposal of vegetation	Mulching of residues may affect air quality	Unlikely	Minor	Low	Keep material moist, consider wind speed and direction prior to and during activity. As per <u>WI225 Management of Clearing Operations</u>	Very	LOW
Disposal of vegetation	Burning residues may affect dust emissions/smoke	Likely	Moderate	Significant	Consider wind speed and direction prior to and during activity. Advise local community prior to planned burning operations. As per <u>WI225 Management of Clearing Operations</u>	Mostly	LOW
Stockpiling of HMC	HMC stockpile may contribute to dust emissions	Moderate	Insignificant	Low	Keep stock pile moist using sprinklers or other methods.	Very	LOW
Stormwater runoff	Stormwater may cause erosion of landforms resulting in dust	Unlikely	Insignificant	Low	Install drains, contour banks or other controlled drainage measures in areas prone to erosion	Very	LOW

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Fabrication of new plant/equipment	Fabrication of new equipment may affect dust levels (abrasive blasting)	Unlikely	Insignificant	Low	Conduct a significant distance from surrounding residences. Monitor and manage as appropriate.	Very	LOW
Fire control	Prescribed burning may contribute to dust and smoke levels	Unlikely	Moderate	Moderate	Under management of CALM.	-	MODERATE

**Summary of Potential Impacts and Management Associated with Surface Water.**

Activity	Potential Impact	Likelihood	Consequence	Risk	Management	Effectiveness	Residual
<b>Mine Planning, Development and Operation</b>							
HE normal use	HE may increase turbidity/suspended solids in water bodies from road runoff	Moderate	Minor	Moderate	Do not use near water courses as far as practical.	Mostly	LOW
HE normal use	HE may increase turbidity/suspended solids in water bodies from mud tracking	Moderate	Minor	Moderate	Monitoring of mud tracking on entry and exit roads.	Mostly	LOW
Vehicle refueling	Fuel spills may affect beneficial use of surface waters	Unlikely	Moderate	Moderate	Refueling conducted in specially designed areas. Spill kits on hand.	Very	LOW
LV off road use	ORV may increase turbidity/suspended solids in water bodies	Moderate	Insignificant	Low	Operator training	Mostly	LOW
Removal of soil material	Removal or disturbance of soil may affect water quality (sediment transport)	Moderate	Moderate	Moderate	Vegetation buffer left. Implementation of Integrated Mining and Rehabilitation Plan (IMRP)	Mostly	LOW
Removal of soil material	Removal or disturbance of soil may affect drainage characteristics	Moderate	Moderate	Moderate	Current drainage lines under specific management (includes creation of more drains as required). Implementation of IRMP.	Very	LOW
Stockpiling of soil material	Stockpiles may affect water quality	Unlikely	Minor	Low	Stockpiles vegetated (topsoil) or sealed (overburden) using fines or another agent. Drainage lines/water courses diverted away from stockpiles. Containment of run-off from stockpiles as far as practical	Very	LOW
Road construction	Road construction may require the diversion of water courses	Unlikely	Minor	Low	Drainage lines/streams will be diverted around mine infrastructure, according to IMRP.	Very	LOW
Road construction	Culverts may restrict flow	Unlikely	Minor	Low	Drainage lines/streams will be diverted around mine infrastructure, according to IMRP.	Very	LOW
Groundwater supply assessment	Soil erosion from pump test discharge - sediment transport	Unlikely	Insignificant	Low	Discharge will be minimised. Area of discharge appropriate. Buffers around drainage lines.	Mostly	LOW

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Activity	Potential Impact	Likelihood	Consequence	Risk	Management	Effectiveness	Residual
Removal of vegetation	Vegetation removal may affect surface water quality	Moderate	Moderate	Moderate	Leave a buffer near water course (drainage lines). Staged clearing and rehabilitation. Implement IMRP.	Mostly	LOW
Removal of vegetation	Vegetation removal may affect catchment hydrology	Unlikely	Moderate	Moderate	Staged clearing and rehabilitation. Implement IMRP.	Mostly	LOW
Disposal of vegetation	Burning may affect surface water quality	Unlikely	Minor	Low	If burning is necessary then it should be done during times of either lowest water flow or highest.	Potentially	LOW
Disposal of vegetation	Decomposition of vegetation may affect surface water quality	Unlikely	Minor	Low	Vegetation buffers left were appropriate	Mostly	LOW
Piping feed to wet plant	Wet plant feed pipe may leak or burst, potentially causing siltation of water bodies	Unlikely	Minor	Moderate	Routine inspections; correct placement, and containment of working areas	-	LOW
Normal operation of wet plant	Wet plant drainage water may discharge directly to water course, carrying sediment	Unlikely	Minor	Low	Discharge minimised. Monitor	Mostly	LOW
Return of sand tails to pit	Sand tails may alter drainage characteristics	Unlikely	Moderate	Moderate	Sand tails to be replaced as per IMRP. Monitor.	Very	LOW
Stockpiling of HMC	HMC stockpile leachate may discharge directly to a water course	Unlikely	Moderate	Moderate	Diversion of all drainage lines away from mine infrastructure. Monitor discharge	Mostly	LOW
Stormwater runoff	Not utilising full potential of rain and stormwater runoff				Efficient drainage system as per WRMP.		
Stormwater runoff	Contaminated stormwater may reduce beneficial uses of surface water	Unlikely	Minor	Low	Stormwater runoff collected internally and treated prior to discharge or inclusion into process water circuit.	Very	LOW
Discharging surplus water	Discharge water may affect beneficial uses of surface water	Moderate	Minor	Moderate	Discharge will meet licence limits and ANZECC criteria.	Mostly	LOW
Discharging surplus water	Discharge water may influence hydrological cycle	Unlikely	Moderate	Moderate	Discharge will meet licence limits and ANZECC criteria.	Mostly	LOW
Discharging surplus water	Discharge water may increase water availability for other users	Moderate	Moderate	Moderate	Discharge will meet licence limits and ANZECC criteria.	Very	Low

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Activity	Potential Impact	Likelihood	Consequence	Risk	Management	Effectiveness	Residual
Mine dewatering	Discharge of mine pit water may impact on surface waters	Rare	Minor	Low	Refer to section 9.	Very	LOW
Normal use of production bore(s)	Groundwater abstraction may impact on local wetlands and water bodies	Rare	Moderate	Low	Abstraction from Yarragadee aquifer. Monitor as per Groundwater Management Plan (GMP)	Very	LOW
Construction of water supply pipeline	Water supply pipeline may affect surface drainage, resulting in siltation	Unlikely	Minor	Low	No management specified (correct placement and/or raise pipe off the ground if required)	-	LOW
Water storage dam	Controlled discharge from water storage dam may impact on water resource	Rare	Moderate	Low	Discharge will be minimised and quality meet ANZECC and DoE criteria.	Very	LOW
Water storage dam	Uncontrolled discharge from water storage dam may impact on water resource	Rare	Moderate	Low	No management specified.	-	LOW
Use of amenities	Domestic liquid waste may impact on surface water quality (Bacterial)	Moderate	Moderate	Moderate	Liquid waste disposal will meet Shire and DoE requirements	Very	LOW
Use of amenities	Domestic liquid waste may impact on surface water quality (Nutrients)	Moderate	Moderate	Moderate	Liquid waste disposal will meet Shire and DoE requirements	Very	LOW
Vehicle and plant maintenance	Spills from workshop may affect surface water quality	Moderate	Minor	Moderate	Refer to section 2	Very	LOW
Vehicle washdowns	Potential water quality impacts from runoff	Unlikely	Minor	Low	Refer to section 2	Very	LOW
Vehicle washdowns	Potential water quality impacts from washdown PO traps	Unlikely	Minor	Low	Refer to section 2.	Very	LOW
Hydrocarbon and flocculant storage	Potential water contamination from improper storage of chemicals	Rare	Major	Moderate	Refer to section 2.	Very	LOW
Hydrocarbon storage	Potential water contamination from chemical spills	Rare	Major	Moderate	Refer to section 2.	Very	LOW
<b>Rehabilitation</b>							
Remade ground	There may be an impact on groundwater salinity as a result of changes to soil profile	Unlikely	Major	Significant	Refer to section 9	Mostly	MODERATE
Remade ground	A change in geological subsurface structure may result in excess pooling or infiltration of surface water	Unlikely	Major	Significant	Refer to section 9	Mostly	MODERATE

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<b>Activity</b>	<b>Potential Impact</b>	<b>Likelihood</b>	<b>Consequence</b>	<b>Risk</b>	<b>Management</b>	<b>Effectiveness</b>	<b>Residual</b>
Reinstating drainage lines	Insufficient drainage may lead to flooding	Rare	Minor	Low	Drainage density will be retained, by creating or protecting drainage lines.	Very	LOW
Weed control	Weed control sprays may impact on surface water bodies	Rare	Minor	Low	Spray operators trained in the correct application of herbicides	Mostly	LOW
Fire control	Prescribed burning may pollute surface water (sedimentation)	Unlikely	Minor	Low	No management specified . (Perhaps burning done in consultation with CALM).	Mostly	LOW
Monitoring	Stream flow monitoring structures may restrict flow	Rare	Insignificant	Low	Install as per manufacturers directions	-	LOW

**Summary of Potential Impacts and Management Associated with Surface Water (Fines Management).**

Activity	Potential Impact	Likelihood	Consequence	Risk	Management	Effectiveness	Residual
Water treatment/thickener	Treatment plant may structurally fail, impacting on flora	Unlikely	Minor	Low	Routine inspections; correct placement.	Very	LOW
Water treatment/thickener	Treatment plant may structurally fail impacting on fauna	Unlikely	Minor	Low	Routine inspections; correct placement.	Very	LOW
Water treatment/thickener	Water treatment plant may structurally fail, possibly resulting in water pollution	Unlikely	Moderate	Moderate	Routine inspections; correct placement	Very	LOW
Water treatment/thickener	Water treatment plant may structurally fail, possibly causing erosion	Rare	Moderate	Low	Regular integrity inspections	Very	LOW
Water treatment/thickener	Water treatment plant site may be compacted, waterlogged or contaminated with salts or other chemicals	Unlikely	Minor	Low	Regular inspections and testing to determine any levels of contamination. Appropriate remediation works conducted if necessary.	Very	LOW
Piping fines from thickener to dams	Fines pipelines may leak, possibly resulting in localized impacts on vegetation	Unlikely	Minor	Low	Fines material inert. Monitoring in accordance with <u>WI210 Laying a Pipeline</u>	Very	LOW
Piping fines from thickener to dams	Fines pipeline placement may impact on animal movements	Rare	Moderate	Low	Placement in accordance with <u>WI210 Laying a Pipeline</u>	-	LOW
Piping fines from thickener to dams	Fines pipeline may burst, possibly causing erosion or siltation	Rare	Minor	Low	Placement and monitoring in accordance with <u>WI210 Laying a Pipeline</u>	Very	LOW
Piping fines from thickener to dams	Fines pipeline may burst, possibly impacting on surface waters	Moderate	Minor	Moderate	Placement and monitoring in accordance with <u>WI210 Laying a Pipeline</u>	-	LOW
Piping fines from thickener to dams	Fines pipeline pumps may contribute to noise emissions	Unlikely	Minor	Low	Pumps regularly maintained to ensure emissions are minimal.	Very	LOW
Use of flocculant/coagulant	Spillage of flocculant may impact on surface waters possibly polluting water bodies	Unlikely	Insignificant	Low	Coagulant feed tanks to be filled as per filled as per <u>WI239 Taking Delivery of Optimer-Coagulant Flocculant</u> Flocculent/coagulent stored away from water courses. Flocculent is inert.	Mostly	LOW
Use of flocculant/coagulant	Spillage of flocculant may impact on surface waters	Unlikely	Insignificant	Low	As above	Mostly	LOW

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Activity	Potential Impact	Likelihood	Consequence	Risk	Management	Effectiveness	Residual
Use of flocculant/coagulant	Potential soil contamination	Rare	Insignificant	Low	As above	Mostly	LOW
Use of flocculant/coagulant	Storage or spillage of flocculant may result in soil contamination	Rare	Minor	Low	As above	Mostly	LOW
Fines Dams	Fine dams may leak or fail possibly resulting in localized and/or widespread impact on vegetation	Unlikely	Moderate	Moderate	Dam construction and monitoring in accordance with <u>WI220 Dam Construction – Management of Levels and Overflow</u> . Fine material inert.	Very	LOW
Fines dams	Animals may become stuck and perish in fines dams	Rare	Moderate	Low	No management specified	-	LOW
Fines dams	Dams may leak or fail causing local and/or widespread impacts on fauna	Unlikely	Moderate	Moderate	Dam construction and monitoring as per <u>WI220 Dam Construction – Management of Levels and Overflow</u> . Fines material inert.	Mostly	LOW
Fines dams	Fines dams may overflow, possibly impacting on surface waters	Rare	Moderate	Low	Dams built in accordance <u>WI220 Dam Construction – Management of Levels and Overflow</u> and DoIR Guidelines	Very	LOW
Using fines dams	Fines dams may leak/decant, or structurally fail causing soil erosion	Unlikely	Moderate	Moderate	Dams built in accordance <u>WI220 Dam Construction – Management of Levels and Overflow</u> and DoIR Guidelines	Very	LOW
Using fines dams	Fines dams may leak, resulting in possible saline water plume	Unlikely	Moderate	Moderate	Dams built and monitored in accordance <u>WI220 Dam Construction – Management of Levels and Overflow</u> and DoIR Guidelines.	Very	LOW
Using fines dams	Fines dams may structurally fail, impacting on water quality	Unlikely	Moderate	Moderate	Dams built in accordance <u>WI220 Dam Construction – Management of Levels and Overflow</u> and DoIR Guidelines. Keep internal water circuit salinity within ambient levels.	Very	LOW

**Summary of Potential Impacts and Management Associated with Fauna**

Activity	Potential Impact	Likelihood	Consequence	Risk	Management	Effectiveness	Residual
<b>Mine Planning, Development and Operation.</b>							
HE normal use	HE may affect fauna behaviour (stress)	Likely	Minor	Moderate	Staged mining and rehabilitation process. Implement Integrated Mining and Rehabilitation Plan (IMRP)	Very	LOW
HE normal use	HE may kill or injure fauna (road deaths)	Rare	Minor	Low	Internal speed limits (30km/h), incident reporting through EMS	Very	LOW
HE normal use	HE may affect fauna range and distribution (migration)	Unlikely	Minor	Low	No management specified	-	LOW
HE normal use	HE may affect local population size in the long term (reduction in fecundity)	Unlikely	Moderate	Moderate	Staged mining and rehabilitation process. Implement IMRP	Potentially	LOW
Vehicle refueling	Fuel spills into waterways may kill or stress aquatic fauna	Unlikely	Moderate	Moderate	Refueling facility designed to contain spillage. Staff training.	Very	LOW
LV on road use	LV may kill or injure fauna (road deaths)	Moderate	Insignificant	Low	Internal speed limits (30km/h), incident reporting through EMS	Very	LOW
LV off road use	ORV may kill or injure fauna	Moderate	Insignificant	Low	Internal speed limits (30km/h), incident reporting through EMS	Very	LOW
LV off road use	ORV may affect fauna behaviour (stress)	Unlikely	Minor	Low	Driver awareness training	Potentially	LOW
Pedestrian access	Pedestrian thoroughfare may affect fauna behaviour (stress)	Unlikely	Insignificant	Low	Controlled access throughout mine site during project life.	Mostly	LOW
Soil disturbance	Removal or disturbance of soil may impact on subterranean fauna	Unlikely	Major	Significant	Staged removal of soil, topsoil stored in vegetated stockpiles, comprehensive baseline surveys conducted.	Mostly	LOW
Environmental baseline surveys	Environmental surveys may provide incorrect or misleading information	Unlikely	Major	Significant	Surveys to be carried out by suitably qualified professionals	Mostly	LOW
Environmental baseline surveys	Environmental surveys may affect fauna behaviour	Moderate	Minor	Moderate	Surveys to be carried out by suitably qualified	Mostly	LOW

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Activity	Potential Impact	Likelihood	Consequence	Risk	Management	Effectiveness	Residual
	(stress)				professionals		
Environmental baseline surveys	Environmental surveys may kill or injure fauna in traps	Unlikely	Minor	Low	Surveys to be carried out by suitably qualified professionals	Mostly	LOW
Fencing	Fencing may kill or injure fauna	Moderate	Minor	Moderate	Construct to a standard approved by CALM	Very	LOW
Fencing	Fencing may impede fauna movement/migrations	Moderate	Minor	Moderate	Construct to a standard approved by CALM	Very	LOW
Powerlines	Power lines may kill or injure fauna	Likely	Minor	Moderate	Lines kept to a minimum. Possum guard erected around base of poles.	Very	LOW
Removal of vegetation	Vegetation removal may result in reduction of available habitat	Likely	Major	High	Retention of habitat trees, implementation of Cable Sand's Native Vegetation Protection Strategy (NVPS), and IMRP	Mostly	MODERATE
Removal of vegetation	Vegetation removal may result in reduction of available food source	Likely	Moderate	Significant	Retention of habitat trees, staged clearing and rehabilitation, Implementation of NVPS and IMRP.	Mostly	LOW
Removal of vegetation	Vegetation removal may affect fauna behaviour (stress)	Likely	Minor	Moderate	Retention of habitat trees, staged clearing and rehabilitation, Implementation of NVPS and IMRP.	Mostly	LOW
Removal of vegetation	Vegetation removal may affect local population size in the long term (fecundity)	Moderate	Moderate	Moderate	Retention of habitat trees, staged clearing and rehabilitation, Implementation of NVPS and IMRP.	Mostly	LOW
Removal of vegetation	Vegetation removal may affect fauna range and distribution (migration)	Unlikely	Moderate	Moderate	Implementation of NVPS and IMRP.	Mostly	LOW
Removal of vegetation	Vegetation removal may kill or injure fauna	Moderate	Major	Significant	Staged clearing of vegetation. Relocation prior to disturbance if required	Mostly	LOW
Removal of vegetation	Vegetation removal may affect territorial behaviour	Moderate	Moderate	Moderate	Retention of habitat trees, staged clearing and rehabilitation, Implementation of NVPS and IMRP.	Mostly	LOW
Disposal of vegetation	Reduction of available habitat	Unlikely	Moderate	Moderate	Implementation and IMRP to aid in the retention of habitat logs, stag trees, and debris for final rehabilitation.	Very	LOW
Wet plant	Wet plant may be used as habitat by birds, frogs,	Moderate	Insignificant	Low	No feeding of animals. All food scraps placed in	-	LOW

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Activity	Potential Impact	Likelihood	Consequence	Risk	Management	Effectiveness	Residual
	,possums etc				bins with secure lid		
Stormwater runoff	Contaminated stormwater may result in loss of habitat in water bodies	Unlikely	Minor	Low	Creation of bunds and drainage lines to divert flow into fines dams and water storage dams. Storm water will be recycled where possible. Discharges will be monitored, usually daily, (under DoE licence).	Very	LOW
Discharging surplus water	Discharge water may affect aquatic ecosystems	Moderate	Insignificant	Low	Discharges must be monitored, usually daily, under DoE licence.	Very	LOW
Constructing water supply pipeline	Water supply pipeline may disturb local fauna	Rare	Minor	Low	No management specified	-	LOW
Water storage dam	Waterbirds using water storage dam may be injured by supply equipment	Rare	Moderate	Low	No management specified	-	LOW
Facilities	Facilities may affect fauna behaviour or distribution	Unlikely	Minor	Low	No feeding of animals. All food scraps placed in bins with secure lid	-	LOW
<b>Rehabilitation</b>							
Replacing vegetation cover	Baits or other feral animal control may be required	Unlikely	Minor	Low	Implement pest selective eradication program in consultation with CALM	Mostly	LOW
Weed control	Weed control method may impact on fauna	Moderate	Minor	Moderate	Selective eradication techniques implemented in consultation with CALM.	Mostly	LOW
Fire control	Prescribed burning may impact on fauna	Unlikely	Moderate	Moderate	Prescribed burning conducted consultation with CALM.	Mostly	LOW
Monitoring	Streamflow monitoring structures may restrict fauna movement	Rare	Minor	Low	No management specified	-	LOW

**Summary of Potential Impacts Associated with Indigenous and Non-Indigenous Cultures (Heritage).**

<b>Activity</b>	<b>Potential Impact</b>	<b>Likelihood</b>	<b>Consequence</b>	<b>Risk</b>	<b>Management</b>	<b>Effectiveness</b>	<b>Residual</b>
LV off road use	ORV may affect heritage values	Rare	Minor	Low	Archaeologist and Aboriginal representatives to monitor site. Avoidance if possible of any significance sites that are located	Very	LOW
Removal of soil material	Removal or disturbance of soil may uncover cultural artifacts	Rare	Moderate	Low	As above	Very	LOW
Removal of Vegetation	Vegetation removal may affect heritage and cultural values and associations	Rare	Moderate	Low	As above	Very	LOW

**Summary of Potential Impacts and Management Associated with Radiation.**

Activity	Potential Impact	Likelihood	Consequence	Risk	Management	Effectiveness	Residual
Return of tails to pit	Increased radiation levels	Insignificant	Minor	Low	Radioactive elements removed during wet separation	Very	LOW
Return of mill tailing to pit	Increased radiation levels	Insignificant	Minor	Low	No concentrations of radioactive elements in mill tails during processing	Very	LOW
Return of monazite tails	Increased radiation levels	Rare	Moderate	Low	Dilute to appropriate concentration with wet concentrate tails. Provide adequate capping layer of pure tails, overburden and topsoil.	Very	LOW
Handling and transport	Dust generation containing radiation	Rare	Moderate	Low	Keep mill tails moist during handling and transport. Store in enclosed facility prior to disposal and cover and seal truckloads prior to transport.	Very	LOW
Transport of monazite tailings	Accidental spillage	Rare	Moderate	Low	Specialised training to drivers including emergency procedures. All weather tarps, sealed tailgates, and radiation sign posting on trucks carrying monazite tailings.	Very	LOW

**Summary of Potential Impacts and Management Associated with Visual Amenity.**

Activity	Potential Impact	Likelihood	Consequence	Risk	Management	Effectiveness	Residual
Heavy Earthmoving Equipment	Lights from earthmoving equipment visible at night	Unlikely	Minor	Low	Use <u>Australian Standard (AS)</u> in design and placement of lights	Very	LOW
Vehicle refueling	Vehicle fueling points may increase light spill	Unlikely	Minor	Low	Use <u>AS</u> in design and placement of lights	Very	LOW
Removal of soil material	Removal or disturbance of soil may affect visual amenity	Unlikely	Minor	Low	Planting of shelter belts in strategic places before mining commences. Topography of mine location. Retention of habitat trees help improve visual amenity	Very	LOW
Stockpiling of soil material	Stockpiles may affect visual amenity (bunds)	Unlikely	Minor	Low	Bunds will be used to shield mining operations from people travelling on minor roads west of project area.	Very	LOW
Fencing	Fencing may affect visual amenity (aesthetics)	Unlikely	Minor	Low	Planting of shelter belts in strategic places before mining commences. Topography of mine location. Retention of habitat trees help improve visual amenity	Very	LOW
Installation of power lines	Power lines may affect visual amenity (aesthetics)	Unlikely	Minor	Low	As above	Very	LOW
Installation of monitoring bore(s)	Monitoring bores may affect visual amenity	Unlikely	Minor	Low	As above	Very	LOW
Survey pegs	Affect visual amenity	Unlikely	Minor	Low	As above. Removal when no longer required	Very	LOW
Survey tape	Affect visual amenity	Unlikely	Minor	Low	As above. Removal when no longer required	Very	LOW
Removal of vegetation	Loss of screens and/or buffer	Moderate	Moderate	Moderate	Screens will be planted in strategic locations before mining commences as per <u>WI224 Native Pre-clearing Checklist</u>	Very	LOW
Removal of vegetation	Vegetation removal may affect visual amenity (landscape)	Moderate	Moderate	Moderate	Planting of shelter belts in strategic places before mining commences. Topography of mine location will limit view. Retention of habitat trees help improve visual amenity. As per <u>WI224 Native Pre-clearing Checklist</u>	Very	LOW
Disposal of vegetation	Burning residues may affect visual amenity	Unlikely	Minor	Low	As above	Very	LOW

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Environmental Management and Monitoring Program

Activity	Potential Impact	Likelihood	Consequence	Risk	Management	Effectiveness	Residual
Disposal of vegetation	Residue stockpiles may affect visual amenity	Unlikely	Minor	Low	As above	Very	LOW
Removal and storage of soil material	Light spill	Moderate	Minor	Moderate	Use AS in design and placement of lights	Very	LOW
Excavation of pit material	Light spill	Moderate	Minor	Moderate	Use AS in design and placement of lights	Very	LOW
Screening of oversize material	Light spill	Moderate	Minor	Moderate	Use AS in design and placement of lights	Very	LOW
Normal operation of wet plant	Wet plant may reduce visual amenity (aesthetic)	Unlikely	Minor	Low	Planting of shelter belts in strategic places before mining commences. Topography of mine location. Retention of habitat trees. Selection and maintenance of paint colour.	Very	LOW
Normal operation of wet plant	Wet plant may cause light spill	Moderate	Minor	Moderate	Use AS in design and placement of lights	Very	LOW
Stockpiling of HMC	HMC stockpile may unduly impact on visual amenity (aesthetics)	Unlikely	Minor	Moderate	Planting of shelter belts in strategic places before mining commences. Topography of mine location will limit view. Retention of habitat trees help improve visual amenity	Very	LOW
Stockpiling of HMC	HMC stockpile may cause light spill	Unlikely	Minor	Moderate	Use AS in design and placement of lights	Very	LOW
Stormwater runoff	Stormwater may cause erosion of landforms reducing visual amenity	Unlikely	Minor	Low	Erosion control measures including storm water controls established as per Grooundwater Management Plan (GMP)	Very	LOW
Piping fines from thickener to dams	Fines pipeline placement may reduce visual amenity	Unlikely	Minor	Low	Planting of shelter belts in strategic places before mining commences. Topography of mine location will limit view. Retention of habitat trees help improve visual amenity	Very	LOW
Constructing fines dams	Placement of fines dams may reduce visual amenity	Unlikely	Minor	Low	As above	Very	LOW
Constructing water supply pipeline	Water supply pipeline may reduce visual amenity	Unlikely	Minor	Low	As above	Very	LOW
Facilities	Facilities may reduce visual amenity	Unlikely	Minor	Low	As above	Very	LOW

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Environmental Management and Monitoring Program

Activity	Potential Impact	Likelihood	Consequence	Risk	Management	Effectiveness	Residual
Facilities	Facilities may contribute to light spill	Moderate	Minor	Moderate	Use AS in design and placement of lights	Very	LOW
Vehicle and plant maintenance	Potential light spill from workshop	Moderate	Minor	Moderate	Use AS in design and placement of lights	Very	LOW
Fabrication of new plant/equipment	Potential light spill from fabrication area	Moderate	Minor	Moderate	Fabrication normally conducted during 7am-7pm Mon-Sat.  Use AS in design and placement of lights.	Very	LOW
Hydrocarbon storage	Storage facilities may affect visual amenity	Unlikely	Minor	Low	Small storage vessels maintained on site	Very	LOW
Fire control	Prescribed burning may reduce visual amenity through changes to the landscape	Unlikely	Minor	Low	Consideration of wind strength and direction before burning occurs, Consultation with CALM.	Very	LOW
Fire control	Prescribed burning may reduce visual amenity due to smoke	Unlikely	Minor	Low	Consideration of wind strength and direction before burning occurs, Consultation with CALM.	Very	LOW
End land use	Inconsistent with expectations	Rare	Moderate	Low	Consult with adjoining landowners and CALM.	Very	LOW



