Mt Gibson Iron Ore Mine and Infrastructure Project

Extension Hill & Extension Hill North Environmental Management Plan (Rev 2)

Mount Gibson Mining Limited & Extension Hill Pty Ltd

10 July 2008

Mount Gibson Iron

Extension Hill Pty Ltd

Mt Gibson Iron Ore Mine and Infrastructure Project

Prepared for

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Table of Contents

List of Tables

List of Figures

List of Appendices

Executive Summary

Implementation of the Mt Gibson Iron Ore Mine and Infrastructure Project (**Project**) was approved, subject to conditions, by the Minister for the Environment (24 October 2007) by the issuing of Ministerial Statement No. 753 (**Ministerial Statement No. 753**); a subsequent section 45 C (*Environmental Protection Act*, 1986) amendment (approved 20 February 2008; Attachment 1 to Statement 753); and a change in the project proponent to Extension Hill Pty Ltd and Mount Gibson Mining Limited (Section 38(7) of the *Environmental Protection Act*, 1986; 21 April 2008).

The Extension Hill & Extension Hill North Environmental Management Plan (**EMP**) has been prepared to meet the conditions of Ministerial Statement No. 753. In particular, Conditions 6 to12 and 14 of Ministerial Statement No. 753 require the preparation, prior to ground disturbing activities, of a number of environmental management plans to address particular environmental factors. The EMP has been prepared using a risk based approach for environmental management following consultation with the Environmental Protection Authority (**EPA**) and Department of Environment and Conservation (**DEC**).

The objectives of the EMP are to:

- demonstrate that both Mount Gibson Mining Limited (**MGM**) and Extension Hill Pty Ltd (**EHPL**) have a high level corporate commitment to protect the environment which will ensure that the environmental management of the Project meets the requirements of Ministerial Statement No. 753 and is consistent with practices of other similar iron ore mining activities;
- demonstrate that the key environmental factors identified in the assessment of the Project under Part IV *Environmental Protection Act 1986,* namely the introduction and spread of weeds, altered fire regimes, altered hydrology and deposition of dust on declared rare flora and floristic communities can be managed at an acceptable level of risk;
- provide appropriate impacts and risk objectives, performance standards and measurement criteria;
- provide an appropriate management strategy;
- demonstrate an appropriate level of consultation with authorities, persons and organizations; and
- provide environmental management actions, which will be continuously improved as the Project develops.

The environmental risk management method of this report is aligned with *Guidelines for the Preparation and Submission of an Environmental Plan under the Petroleum (Submerged Lands) (Management of Environment) Regulations 1999, Environmental Risk Management – Principles and Process Handbook* (Standards Australia HB 203:2006), and *Risk Management* (Standards Australia AS/NZS 4360: 2004).

Ministerial Statement No. 753 requires that particular environmental management plans be prepared in relation to declared rare flora *Darwinia masonii* and *Lepidosperma gibsonii* (requiring both research and recovery plans), conservation of significant flora and communities, weeds, bushfires, malleefowl, fauna management at the mine site and services corridor and closure of the mine and infrastructure facilities. This EMP specifically addresses these environmental management plans within the risk framework and methodology referred to above.

For this purpose, environmental performance objectives identified in Ministerial Statement No. 753 have been used in the EMP. Environmental performance standards and measurements have been defined for each performance objective, providing an effective and practical framework for environmental monitoring.

An environmental risk assessment was implemented through workshops involving senior management, mine managers and operators, environmental managers, legal and environmental advisors. Environmental aspects of mining activities, their sources of risks and risk events likely to have an impact were identified. The inherent risks were identified, evaluated and ranked by severity.

Subsequently, the environmental risk assessment process focussed on those sources of risk that were assessed as *extreme* or *high* inherent risks and the key control measures (requiring management actions) that could be adopted to most effectively reduce these risks. The residual risk for each of these extreme or high level inherent risk sources was then determined on the basis that the key control measures were in place. In all cases, the residual risk for all extreme or high inherent risk sources associated with the development and implementation of the Project has been determined as *moderate* or *low*.

This EMP identifies the key control measures and the necessary management actions to ensure that sources of risk are maintained at the moderate or low level during the development and operation of the Project. Procedures for implementing the management actions to achieve this outcome are contained in the environmental management systems for the Project. As the planning, development and operation of the Project proceeds, these procedures and the management actions identified in the EMP will be reviewed and, as appropriate, adapted to achieve a high level of environmental management consistent with the requirements of Ministerial Statement No. 753.

1.0 Introduction

1.1 Background

Implementation of the Mt Gibson Iron Ore Mine and Infrastructure Project (**Project**) was approved, subject to conditions, by the Minister for the Environment (24 October 2007) by the issuing of Ministerial Statement No. 753 (**Ministerial Statement No. 753**)); a subsequent section 45 C (*Environmental Protection Act*, 1986) amendment (approved 20 February 2008; Attachment 1 to Statement 753); and a change in the project proponent to Extension Hill Pty Ltd and Mount Gibson Mining Limited (Section 38(7) of the *Environmental Protection Act*, 1986; 21 April 2008).

The Extension Hill & Extension Hill North Environmental Management Plan (**EMP**) has been prepared to meet the conditions of Ministerial Statement No. 753. In particular, Conditions 6 to 12 and 14 of Ministerial Statement No. 753 require the preparation, prior to ground disturbing activities, of a number of environmental management plans to address particular environmental factors. The EMP has been prepared using a risk based approach for environmental management following consultation with the Environmental Protection Authority (**EPA**) and Department of Environment and Conservation (**DEC**).

Mount Gibson Mining Limited (**MGM**) and Extension Hill Pty Ltd (EHPL) propose to mine iron ore at Extension Hill and Extension Hill North in the Mt Gibson Ranges, approximately 350km north-east of Perth in Western Australia (Section 2.0). The proposed mining operations will involve an open cut mine, a residential camp, administrative centre, an airstrip, a co-located waste and dry tailings dump and associated infrastructure.

The Project has been the subject of a Public Environmental Review (**PER**) (ATA Environmental 2006a), a report by the Western Australia Environmental Protection Authority (EPA Bulletin 1242, November 2006), and a Ministerial Statement that a Proposal may be Implemented (Statement No. 753) by the Western Australian Minister for the Environment and Approval to Undertake a Controlled Action by the Commonwealth Minister for Environment (EPBC Ref 2005/2381; 18 December 2007).

MGM and EHPL met with EPA and DEC in January 2008 to discuss the preparation of the EMP. It was agreed that the EMP would be revised within a framework of risk based environmental management similar to the approach adopted in the Commonwealth *Guidelines for the Preparation and Submission of an Environmental Plan* (October 2007). A further meeting between MGM and EHPL, EPA and DEC was held in March 2008 to discuss the draft risk based EMP. At that meeting it was agreed to finalise the EMP, adhering to the risk based approach and including the environmental management of the mine site and services corridor.

1.2 This document

This EMP addresses the conditions of Ministerial Statement No. 753, using a risk based approach, on advice from EPA and DEC. This approach was promoted to allow greater flexibility and adaptability in specific management procedures to ensure procedures are modified to keep pace with changing environmental conditions and new data availability, while focussing attention on higher risk areas to achieve high level environmental outcomes and performance. Specific procedures are contained in the site Environmental Management System (EMS) and are managed by the proponents internally with regular reporting to DEC.

Figure 1 outlines the risk based approach and the relationship between relevant sections of this document. Appendix A has been added which details the corresponding sections of this document and the relevant conditions of Ministerial Statement No. 753. This document addresses all of the conditions of Ministerial Statement No. 753 that require the preparation of a management or other plan, with the exception of Conditions 6 and 7 – the Research and Recovery Plans for *Darwinia masonii* and *Lepidosperma gibsonii* - which are separate documents.

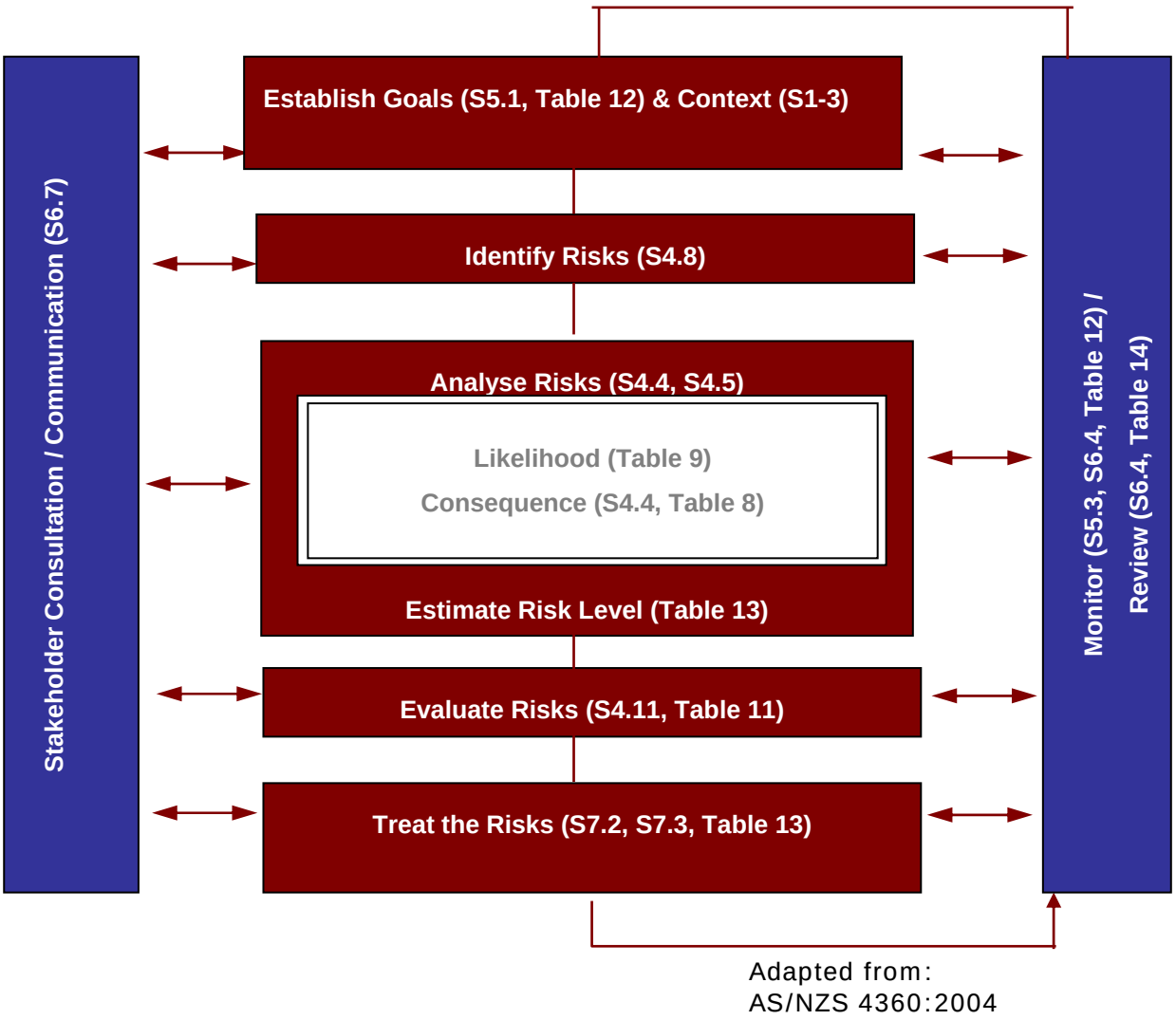

Figure 1: The Risk Management Process as adapted from Australian Standard 4360: 2004.

A description of the Project environment, including the mine site and service corridor, is presented in Section 3.0. Three species of declared rare flora have been identified in the area of the Mt Gibson Ranges. Seven floristic communities have been identified in the area and four of those appear to be restricted to the Mt Gibson Ranges. Three fauna species of conservation significance also occur within the Mt Gibson Ranges.

The environmental risk assessment of Project activities is presented in Section 4.0. In particular, the risk model used in this EMP is presented in Section 4.4. The risk assessment methodology, including consequence and likelihood tables, is outlined in Section 4.5. Environmental aspects of the mining activities are discussed in Section 4.7. The results of the inherent risk assessment are tabulated in Section 4.10.

Definitions of the performance objectives, standards and measurement are discussed in Section 5.0. This section defines the framework for environmental monitoring.

The management strategy forms part of MGM and-EHPL's Environmental Management System (**EMS**), which is outlined in Section 6.0. The strategy includes systems, practices, procedures, roles and responsibilities, training, monitoring, audit and management of non conformance and review, emergency response and incident reporting, record keeping and reporting. In addition provision has been made for consultation with stakeholders in Section 6.7.

Section 7.0 presents the environmental management actions based on the mining activities likely to cause severe environmental risk. The risks were ranked by severity and the extreme and high risks were identified for specific mitigation in this plan. The risks were reassessed after the proposed mitigation.

Section 7.0 also includes the preliminary mine closure plan, interim research and recovery plans for *Darwinia masonii* and *Lepidosperma gibsonii.*

Section 8.0 outlines the regular, incident, annual and five yearly reporting framework.

MGM and EHPL have consulted with organisations as required by the conditions of Ministerial Statement No. 753.

1.3 Project proponents

The proponents for the Mt Gibson Iron Ore Mine and Infrastructure Project are:

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2.0 Mt Gibson Iron Ore Mine and Infrastructure Project

2.1 Project description

The Project is a combined hematite and magnetite open cut mining operation. Hematite ore and magnetite bearing Banded Iron Formation (BIF) will be mined by conventional open cut methods of blasting and excavation with material loaded onto trucks and transported to stockpile areas.

The hematite is expected to be mined over a minimum period of five years. The hematite is direct shipping grade ore and no processing of the ore will be required other than the crushing and screening of the ore into fines (<6.3mm) and lump (6.3 – 32.0mm). An anticipated 13 Mt of hematite concentrate will be produced over the life of the project. The transport of the hematite is the subject of a separate referral to the EPA for assessment of the environmental impacts.

Magnetite-bearing BIF will be mined generally after the hematite removal, and it will continue for a minimum of 20 years. It will be processed by crushing, grinding and magnetic separation to produce magnetite concentrate, which will be transported as piped slurry to Geraldton Port. At the Port, the magnetite will be stored then loaded onto ships at Berth 5. Power is likely to be reticulated to the mine site by way of a 330 kV power transmission line which will be the subject of a separate referral to the EPA for assessment of the environmental impacts.

The Project will involve the establishment of mining infrastructure including the processing plants, workshops, offices and mine camp. The mine footprint will include the mine pit, co-located waste and dry tailings dump and associated transportation corridors as well as the built infrastructure including a realignment of the Great Northern Highway to maintain a safe distance from the mine pit.

Process water for the magnetite operations will be obtained from the Arrowsmith Groundwater Area at Tathra, 20km south west of Three Springs and piped 168km to the mine site. Water from the slurry pipeline will be returned to the mine and reused in a closed circuit. Gas will be potentially sourced from the Dampier Bunbury Gas Pipeline, however, power is likely to be reticulated to the mine via a separate 330 kV power transmission line which will be the subject of a separate referral to the EPA for assessment of the environmental impacts. The pipelines for the magnetite concentrate slurry, process water from Tathra, return water from Geraldton Port and potentially gas will be contained in a services corridor. There will be a total of ten pumping stations: two pump stations for the slurry pipeline, seven for the return water as well as a pumping station at the Tathra borefield.

The width of the services corridor has been kept to an operational minimum in the pastoral section of the route to limit impacts on vegetation. The easement in the agricultural section of the route is 20m to allow for access, with the construction right of way being 40m. The width of the easement may be reduced in areas of remnant vegetation within the agricultural section of the route.

The services corridor, inclusive of the bore line from Tathra may take the form of an easement over freehold land and a Crown easement over crown lands (including pastoral leases) but is likely to be covered by a Miscellaneous Licence under the Mining Act in the name of EHPL. Once the pipelines are constructed, the full land use will be regained by the landholder with minor restrictions based on ongoing access for monitoring and maintenance.

In addition, MGM will require approvals for the establishment of a rail siding 2km south of Perenjori, which includes two open stockpile areas of 150,000 tonnes capacity each (one for lump and one for fines product) on either side of a train line spur. The rail siding will link into the WestNet rail line south of Perenjori, from which hematite product will be transported by rail to the Geraldton Port via Mullewa. This part of the infrastructure has been referred separately under section 38 of the *Environmental Protection Act 1986*.

2.2 Project area covered by this EMP

The project area for the purposes of the EMP is defined as the area of the mining tenements and the services corridor.

The mining tenements are:

- E59/1179
- G59/0030
- G59/0031
- G59/0032
- G59/0033
- G59/0034
- G59/0035
- L59/0063
- L59/0066
- L59/0067
- L59/0068
- L50/0069
- M59/0338-I
- M59/0339-I
- M59/0454-I
- M59/0455-I
- M59/0526
- M59/0550
- M59/0609

The mining tenements include the proposed Extension Hill and Extension Hill North mine site (Figure 2) stockpiles, waste dump, haul roads, camp site and other infrastructure.

The services corridor from the mine site to Geraldton Port includes the Tathra bore field and bore line (Figure 6).

3.0 Description of Environment

The existing environment is described in detail in the PER (ATA Environmental 2006a) and EPA Bulletin 1242, and relevant factors are summarised below.

3.1 Climate

The Mt Gibson Ranges have a semi-desert Mediterranean climate. This climate type is characterised by hot, dry summers with 9 to 11 months of dry weather and mild, wet winters (Payne *et al*. 1998). The rainfall in the area averages approximately 280mm per annum at Paynes Find, 70km to the north (Bureau of Meteorology 2007). Almost 70% of the annual rainfall occurs between the months of March to August. The winter rainfall is associated with southerly low-pressure systems, while the summer rainfall is derived from thunderstorm activity associated with northerly low pressure systems. Rainfall is both irregular and variable. The average annual temperature for Paynes Find is 27.7°C, and ranges from 18.5°C in July to 37.0°C in January (Bureau of Meteorology 2007).

The climate gradually changes toward the coast. The climate of Geraldton is characterised by hot dry summers with 7-8 months of dry weather and mild to cool, wet winters. The average annual rainfall is 460mm per annum at Geraldton (Bureau of Meteorology 2007). Approximately 75% of the annual rainfall falls between the months of May and October as a result of the passage of a series of cold fronts from the south. The average monthly maximum ranges from 19.5°C in July to 32.6°C in February (Bureau of Meteorology 2007).

3.2 Winds

Winds in the Midwest region have a distinct seasonal and diurnal pattern. Winds at Paynes Find in spring and summer are dominated by light to moderate easterlies in the mornings with weak southerlies to south westerlies in the late afternoons. The wind pattern in the autumn and winter months is dominated by light winds from the northwest, typically in the afternoons. Winds in spring are typically moderate to strong westerly winds in the afternoons (Bureau of Meteorology 2007).

3.3 Ambient dust

The Midwest region of WA is known to have high ambient dust levels due to climatic conditions (Payne *et al.* 1998). Significant uncertainty currently exists with regard to the ambient level of total suspended particles (TSP).

3.4 Hydrology

Mine site

Surface drainage in the Mt Gibson Ranges area is primarily characterised by ephemeral flows. An ephemeral drainage line flows from Iron Hill North in a south easterly direction to a claypan located 4km south-southeast of the proposed mine site. Two smaller salt lakes are located approximately 2km to the south of the claypan. A second ephemeral drainage line flows in a north easterly direction from Iron Hill East while a third drainage line also flows in north easterly direction from Extension Hill South. Both of the latter drainage lines result in sheet flow across the plain after periods of heavy rain, with the drainage leading to the Lake Monger paleo-drainage system, 30km to the north of Extension Hill.

Services corridor

The services corridor crosses a number of watercourses including the Greenough River, Lockier River, Irwin River and Nangetty Creek and several minor seasonal watercourses comprise the catchment and drainage systems traversed by the route. The watercourses are characterised by winter flow which can flood after heavy rains.

The saline watercourses draining to the Yarra Yarra Lakes system and the Mongers Lake system are crossed by the corridor. The Yarra Yarra Lakes system is classified as seasonal saline wetlands which are subject to flooding. The State Water Quality Management Strategy describes the Yarra Yarra and Ninghan Basin as internally draining systems with little well defined drainage, consisting of small

creeks feeding into salt lake systems. The Yarra Yarra Lake is not traversed by this proposal. However crossing of tributaries of the Lake can not be avoided and a suitable crossing has been identified. The route has been deviated several times to achieve this.

The services corridor will cross Mongers Lake within the causeway of Wanarra Road.

The corridor also crosses a number of artificial drainage lines (contour banks) used to redirect surface flows.

3.5 Bioregions

The Mt Gibson Ranges occurs on the boundary of the Austin Botanical District of the Eremaean and the Avon Botanical District of the Southwest Botanical Provinces (Beard 1990). They are located in the Avon Wheatbelt bioregion (McKenzie *et al*. 2003), but it is near the junction of the Yalgoo and Coolgardie Interim Biogeographical Regional Assessment (IBRA) bioregions. As a consequence, the floristic composition of the area is considered to be representative of all three Bioregions. The area has been recognised for its biological diversity (Vital Options Consulting 2004).

The services corridor crosses through three IBRA Bioregions. The majority of the proposed route is located in the Avon Wheatbelt and Geraldton Sandplains Bioregions with a small portion crossing into the Yalgoo Bioregion (ATA Environmental 2005f).

3.6 Vegetation

Mine site
The Mt Gibson Ranges contain diverse vegetation communities including woodland, Mallee, thicket and heath associations. Sixty vegetation associations have been identified across the Project tenements (ATA Environmental 2005a, 2006b; Bennett Environmental Consulting 2000).

The ridges of the Mt Gibson Ranges support flora of conservation significance and a variety of vegetation communities, with Acacia species, Melaleuca species and *Allocasuarina acutivalvis* subsp. *prinsepiana* being the dominant taxa. The woodland plains typically consist of *Eucalyptus loxophleba* subsp. *supralaevis* or mallees of *E. brachycorys* and *E. hypochlamydea* subsp. *hypochlamydea*, which are often associated with *Callitris collumellaris* and *Eucalyptus loxophleba* subsp. *supralaevis*.

Service corridor
The majority of the route of the services corridor between the Mt Gibson Ranges and Geraldton Port is on cleared agricultural land. A total of 82 vegetation communities (forests, woodlands, shrublands and heaths) were identified along the services corridor (ATA Environmental 2005f; Connell Wagner 2000; Paul Armstrong and Associates 2004).

3.7 Flora

Mine site
A total of 285 plant taxa were recorded about the mine site by Bennett Environmental Consulting (2000) reflecting that the Project is located at the junction of three bioregions. The dominant families are Asteraceae (41 native taxa, 6 introduced), Myrtaceae (28 native *taxa),* Mimosaceae (22 native taxa), Chenopodiaceae (21 native taxa), Poaceae (11 native taxa, 5 introduced taxa) and Proteaceae (13 native taxa). A small percentage of the plant taxa are weeds. Complementary surveys on the sandplains and woodlands (ATA Environmental 2005) recorded 192 native and one weed species.

Service corridor
A total of 217 plant taxa were recorded on the route of the services corridor. Of these, 202 are native species and 15 introduced. The families with the greatest representation of species were the Myrtaceae (45 native taxa), Mimosaceae (15 native taxa, one introduced taxa), and the Proteaceae (15 taxa). The largest representation of species was recorded for the Eucalypts (19 species), Mimosaceae or wattles (16 species) and Melaleuca (11 species) (ATA Environmental 2005f).

The relatively low number of taxa along the alignment of the service corridor is due to the large proportion of the route being devoid of native vegetation and the effort taken during the selection of the alignment to avoid areas of native vegetation. Most of the vegetation that does remain along the route, particularly within the agricultural portion of the alignment, has been altered significantly by human disturbance.

3.8 Significant flora species impacted by mining

Three gazetted (WA) rare flora *Darwinia masonii, Lepidosperma gibsonii* and *Eucalyptus synandra* have been recorded from the area. *Darwinia masonii* and *Eucalyptus synandra* are listed as vulnerable under the Commonwealth EPBC Act (1999). *Lepidosperma gibso*nii is being considered for listing under the Commonwealth EPBC Act.

Ministerial Statement No. 753 facilitates the continued *in situ* survival and conservation status of significant native flora species including *Darwinia masonii*, *Lepidosperma gibsonii* and *Acacia cerastes*.

For the purposes of this document the known population of these species within the Mt Gibson Ranges, is that population that is outside of the approved clearance footprint. The current known population is shown in Table 1.

Table 1 Known population of significant flora at Mt Gibson

Species	Conservation classification	Known Population within the Mt Gibson Ranges prior to impact.	Known population Mt Gibson Ranges outside of approved clearance footprint to be preserved	Approximate impact on plants by mining activity	Reference
Darwinia masonii	DRF	14,307	12,207	2,100	ATA 2004
Lepidosperma gibsonii	DRF	45,002	35,302	9,700	ATA 2006a, Coffey 2008a, Coffey 2008b
Acacia cerastes	P1	1,702	1,582	120	ATA 2006a

Darwinia masonii

Darwinia masonii is described as an erect shrub 1.5 to 3m tall, with narrow leaves approximately 1cm long, which are almost triangular in cross section. The flowering inflorescences are approximately 3cm in diameter and are surrounded by numerous spreading, pinkish bracts that are pendulous on the end of small branchlets (ATA Environmental 2004). *Darwinia masonii* has a known flowering period from April to November (Brown *et al*. 1998). As the rainfall in the region is unreliable, *D. masonii* is likely to respond opportunistically to rainfall events (i.e. tropical cyclonic summer rainfall events and southern winter cold fronts).

Darwinia masonii appears to be restricted to the Mt Gibson Ranges (Paul Armstrong and Associates 2004). It is generally found on the slopes (350m+ AHD), crests and ridges over the 6km length of the Mt Gibson Ranges. Nine discrete populations of the species were recorded from the Mt Gibson Ranges, with a total population of 14,315 adult plants and 1,725 seedlings (ATA Environmental 2004; Figure 1). *Darwinia masonii* was most abundant on the hill tops and upper slopes of the Mt Gibson Ranges. Standard population genetics statistical techniques by the Botanic Gardens and Parks Authority (BGPA) concluded that the whole Mt Gibson area is a single provenance unit for *D. masonii* (Botanic Gardens and Parks Authority 2005a).

Darwinia masonii habitats are tall shrublands on yellow-brown clay loams on the Banded Iron Formations with the majority of populations on crest and east-facing slopes of the Mt Gibson Ranges. The soils are extremely skeletal and limited to shallow pockets between exposed ironstone and BIF. It is likely that the fissures and soils between the BIF capture and retain sufficient water to enable the

plants to survive during periods of low rainfall (ATA Environmental 2004; Brown *et al*. 1998; Muir Environmental 1995; Paul Armstrong and Associates 2004).

A trial planting of 211 *Darwinia masonii* plants from cuttings was undertaken on a disused drill pad at Iron Hill East in June 2005, with 90% survival as at January 2008 (Botanic Gardens and Parks Authority 2008).

Lepidosperma gibsonii
Lepidosperma gibsonii is a newly described species recognised in January 2006. The species has terete, finely ribbed, pale green, fully erect culms growing 35-45 cm tall. The leaves are angular and distinctly diamond shaped. *Lepidosperma gibsonii* has an unknown flowering time. Flowering has been recorded for May and June, with mature seed recorded for September.

The species occurs within and in the vicinity of the Mt Gibson Ranges (Figure 1). The known population is 45,013 plants, occurring in 13 largely discrete populations (Table 1; Coffey Environments 2008b). Nine populations occur within the Mt Gibson Ranges while four are located outside of the ranges (i.e. ATA Environmental 2006b; Coffey Environments 2008b). The geographical extremes of the populations are less than 8km apart, thus making the species a highly restricted, narrow endemic.

Within the Mt Gibson Ranges, the species prefers steep slopes or gullies that provide increased water availability from the Ranges. The populations occurring outside of the ranges are associated with low granite outcrops and breakaways, flow lines downslope of granite outcrops and breakaways, and loamy flats in close proximity to the breakaways. The species appear to prefer steep slopes, gullies or flow lines that provide increased water availability.

Lepidosperma gibsonii has been recorded from a number of vegetation communities including three thicket and one heath community (identified as T1, T3, T6 and HS1; ATA Environmental 2006b) within the Mt Gibson Ranges, and low woodland and thicket communities for the populations located outside of the ranges (Coffey Environments 2008a, 2008b).

Although other areas of BIF were surveyed, to date, the species appears to be restricted to the slopes or breakaways / flow lines in the general vicinity of the Mt Gibson Ranges (ATA Environmental 2006b; Coffey Environments 2008a, 2008b).

Acacia cerastes
Acacia cerastes is a low, tangled, glabrous and apparently leafless shrub, growing 0.5 to 1.5m tall with a spread to 2m in diameter (Maslin 2001). The species has a known distribution from Mt Gibson and Mt Singleton (CALM 2004) where it occurs on rocky hills (Maslin 2002) and appears to be a coloniser of disturbed areas. Bennett Environmental Consulting (2000) also recorded the species along tracks on Mt Gibson pastoral station and the adjacent emu farm. DEC records indicate there are 11 populations of *Acacia cerastes* of which at least five are in the general area of the project, near the Mt Gibson Ranges. Populations additional to the DEC records consisting of approximately 1700 plants have been recorded from the Project tenements (ATA Environmental 2005a, 2006b; Figure 2).

3.9 Other Significant Flora Species

Other significant flora have been recorded about the mine site include *Eucalyptus synandra* (DRF), *Chamelaucium sp.* Yalgoo (P1), *Persoonia pentisticha* (P2), and *Grevillea scabrida* (P2).

None of the other significant flora species or populations will be impacted by mining activities as determined by the Ministerial Statement No. 753.

Eucalyptus synandra
The known distribution of *Eucalyptus synandra* is restricted to the northern Wheatbelt from Morawa to near Koorda, east to Karroun Hill and northeast to Beacon. There are 24 known populations, including two populations near the Mt Gibson Ranges. The species is a small mallee, which is reported to flower in February. The species was located in the Mt Gibson area in the col (saddle) to the north east of Mt

Gibson-Mt Gibson South. The second population was located approximately 4km to the south of Mt Gibson (Paul Armstrong and Associates 2004).

***Chamelaucium* sp. Yalgoo**
Chamelaucium sp. Yalgoo is a low shrub growing to 0.3m tall. CALM (2005) reports flowering between July and September. This species has a known distribution from between Mullewa to Lake Moore and Burnerbinmah (CALM 2005). Due to the lack of flowering material suitable for identification, this taxon's identity has not been confirmed. A total of 35 plants of this species were recorded at three locations, two of which were in the vicinity of Wanarra Road approximately 1.5 (12 plants) and 2.3km (11 plants) west of Great Northern Highway while a third population of 12 plants is located to the east of Great Northern Highway (Figure 2). DEC records indicate four populations of *Chamelaucium* sp. Yalgoo, all of which are located to the north of the project (Figure 2).

Persoonia pentisticha
Persoonia pentasticha is a small yellow flowering shrub growing 0.3 to 1.8m tall with a spread to 1m diameter. This species has a known distribution from the following locations: Camel Soak, Mingenew, Mullewa, Perenjori, Yuna and Oudabunna Station. A small population of this species occurs to the south east of the accommodation village (Figure 2).

Grevillea scabrida
Grevillea scabrida is a much branched, silvery leafed shrub growing to 1m tall. This species has a known distribution from Mt Singleton and Mt Gibson. DEC records indicate that there are 13 populations of *Grevillea scabrida*. Of these populations, two populations consisting of approximately 20 plants are in the general area of the project, located to the north and east of the project area (ATA Environmental 2005a; Figure 2). The species will not be impacted by mining.

3.10 Significant flora species along the service corridor

Significant flora species recorded from the vicinity of the service corridor include *Chamelaucium* sp. Yalgoo (P1), *Cryptandra imbricate* (P3), *Gnephosis setifera (P1), Philotheca nutans (P1), Podotheca uniseta* (P3), *Psammomya implexa* (P3) and *Grevillea aff yorkrakinensis* (not priority listed but considered significant) (ATA Environmental 2006a, Coffey Environments 2007, Coffey Environments 2008c). No Declared Rare Flora (DRF) was recorded from, or will be impacted upon by the service corridor.

However, the service corridor will directly impact *Cryptandra imbricata* (P3), *Podotheca uniseta* (P3), *Psammomya implexa* (P3) and *Grevillea* aff *yorkrakinensis* (significant) (Table 2). Subsequent taxonomic advice from Peter Olde of the Royal Botanic Gardens in Sydney has confirmed that the species previously recorded as *Grevillea* aff *yorkrakinensis* is in fact *Grevillea deflexa* F. Muell. sens. lat. (May 2008). *Grevillea deflexa* is not listed as conservation significant. These species occur within the pastoral section of the service corridor (i.e. to the east of Lake Monger).

Table 2 Known population of significant flora about the services corridor

Species	Conservation category	Known population about the service corridor outside of approved clearance footprint	Approximate impact on plants in service corridor
Chamelaucium sp. Yalgoo	P1	28	7
Cryptandra imbricata	P3	1,533	80
Podotheca uniseta	P3	>7,000	1000
Psammomya implexa	P3	3,850	650

***Chamelaucium* sp. Yalgoo**
Chamelaucium sp. Yalgoo occurs on granite outcrops along the services corridor and about the mine site (Section 3.8). This species has a known distribution from between Mullewa to Lake Moore and Burnerbinmah (CALM 2005). One population will be affected by the service corridor.

Cryptandra imbricata
Cryptandra imbricata is a much branched spiny low shrub growing to 0.5m tall and flowers between July and September. This species has a known distribution from between Mullewa to Lake Moore and Burnerbinmah (CALM 2005) on red/brown loams or sand on flats. A total of 83 plants of this species may be affected by the proposed services corridor in two locations along the proposed route. The eastern most population is located along Wanarra East Road, approximately 11km west of Great Northern Highway. A total of three plants at this location may be affected by the proposed pipeline route. The western population is located along Wanarra East Road approximately 18km west of Great Northern Highway. DEC records indicate there are eight populations of *Cryptandra imbricata*, of which two populations are in the general area of the project with the closest population recorded by DEC being approximately 8km east of the project.

Podotheca uniseta
Podotheca uniseta is a small single stemmed annual daisy with yellow flowers growing to 5cm tall, which flowers in September. This species was located at two locations along the proposed pipeline route. The western population was located close to Mongers Lake and comprised of more than 8000 plants and it is estimated that approximately 1000 of these will be affected by the proposed pipeline route. DEC records indicate 10 populations of *P. uniseta*, of which one is the western population detailed above.

Psammomoya implexa
Psammomoya implexa is an intricately branched, leafless, white flowering shrub growing 0.5 to 0.9m tall with a spread to 0.6m diameter. DEC reports flowering between August to October. This species has a known distribution from Wilroy, White Wells to Ninghan Stations, Wubin, Gabyon Station and Morawa (CALM 2005). A total of 4,500 plants have been recorded from five locations (three populations) along Wanarra Road East, between 25 and 30km from Great Northern Highway. Approximately 650 plants may be affected by the proposed pipeline route. DEC records indicate five populations of *P. implexa*, two of which may have been along Wanarra Road.

Gnephosis setifera
Gnephosis setifera is a small prostate annual herb with yellow flowers, which flowers in September. One population of this species is located to the east of Mongers Lake, in the vicinity of the services corridor. More than 300 plants were recorded from this location, none of which are expected to be impacted by the service corridor.

Philotheca nutans
Philotheca nutans is an upright shrub 0.3 to 0.9m tall which flowers between April and September. A total of 150 plants in 14 populations have been recorded within the vicinity of the services corridor, none of which are expected to be impacted by the service corridor.

3.11 Significant communities

Mine site
The BIF within the Mt Gibson Ranges contains floristic communities that are recognised as distinct from the floristic communities on other areas of BIF within the Yilgarn Craton. The floristic communities in the Mt Gibson Ranges have been assessed at a number of levels and geographical areas, all of which meet the EPA's definition of significance, i.e. a geographically restricted community. A number of botanists in both government and private organisations undertook this work.

The subtleties in the differences between the communities, when assessed at different levels, have made the floristic communities a complex environmental factor with technical uncertainty.

Accordingly, the various assessments were reviewed to determine the appropriate definition of significant floristic community for management and rehabilitation purposes. This review concluded that the definition should be the “Group 10” level. The review is summarised below.

Regional analysis (Group 7)
Regional surveys were undertaken by DEC to determine the regional significance of floristic communities on Banded Iron Formations within the Yilgarn Craton, including those in the Mt Gibson Ranges. Of the seven floristic communities identified by DEC within the Mt Gibson and surrounding area, four occur only within the Mt Gibson Ranges (Table 3; Meissner and Caruso 2006), thus meet the EPA’s definition of a significant floristic community (EPA 2006).

Mt Gibson Ranges analysis (Group 40)
Detailed analysis of the communities within the ridges and BIF ranges within a 20km radius of the Mt Gibson Ranges was undertaken at a finer level (i.e. at Group 40 level) than that undertaken by DEC. This analysis identified 20 floristic communities within the ranges. Thirteen of the 20 communities identified at the Group 40 level occurred on Extension Hill and Extension Hill North. The communities occurring on the ridges were largely different to those in other areas. The communities on Iron Hill and Iron Hill East have some similarities but these appear to be associated with the vegetation related to the colluvium and less with that of the prominent ridges (Griffin and Associates 2005). The communities defined at the Group 40 level meet the EPA’s definition of a significant floristic community.

Further analysis of the floristic communities at Extension Hill (Griffin and Associates 2006) found that the differences in the composition of the communities at the Group 40 level occurring on Extension Hill and Iron Hill North were modest. Most communities differed in the presence or absence of three or fewer species (Griffin and Associates 2006).

Extension Hill and Extension Hill North analysis (Group 20 and 10)
Additional sampling and analysis of the communities was undertaken at Extension Hill and Extension Hill North (Griffin and Associates 2007; Table 3, Ministerial Statement No. 753, Condition 8.1.1). In general terms, the communities on the crests and slopes of one hill have more in common with each other than those located on the crests of different hills. As in the earlier analyses summarised in the PER (ATA Environmental, 2006a), there are geographic differences in the distribution of the communities, with the overlapping patterns suggesting gradients rather than a definite delineation of floristic communities (Griffin and Associates 2007).

Geographic patterns were also evident when pattern analysis (PATN) (Belbin 1989) was undertaken at both the Group 20 level and the Group 10 level. When analysed at the Group 20 level, six floristic communities were identified on Extension Hill, Extension Hill North and Extension Hill South (Griffin and Associates 2007).

When analysed at the Group 10 level, four communities were identified on Extension Hill, Extension Hill North and Extension Hill South (Figure 3). The four communities on Extension Hill, Extension Hill North and Extension Hill South at the Group 10 level generally correspond with position in the landscape (Table 3), with Community 1 generally on the ridges of Extension Hill, Extension Hill North and Extension Hill South, Community 2 was associated with the lower slopes in central Extension Hill with a steep gradient, Community 3 occurred on slopes with a gentle gradient on Extension Hill and Extension Hill North and Community 4 occurred on the lower slopes and the colluvium.

Services corridor
There are no significant floristic communities along the service corridor.

3.12 Working definition of significant communities

The Ministerial Statement No. 753, Condition 8-1 states that “significant communities” include Threatened Ecological Communities, Priority Ecological Communities and geographically restricted ecological communities.

The composition of several of the communities when classified at the Group 40 level and the Group 10 level are similar. Due to the similarity, the Group 10 level is considered to be appropriate for management and rehabilitation.

The floristic communities identified at Group 10 level are geographically restricted to the Mt Gibson Ranges and thus meet the EPA's definition of a significant floristic community.

The working definition of floristic communities may change due to research and improved knowledge of the floristic communities in this region.

The distribution of populations of significant flora species relative to floristic communities is shown in Figure 4.

Table 3 Floristic communities (Group 10 level) on Extension Hill North and Extension Hill South

	Geographical location	Location within Mt Gibson ranges	Topographical location	Dominant floristic components of community
Group10-1	Limited to Mt Gibson Ranges	Extension Hill, Iron Hill North, Iron Hill, Iron Hill East, Mt Gibson North, and Mt Gibson South.	Ridges	*Allocasuarina acutivalvis* subsp. *prinsepiana* *Melaleuca conothamnoides x nematophylla* *Grevillea obliquistigma* subsp *obliquistigma* *Philotheca sericea* *Acacia assimilis* subsp. *assimilis* *Calycoplus paucifolius* *Grevillea paradoxa* *Aluta aspera* *Hibbertia hypercoides*
Group10-2	Limited to Mt Gibson Ranges	Extension Hill only	Lower slopes with a steep gradient	*Allocasuarina acutivalvis* subsp. *prinsepiana* *Acacia assimilis* subsp. *assimilis* *Aluta aspera* *Enekbatus stowardii* *Melaleuca fabri* *Acacia aneura* var. *aneura* *Acacia stereophylla* var. *sterophylla* *Grevillea paradoxa*
Group10-3	Mt Gibson Ranges and Taylor Well	Extension Hill, Iron Hill, Iron Hill East, Mt Gibson North, and Mt Gibson South	Slopes with a gentle gradient	*Allocasuarina acutivalvis subsp. prinsepiana* *Calycopeplus paucifolius* *Philotheca sericea* *Dodonaea inaequifolia* *Eremophila clarkei* *Acacia tetragonophylla* *Grevillea paradoxa*
Group 10-4	Mt Gibson lower slopes and Well to east of Mt Gibson ranges	Extension Hill and Extension Hill North	Lower slopes and colluvium	*Austrostipa nodosa* *Acacia andrewsii* *Alyxia buxifolia* *Olearia muelleri*

	Geographical location	Location within Mt Gibson ranges	Topographical location	Dominant floristic components of community
				Ptilotus obovatus *Acacia acuminate* *Callistris columellaris* *Dodonaea inaequifolia*

3.13 Environmental and declared weeds

Mine site

Very few weeds occur within the tenements. The Environmental Weed Strategy (EWS) rates environmental weeds as high, moderate, mild or low based on their potential invasiveness, distribution and ability to change the structure, composition and function of ecosystems (CALM 1999). This rating provides the basis for identifying control priorities, with the highest rated species posing the greatest threat to conservation values. The weed species recorded at or within the vicinity of the Mt Gibson Ranges have been identified and their respective rating of potential impact on biodiversity is detailed in Table 4.

Of the species recorded at or in the vicinity of the Mt Gibson Ranges, Paterson's Curse (*Echium plantagineum*), Ruby Dock *(Rumex vesicarius*), Maltese Cockspur (*Centaurea melitensis)* and Ward's Weed (*Carrichtera annua*) are highly invasive weeds (Bennett Environmental Consulting 2000). Paterson's Curse has been recorded at Paynes Find while Ruby Dock, Maltese Cockspur and Wards Weed are all common throughout the Goldfields. The population of these weeds at or within the vicinity of the Mt Gibson Ranges is currently small and isolated.

None of the weeds recorded within the Project tenements are 'Declared' weeds or 'Pest Plants' (under the *Agriculture and Related Resources Protection Act 1976*) within the Shire of Yalgoo.

Table 4 Weeds recorded within or adjoining the Mt Gibson tenement area

Scientific name	Common name	Rating for impact on biodiversity1
Acetosa vesicaria (formerly *Rumex vesicaria*)	Ruby Dock	high
Anagallis arvensis	Scarlet Pimpernel	moderate
Artctotheca calendula	Capeweed	moderate
Bromus diandrus	Great Brome Grass, Brome Grass, Ripgut	high
Bromus rubens	Red Brome	moderate
Carrichtera annua	Ward's Weed	high
Centaurea melitensis	Maltese Cockspur	moderate
Echium plantagineum	Paterson's Curse	high
Ehrharta longiflora	Annual Veldtgrass	moderate
Erodium botrys	Long Storksbill	low
Hedypnois rhagadiodes	Cretin Weed	mild
Hypochaeris glabra	Smooth Catsear	moderate
Medicago truncatula	Barrel Medic	mild
Monoculus monstrosus (formerly *Osteospermum clandestinum)*	Stinking Roger	low
Pentaschistis airoides	False Hairgrass	moderate

[1] after CALM (1999)

Scientific name	Common name	Rating for impact on biodiversity1
Petrorhagia dubia (formerly *Petrorhagia velutina*)	Velvet Pink	mild
Rostraria pumila	Tiny Bristle Grass	moderate
Sisymbrium orientale	Indian Hedge Mustard	moderate
Sonchus oleraceus	Common Sowthistle	moderate
Spergularia rubra	Sand Spurry	moderate
Trifolium tomentosum	Clover	low
Ursinia anthemoides	Ursinia	moderate

Service corridor

Around 40 weed species have been recorded on or adjacent to the alignment of the services corridor (ATA Environmental 2005f, Paul Armstrong and Associates 2004) (Table 5). Weeds are particularly common in the western portion of the service corridor, reflecting the agricultural land use of the area.

Table 5 Weeds recorded about the services corridor

Scientific name	Common name	Biodiversity impact rating
Acetosa vesicaria (formerly *Rumex vesicaria)*	Ruby Dock	high
Anagallis arvensis	Scarlet Pimpernel	moderate
Angianthus tomentosus		-
Artotheca calendula	Capeweed	moderate
Avena fatua	Wild Oats	moderate
Brassica tournefortii	Wild Turnip	-
Briza minor	Shivery Grass	moderate
Bromus diandrus	Great Brome Grass, Brome Grass	high
Bromus rubens	Red Brome	moderate
Carrichtera annua	Ward's Weed	high
Centaurea melitensis	Maltese Cockspur	moderate
Chondrilla juncea	Skeleton Weed	-
Cynodon dactylon	Couch	moderate
Cleretum papulosum	-	-
Echium plantagineum	Paterson's curse	high
Ehrharta calycinus	Perennial Veldtgrass	high
Ehrharta longifolia	Annual Veldtgrass	moderate
Emex australis	Doublegee	low
Erodium botrys	Long Storksbill	low
Glischrocaryon aurem		-
Hedypnois rhagadioloides	Cretin Weed	mild
Hypochaeris glabra	Smooth Catsear	moderate
Lolium rigidum	Annual ryegrass	-
Medicago sp.	Medics	-
Medicago truncatula	Barrel Medic	mild
Mesembryanthemum nodiflorum	Slender ice plant	mild
Oxalis pes-caprae	Sour sob	mild

Scientific name	Common name	Biodiversity impact rating
Paspalum vaginatum	Saltwater couch	moderate
Pentaschistis airoides	False hair grass	moderate
Petrorhagia velutina	Velvet Pink	mild
Raphanus raphanistrum	Wild Radish	low
Rostraria pumila	Tiny Bristle Grass	moderate
Rumex crispus	Curled Dock	mild
Salvia reflexa	Mintweed	high
Sisymbrium orientale	Indian Hedge Mustard	moderate
Sonchus oleraceus	Common Sowthistle	moderate
Spergula pentandra	Five anthered Spurry	-
Spergularia rubra	Sand Spurry	moderate
Tribulus terrestris	Caltrop	-
Trichanthodium exile		-
Trifolium tomentosum	Clover	low
Ursinia anthemoides	Ursinia	moderate
Zaluzianskya divaricata	Zedweed, Spreading Night Phlox	low

The weeds (Tables 4 and 5) were mapped by GPS. Coordinates for each weed grouping are recorded in the EMS (refer to weed management procedure in Section **7.3**).

3.14 Fire

Bushfires occur naturally and frequently in this region, mostly started by lightning strikes or human activities. Bushfires may occur in any month of the year, but generally will not run through the night during the cooler winter months. Fires in the ranges historically occur at an interval of 15-35 years, although they have in recent times occurred every 2-3 years (ICS Group 2006).

A preliminary fire history about the mine site was compiled using aerial photography and satellite imagery (Figure 4). A large fire in approximately 1969 appears to have started near the Great Northern Highway rest area and burnt about half of the central and eastern parts of the Mt Gibson Ranges including the west slope of Extension Hill, all of Extension Hill South and Mt Gibson, and the hills between Iron Hill and Mt Gibson. Some parts of Extension Hill North may also have been burnt but have not been mapped.

An extensive fire occurred around 1973 on the sand plain to the west of the range, and burnt the hill south of Extension Hill South.

A large fire in February 2003 burnt approximately one third of the range – between the eastern slope of Iron Hill and the western slope of Mt Gibson. The eastern half of this fire was previously burnt in the 1969 fire.

A small fire in December 2005 burnt a small area on the western slope of Extension Hill North. This area was last burnt around 1969.

Anecdotal observations by geologists and botanists (Muir Environmental 1995) suggest that a fire occurred somewhere in the Ranges in 1992-1993 and in the northern part (at least) of Extension Hill between 1983 and 1990. These observations do not agree with the air photos from 1990 and 1996 or medium quality satellite imagery from 1989 and 2000, which show no other fire scars. It appears that casual observations of the fire intervals are unreliable.

Considering the fire history, it appears that images, weather conditions, vegetation and topography have a bigger influence on fire behaviour than fuel age.

From a bushfire perspective, the vegetation in the Mt Gibson Ranges area is of four main types, two of which are fire-prone:

1. Open eucalypt woodland, dominated by York gum and Salmon gum, with flat to gently undulating topography and an open shrub understorey. This landscape will not support a running fire, except when seasonal conditions (especially winter rainfall) promotes the development of fields of annuals ("everlastings") which cure and become a continuous fire fuel in the subsequent summer. These areas will burn every two years if there is sufficient winter rainfall to germinate the fields of annuals, but the fires are generally patchy, leaving unburnt rocky areas and eucalypt thickets without an understorey or grass;
2. Sandplains, comprising dense woody shrublands mostly undifferentiated into an over- and understorey. These areas will burn *en masse* under hot windy conditions, and the fires are usually very intense and widespread, leaving nothing unburnt in their path. Burnt areas are rendered relatively "fire-proof" for the subsequent 5-8 years;
3. Salt lake verges, comprising cypress pine and scattered shrubby eucalypts with a sparse understorey. These areas generally do not carry a fire except after an exceptionally wet winter; and
4. The rocky slopes and ironstone uplands of the ranges, which carry a heath-like low woody shrub cover and a few low trees, mostly wattles or sheoaks. These areas are highly flammable and will burn fiercely, but not generally more frequently than at 5-year intervals. Fires are wind-driven, and burn in tongues, leaving unburnt strips.

The bushland in the immediate vicinity of the mine site is open eucalypt woodlands or rocky uplands. The dry tailings and waste dump will be located in an area of sandplain. There is a small area of salt lake country on the mining lease located to the south of the BIF ranges.

3.15 Fauna

Mine site
The Mt Gibson area contains diverse fauna assemblages representing 112 species including 64 species of birds, 38 species of reptiles and 10 species of mammals, of which five have been introduced (ATA Environmental 2005b). The area about the mine site can be divided into three broad fauna habitat types: the flat sand plains, the flat woodlands, and the slopes and iron stone ridges. Further detail on the fauna is provided in the PER (ATA Environmental 2006a).

Services corridor
The majority of the proposed services corridor route between the Mt Gibson Ranges and Geraldton Port is associated with cleared agricultural lands. However, there are areas of native vegetation, particularly along Wanarra Road between Mongers Lake and Mt Gibson, where clearing of vegetation may be necessary. The fauna habitat that is to be disturbed is widely distributed throughout the Midwest region and none of the fauna species expected to be found in the immediate vicinity of the services corridor route have ranges restricted to the immediate vicinity.

The salt lakes and associated vegetation provide isolated habitat types throughout the wheatbelt and Midwest regions. These areas can provide specific habitat for species of reptile (e.g. Claypan Dragon, *Ctenophorus salinarum*) that are not found in other habitat types in the region. Although the salt lakes are often geographically isolated, the faunal assemblages found among these similar habitat types are quite uniform throughout the region.

3.16 Significant fauna species

Mine site
A number of fauna species that have special ecological status under State and/or Commonwealth government legislation, have been previously recorded or have the potential to occur in the vicinity of the Mt Gibson Ranges (Table 6). The known habitat requirements of species that are likely or known to occur in the tenement area (highlighted in bold) are described below.

Table 6 Significant vertebrate species recorded or listed as potentially occurring in the Mount Gibson area

Species	Status under Wildlife Conservation Act	Status under Commonwealth EPBC Act	Comment
Malleefowl *Leipoa ocellata*	Schedule 1	Vulnerable	Species *occurs* on the tenement
Carnaby's Black-Cockatoo *Calyptorhynchus latirostris*	Schedule 1	Endangered	Species *unlikely* to occur in the tenement
Western Spiny-tailed Skink *Egernia stokesii badia*	Schedule 1	Endangered	Species is *possibly* in the tenement
Peregrine Falcon *Falco peregrinus*	Schedule 4		Species is *likely* to occur in the tenement
Slender-billed Thornbill (western sub-species) *Acanthiza iredalei iredalei*		Vulnerable	Species is *likely* to occur in the tenement area but not on-site
Hooded Plover *Charadrius rubricollis*	Priority 4	Migratory	Species is *likely* to occur in the tenement area but not on-site
White-bellied Sea-Eagle *Haliaeetus leucogaster*		Migratory	Species may *occasionally* be seen in the tenement area
Fork-tailed Swift *Apus pacificus pacificus*		Migratory	Species may *occasionally* be seen in the tenement area
Rainbow Bee-eater *Merops ornatus*		Migratory	Species *occurs* in the tenement area
Numbat *Myrmecobius fasciatus*	Schedule 1		Species is *highly unlikely* to occur in the tenement area
Major Mitchell's Cockatoo *Cacatua leadbeateri*	Schedule 4		Species *occurs* in the tenement area
Australian Bustard *Ardeotis australis*	Priority 4		Species is *likely* to occur in the tenement area
Bushstone Curlew *Burhinus grallarius*	Priority 4		Species is *likely* to occur in the tenement area
Carpet Python *Morelia spilota imbricata*	Schedule 4		Species is *highly unlikely* to occur in the tenement area
Woma Python *Aspidites ramsayi*	Schedule 4		Species is *unlikely* to occur in the area
Cyclodomorphus branchialis	Priority 2		Species is *unlikely* to occur in the tenement area

Services corridor

Fauna species of conservation significance that have been previously recorded or have the potential to occur in the vicinity of services corridor are provided in Table 7. The known habitat requirements of species that are likely or known to occur in the services corridor area (Table 7 highlighted in bold) are described below.

Eight scheduled or priority fauna species are likely to visit, be resident or have been recorded in the services corridor. The Malleefowl occurs within areas of native thicket, woodland and shrubland between the Mt Gibson Ranges and Mongers Lake. Other species of conservation significance likely to be resident along the services corridor include the Western Spiny Tailed Skink, Shield Backed

Trapdoor Spider, Peregrine Falcon, Major Mitchell's Cockatoo, White-browed Babbler, Hooded Plover and Rainbow Bee-eater. Other Migratory species listed under the EPBC Act likely to occur within the services corridor include the Common Sandpiper, Sharp Tailed Sandpiper, Curlew Sandpiper, Red-necked Stint, Long-toed Stint, Great Egret and the Cattle Egret.

Table 7 Significant fauna recorded or listed as potentially occurring along the services corridor

Species	Schedule/ Priority	Status under Commonwealth EPBC Act	Comment
Malleefowl *Leipoa ocellata*	Schedule 1	Vulnerable Migratory	Species or species habitat *occurs* along pipeline route
Western Spiny-tailed Skink *Egernia stokesii badia*	Schedule 1	Endangered	Species or species habitat *potentially* occurs along pipeline route
Cyclodomorphus branchialis	Schedule 1		Species or species habitat *potentially* occurs along pipeline route
Shield-backed Trapdoor Spider *Idiosoma nigrum*	Schedule 1		Species or species habitat *potentially* occurs along pipeline route
Carpet Python *Morelia spilota imbricata*	Schedule 4		Species or species habitat *potentially* occurs along pipeline route
Woma (Ramsay's) Python *Aspidites ramsayi*	Schedule 4		Species or species habitat *potentially* occurs along pipeline route
Peregrine Falcon *Falco peregrinus*	Schedule 4		Species or species habitat *likely* to occur along pipeline route
Major Mitchell's Cockatoo *Cacatua leadbeateri*	Schedule 4		Species or species habitat *likely* to occur along pipeline route
White-browed Babbler *Pomatostomus superciliosus ashbyi*	Priority 4		Species or species habitat *likely* to occur along pipeline route
Hooded Plover *Charadrius rubricollis*	Priority 4		Species or species habitat *likely* to occur along pipeline route
Australian Bustard *Ardeotis australis*	Priority 4		Species or species habitat *potentially* occurs along pipeline route
Bush Stone-curlew *Burhinus grallarius*	Priority 4		Species or species habitat *potentially* occurs along pipeline route
Rainbow Bee-eater *Merops ornatus*		Migratory	Species or species habitat *occurs* within project area
Fork-tailed Swift *Apus pacificus*		Migratory	Species or species habitat *possible* along pipeline route
Great Egret *Ardea alba*		Migratory	Species or species habitat *likely* to occur along pipeline route
Cattle Egret *Ardea ibis*		Migratory	Species or species habitat *likely* to occur along pipeline route

Species	Schedule/ Priority	Status under Commonwealth EPBC Act	Comment
Glossy Ibis *Plegadis falcinellus*		Migratory	Species or species habitat *possible* along pipeline route
Grey Plover *Pluvialis squatarola*		Migratory	Species or species habitat *likely* to occur along pipeline route
Common Greenshank *Tringa nebularia*		Migratory	Species or species habitat *likely* to occur along pipeline route
Wood Sandpiper *Tringa glareola*		Migratory	Species or species habitat *likely* to occur along pipeline route
Common Sandpiper *Tringa hypoleucos*		Migratory	Species or species habitat *likely* to occur along pipeline route
Sharp-tailed Sandpiper *Calidris acuminata*		Migratory	Species or species habitat *likely* to occur along pipeline route
Curlew Sandpiper *Calidris ferruginea*		Migratory	Species or species habitat *likely* to occur along pipeline route
Red-necked Stint *Calidris ruficollis*		Migratory	Species or species habitat *likely* to occur along pipeline route
Long-toed Stint *Calidris subminuta*		Migratory	Species or species habitat *likely* to occur along pipeline route
White-bellied Sea-Eagle *Haliaeetus leucogaster*		Migratory	Species or species habitat *possible* along pipeline route
Osprey *Pandion haliaetus*		Migratory	Species or species habitat *possible* along pipeline route
White-winged Black Tern *Sterna leucoptera*		Migratory	Species or species habitat *possible* along pipeline route

***Leipoa ocellata* (Malleefowl)**

Malleefowl is a member of the family of mound building birds. The Malleefowl is now primarily found in semi-arid and arid shrublands and low woodlands dominated by mallee (Frith 1962a, 1962b). Adult birds feed on seeds, flowers and fruit of shrubs and herbs, but they will also eat invertebrates and fungi. Their diet often reflects foods that are locally available and in season (Harlen and Priddel 1996, Harold and Dennings 1998, Kentish and Westbrooke 1994, Reichelt and May 1997). The diet of chicks seems to be very similar to that of the adults (Benshemesh 2000).

This relatively large, mostly terrestrial species tends to be sedentary, nesting in the same general area year after year (Frith 1962a, Priddel and Wheeler 2003). Malleefowl build large mounds of sand, gravel and vegetation, 3-5m wide and over 1m high in which they incubate their eggs. A sandy substrate and abundance of leaf litter are clear requirements for the construction of the birds' incubator-nests (Frith 1959, 1962a). Nest building is mostly done between autumn and spring as a combined effort of the pair intending to use the mound. Once completed, the male then spends most of his time tending the mound, whereas the female spends most of her time foraging. Incubation temperature of the mound is influenced by microbial decomposition of the vegetation, particularly in the early stages, and solar radiation for the entire period. One to twenty-eight eggs are laid (with a mean of 14) between mid-August and mid-February (Frith 1959, Priddel and Wheeler 2005). Incubation takes about 60 days (Benshemesh 2000). Chicks receive no parental assistance once they have hatched. Mortality of chicks is about 80% in their first 10 days (Priddel 1989). Chicks do not appear to respond to habitat boundaries. Malleefowl will reuse ‘old’ mounds that have been inactive for a number of years.

Densities of the birds are generally highest in areas of higher rainfall, on more fertile soils (Benshemesh 2000, Copley and Williams 1995, Frith 1962a) and where shrub diversity is greatest (Woinarski 1989b). Density of the canopy cover is an important feature associated with high breeding densities (Benshemesh 2000, Frith 1962a), and the best predictor of clutch size is rainfall between May and December (Priddel and Wheeler 2005). As a consequence, clutch size will vary from year-to-year. Grazed areas generally have much lower densities (Benshemesh 2000). Outside of the breeding period, birds will range over several square kilometres (Benshemesh 2000, Booth 1987).

One hundred and thirteen Malleefowl mounds were located within the area searched, of which 15 were active (ATA Environmental 2005c). Most of the mounds around the Mt Gibson Ranges (Figure 2) were found in thickets, typically on the sand plain and pebbly soils on the slopes or base of the ironstone range. However, mounds were not confined to these areas.

Malleefowl mounds have been located using GPS and mapped (Figure 2). Coordinates of each mound are recorded in the EMS.

***Egernia stokesii badia* (Western Spiny-tailed Skink)**
Western Spiny-tailed Skink occurs in semi-arid scrub and woodland regions, sheltering in hollow logs, behind the bark of fallen trees and old abandoned buildings. This species has a strong preference for retreating to hollows in York Gums (*Eucalyptus loxophleba*), but it is occasionally found in Gimlet (*E. salubris*) and Salmon Gums (*E. salmonophloia*). Even though suitable habitat is found around the project area, the Western Spiny-tailed Skink has not been found in any surveys to date.

***Falco peregrinus* (Peregrine Falcon)**
Peregrine Falcon is uncommon, although widespread throughout much of Australia, excluding the extremely dry areas, and has a wide and patchy distribution. It shows a habitat preference for areas near cliffs along coastlines, rivers and ranges and within woodlands along watercourses and around lakes. Nesting sites include ledges along cliffs, granite outcrops and quarries, hollow trees near wetlands and old nests of other large bird species. It favours hilly or mountainous country and open woodlands and may be an occasional visitor to the Project area.

***Merops ornatus* (Rainbow Bee-eater)**
Rainbow Bee-eater is found across the better-watered parts of WA. It prefers lightly wooded, preferably sandy soil near water. Rainbow Bee-eaters are scarce to very common across their range depending on the available resources. Rainbow Bee-eaters are present in the Mt Gibson area. There is a large area of suitable habitat for this species in the undisturbed areas adjacent to the Project area.

***Cacatua leadbeateri* (Major Mitchell's Cockatoo)**
Major Mitchell's Cockatoo has a disjunct geographic distribution in Western Australia (WA) with a population in the semi-arid area east of Geraldton to include Lake Moore and Lake Barlee, which includes the Mt Gibson Ranges. Major Mitchell's Cockatoo is most often seen high in the branches of Salmon Gums (*Eucalyptus salmonophloia*) and other large eucalypts, in heavily timbered creek-lines or roadside verges in various parts of the WA wheatbelt. Major Mitchell's Cockatoo breeds in the hollows of large eucalypts. It is scarce throughout most of WA and the primary cause for its decline is land clearing for agriculture and subsequent fragmentation of remaining habitat. Major Mitchell's Cockatoo are present in the Project area.

***Acanthiza iredalei iredalei* (Slender-billed Thornbill)**
This species is sparsely distributed across arid and semi-arid southern Western Australia and western South Australia. Although the subspecies has suffered a contraction of range in the east, there is little evidence for a decline in the more extensive area outside agricultural areas. The western subspecies of the Slender-billed Thornbill occupies treeless chenopod shrubland. In central and western Western Australia, it favours saline flats associated with salt lakes, particularly where there is *Halosarcia* species. In South Australia and south-eastern Western Australia it occurs on plains dominated by *Maireana* (Bluebush) and *Atriplex* (Saltbush) species. It occasionally occurs in *Acacia* shrublands and mangroves adjacent to more preferred habitat. The Slender-billed Thornbill builds domed nests near the ground in a bush. The main threat to this subspecies is habitat degradation mainly due to sheep grazing. The key likely habitat for this species, if present, is to the SE of the Mt Gibson Ranges.

***Charadrius rubricollis* (Hooded Plover)**
The Hooded Plover frequents the margins and shallows of salt lakes, also along coastal beaches, where it forages for invertebrates along the water's edge. It is found along the southern coasts and salt lakes north to Port Gregory, Three Springs, Mt Gibson, Lake Brown, Lake Barlee, Lake Cowan and Eyre, and including Rottnest Island. It is scarce to common throughout the rest of its distribution. The Hooded Plover is unlikely to be found in the Mt Gibson Ranges, if it was, it would be classified as a vagrant. They have not been observed within the Mt Gibson area by Emeritus Professor Harry Recher or during the Hart, Simpson and Associates survey.

***Ardeotis australis* (Australian Bustard)**
Australian Bustards are tall birds that live on open grassy plains and low shrubby areas in northern Australia. The Australian Bustard is possibly found within the Mt Gibson area due to the availability of suitable habitat. They have not been previously observed within the Mt Gibson area by Emeritus Professor Harry Recher or during the Hart, Simpson and Associates survey.

***Burhinus grallarius* (Bushstone Curlew)**
The Bush Stone-curlew is a large, slim, mainly nocturnal, ground-dwelling bird. It is regarded as uncommon or rare having declined as a result of feral cats and foxes. It can be found in open wooded country or scrubs, in many other habitats. DEC records suggest it is likely to occur in the area in question. They have not been observed within the Mt Gibson area by Emeritus Professor Harry Recher or during the Hart, Simpson and Associates survey.

***Idiosoma nigrum* (Shield Backed Trapdoor Spider)**
The Shield-backed Trapdoor Spider has a wide distribution in the central and northern wheat belt and is currently in decline due to its patchy distribution, long life span and loss of suitable habitat. Shield-backed Trapdoor Spiders dig deep burrows that are fitted with a trapdoor lid and lined with radiating twigs. Individuals remain confined to their burrows for their entire lives, except for adult males that mature and wander in search of females, generally during the second half of the year. The spiders are generally confined to tall open Eucalypt woodland and do not occur in open heaths. It is possible that these spiders may occur in any of the tall open woodlands throughout the proposed route of the pipeline.

***Pomatostomus superciliosus ashbyi* (White-browed Babbler)**
This subspecies of bird lives in eucalypt forests and woodlands, and forages on or near the ground for insects and seeds. Clearance for agriculture has removed most of this species' habitat in the wheat belt of Western Australia. Continuing declines are inevitable, even though the subspecies is still widespread and is more persistent in fragments than other wheat belt taxa. This subspecies is likely to be found along the route within the roadside patches of woodlands that have a shrub understorey.

***Tringa hypoleucos* (Common Sandpiper)**
This widespread species inhabits a variety of coastal and interior wetlands, in particular narrow muddy edges of billabongs, river pools, mangroves, among rocks and snags, reefs or rocky beaches. It tends to avoid wide open mudflats. It is often seen perching on branches, posts and boats. This species is likely to be found within any wetland areas along the route.

***Calidris acuminate* (Sharp Tailed Sandpiper)**
This species is a common migrant that usually inhabits both fresh and saline wetlands. It prefers the muddy edges of lagoons, swamps, lakes, dams, soaks, sewage farms and temporary floodwaters. This species is likely to be found within any wetland areas along the route.

***Calidris ferruginea* (Curlew Sandpiper)**
This species is widespread and is a common summer migrant to Australian coastal sites and some are found across suitable interior sites. It is usually found on inter-tidal mudflats of estuaries, lagoons, mangrove channels and around lakes, dams, floodwaters and flooded saltbush surrounds of inland lakes. This species is likely to be found within any wetland areas along the route.

***Calidris ruficollis* (Red-necked Stint)**
This species is a common migrant in large numbers and inhabits a diversity of habitats. It is found on tidal and inland mudflats, salt marshes, beaches, salt fields and temporary floodwaters. This species is likely to be found within any wetland areas, including salt lakes along the route.

***Calidris subminuta* (Long-toed Stint)**
This species is a regular visitor to Australia and is scarce but most common in WA. It prefers shallow, fresh water and brackish swamps, lakes with muddy edges and is often among the low vegetation rather than on open mudflats. This species is likely to be found within any wetland areas along the route.

***Ardea alba* (Great Egret)**
This migratory species is common and very widespread in any suitable permanent or temporary habitat, including wetlands, flooded pastures, dams, estuarine mudflats, mangroves and reefs. This species is likely to be found within any wetland areas along the route

***Ardea ibis* (Cattle Egret)**
This species is often seen in flocks with livestock. The Cattle Egret's close association with livestock and habitat adaptability has helped this species spread. It is usually associated with moist pastures with tall grass, shallow open wetlands and margins and mudflats. This species may be found within any wetland areas along the proposed pipeline route.

3.17 Social

Mine site
The mine site is located in an isolated position and has no nearby townships or settlements, with the closest residence, White Wells Homestead, being located approximately 15km to the west of the mine boundary. Perenjori is located approximately 95km to the east, Wubin is located approximately 80km to the south and Paynes Find is located approximately 70km to the north of the site. The Great Northern Highway (following realignment) passes approximately 1km west of the mine.

The adjoining properties are managed for conservation purposes by the Australian Wildlife Conservancy - Mt Gibson pastoral station (AWC), Bush Heritage Australia – White Wells pastoral station / Charles Darwin Reserve (BHA) and Pindiddy Aboriginal Corporation – Ninghan Station (PAC). The Department of Environment and Conservation (DEC) has also purchased a number of stations in the region to meet the criteria for a comprehensive, adequate and representative reserve system.

Service corridor
The services corridor traverses land used for pastoral, agricultural and urban/infrastructure uses (Figure 6).

4.0 Risk Assessment

4.1 Environmental risk management

The environmental risk management method of this report is aligned with *Guidelines for the Preparation and Submission of an Environmental Plan under the Petroleum (Submerged Lands) (Management of Environment) Regulations 1999 (*Department of Industry, Tourism and Resources, 2007)*, Environmental Risk Management – Principles and Process Handbook* (Standards Australia HB 203:2006), and *Risk Management* (Standards Australia AS/NZS 4360: 2004).

Benefits and special considerations of the risk assessment are discussed in Sections 4.2 and 4.3. The environmental risk model (Section 4.4) and method (Section 4.5) were developed during a series of workshops between senior management, mine managers and operators, environmental managers, legal and environmental advisors.

Section 4.7 identifies potential sources of environmental risk from the environmental impact assessment including the PER (ATA Environmental 2006a), EPA Bulletin 1242 and Ministerial Statement No. 753.

Aspects of the mine operation, sources of risks and risk events likely to have an environmental impact are discussed in Sections 4.8, 4.9 and 4.10, respectively. The risk assessment and inherent risk severity and rating are listed in Table 11.

4.2 Benefits

Key benefits of the risk based environmental assessment (Standards Australia HB 203:2006) are to:

- prioritise environmental risks and manage those risks effectively;
- make compliance with relevant legislation easier to demonstrate;
- combine the protection of significant environmental factors and day to day mine management;
- improve environmental accountability;
- achieve informed decision making and greater transparency in decision making processes;
- reduce the organisations exposure to risk;
- provide effective strategic planning as a result of increased knowledge of environmental risks;
- better prepare and facilitate positive outcomes;
- improve audit processes; and
- provide better outcomes in terms of effectiveness, efficiency and appropriateness of programs.

4.3 Special features

Environmental risk assessment differs from other types of risk assessment because of the complexity of the environment (Standards Australia handbook HB 203:2006). The interactions occurring between different environmental factors within the ecosystems create a high degree of complexity and introduce significant uncertainty. In addition, the environmental effects are very difficult to predict and must often be made when there is still significant scientific uncertainty about potential outcomes. The uncertainty is such that the outcomes could be positive or negative.

Factors that affect the assessment process (Standards Australia HB 203:2006) include:

- lack of data and the need to make assumptions;
- natural variability;
- application of immature sciences with large differences of opinion at a scientific level;
- long time spans in which ecological change may occur, and the differentiation between natural or man-made causes;
- potential effects on the environment and economic welfare at different geographic levels (i.e. local, regional, national, international and global scales); and
- the complex and extensive web of stakeholders.

4.4 Model

The environmental risk model is defined by the following:

- consequence of an event (Table 8);
- likelihood of event occurring (Table 9); and
- risk severity and rating (Table 10).

Table 8 was developed to address the conditions specified in Ministerial Statement No. 753. The site specific levels contained in Table 8 were developed during internal risk assessment workshops attended by senior management, mine managers and operators, environmental managers, legal and environmental advisors. These consequence ratings were based on the ecosystem level of effect of each element and the potential for ecosystem recovery following an incident. The risk elements are interconnected and the consequence rating is triggered by that aspect defining the highest level of severity. These levels and ratings have been developed and revised following technical meetings and discussions with DEC.

Consequences for the mining operations and service corridor are distinct, particularly as the mining operations are continuous over 20 years while the service corridor construction window is small and maintenance is intermittent.

A key management objective is to undertake mining operations in a manner which seeks to avoid any of the potential events referred to in Table 8. The importance of Table 8 is that it governs what responses will be made by management if one of the events occurs. The range of responses, depending on the consequence of the event, are provided in Table 14. Table 8 in no way implies that this EMP is authorising, or providing a defence to, the activity under the *Wildlife Conservation Act 1950* or the *Environmental Protection Act 1986*.

Significant flora and floristic communities' consequences
Significant flora and floristic communities' consequences are shown in Table 8.

Identification and monitoring of significant floristic communities is complex (Section 3.11 and 3.12). Accordingly, whilst significant floristic communities will be monitored, it is proposed that *Darwinia masonii* or *Lepidosperma gibsonii* (or both as applicable) shall serve as a proxy for significant flora and floristic communities about the mine site unless ongoing monitoring identifies another species as a more appropriate bio-indicator in respect to possible impacts at the community level.

The term of the environmental effect, such as dust or fire, on *Darwinia masonii* or *Lepidosperma gibsonii* resulting from mining activities have been categorised as follows:

- Short term – less than 1 year duration;
- Medium term – between 1 year and 5 years; and
- Long term – greater than 5 years.

Weed consequences
Consequence definitions for weeds rely on:

- biodiversity rating; and
- percentage of total tenement area effected.

Responsibility for weeds about the mine site shall extend for the life of the mine until lease relinquishment.

Responsibility for weeds along the service corridor is limited to construction and until rehabilitation criteria is satisfactorily met.

Fauna consequences
Consequence definitions for fauna rely on a specified number of deaths per incident of significant fauna as proxies for general fauna.

Risk model development
The environmental risk model was developed during workshops between senior management, mine managers and operators, environmental managers, legal and environmental advisors.

Table 8 Consequence of actual or potential event, reference text for definitions and proxies. NB: elements are interconnected and the consequence rating is triggered by that aspect defining the highest level of severity

Reference	Descriptor	Significant Flora and Floristic Communities	Fugitive Dust	Bush Fire	Weeds (relative to baseline data)	Malleefowl	Fauna
1	Catastrophic	Short to medium-term severe damage of greater than 30% or long-term damage to greater than 20% of the known populations of *Darwinia masonii* or *Lepidosperma gibsonii* as a result of mining activities.	More than six measurements per annum that exceed the settled fugitive dust standard.	Greater than 11 fires affecting native vegetation per annum as a result of mining activities.	Environmental weed species with a high biodiversity impact rating present in >2% of tenement or services corridor area as a result of mining activities; or Environmental weed species with a moderate biodiversity impact rating present in >5% of tenement or services corridor area as a result of mining activities; or Environmental weed species with a mild or lower biodiversity impact rating present in >10% of tenement or services corridor area as a result of mining activities.	Destruction of two or more active Malleefowl mounds from mining activities; or destruction of greater than three inactive Malleefowl mounds from mining activities; or death of greater than three adult birds from mining activities.	Death of greater than three individuals of species of conservation significance as a result of mining activities.
2	Major	Short to medium-term damage to 15 - 30% or long-term damage to 5-20% of the known populations of *Darwinia masonii* or *Lepidosperma gibsonii* as a result of mining activities.	Four to six measurements per annum that exceed the settled fugitive dust standard.	Six to ten fires affecting native vegetation per annum as a result of mining activities.	Environmental weed species with a high biodiversity impact rating present in 1-2% of tenement or services corridor area as a result of mining activities; or Environmental weed species with a moderate biodiversity impact rating present in 2-5% of tenement or services corridor area as a result of mining activities; or Environmental weed species with a mild or lower biodiversity impact rating present in 5-10% of tenement or services corridor area as a result of mining activities.	Destruction of one active Malleefowl mound from mining activities; or destruction of three inactive Malleefowl mounds from mining activities; or death of 3 adult birds from mining activities.	Death of three individuals of species of conservation significance as a result of mining activities.
3	Moderate	Short to medium-term damage to 5-15% or long-term to less than 5% of the known populations of *Darwinia masonii* or *Lepidosperma gibsonii* as a result of mining activities.	Two to three measurements per annum that exceed the settled fugitive dust standard.	Four or five fires affecting native vegetation per annum as a result of mining activities.	Environmental weed species with a high biodiversity impact rating present in <1% of tenement or services corridor area as a result of mining activities; or Environmental weed species with a moderate biodiversity impact rating present in 1-2% of tenement or services corridor area as a result of mining activities; or Environmental weed species with a mild or lower biodiversity impact rating present in 2-5% of tenement or services corridor area as a result of mining activities.	Damage to one active Malleefowl mound from mining activities; or destruction of two inactive Malleefowl mounds from mining activities; or death of two adult birds from mining activities.	Death of two individuals of species of conservation significance as a result of mining activities.
4	Minor	Short to medium-term damage to less than 5% of the known populations of *Darwinia masonii* or *Lepidosperma gibsonii* as a result of mining activities.	One measurement per annum that exceeds the settled fugitive dust standard.	Two or three fires affecting native vegetation per annum as a result of mining activities.	Environmental weed species with a moderate biodiversity impact rating present in <1% of tenement or services corridor area as a result of mining activities; or Environmental weed species with a mild or lower biodiversity impact rating present in 1-2% of tenement or services corridor area as a result of mining activities.	Destruction of one inactive Malleefowl mound from mining activities; or death of one adult bird from mining activities.	Death of one individual of species of conservation significance as a result of mining activities.
5	Insignificant	Short to medium-term damage to an insignificant proportion of the known populations of *Darwinia masonii* or *Lepidosperma gibsonii* as a result of mining activities.	No measurements exceeding the settled fugitive dust standard.	Less than two fires affecting native vegetation per annum as a result of mining activities.	Environmental weed species with a mild or lower biodiversity impact rating present in <1% of tenement or services corridor area as a result of mining activities.	Damage to an inactive mound from mining activities.	No death of individual(s) of species of conservation significance as a result of mining activities.

NB: Unless a time period is stated the consequence is used to rate each incident. All incidents are recorded in periodic statistics reports. Cumulative events then trigger the appropriate reporting and actions as per table 14.

Table 9 Likelihood of event occurring

Reference	Descriptor	Description
A	Almost certain	Is expected to occur in most circumstances (e.g. several per day)
B	Likely	Will probably occur in most circumstances (e.g. several per month but not daily)
C	Possible	Should occur at some time (e.g. several per year but not monthly)
D	Unlikely	Could occur at some time (e.g. less than one per year)
E	Rare	May occur only in exceptional circumstances (e.g. unlikely to ever occur)

Table 10 Risk rating and severity

Likelihood	Consequences				
	1 Catastrophic	2 Major	3 Moderate	4 Minor	5 Insignificant
A Almost Certain	1	3	6	10	15
B Likely	2	5	9	14	19
C Possible	4	8	13	18	22
D Unlikely	7	12	17	21	24
E Rare	11	16	20	23	25

Risk Severity	Extreme risk (E): 1-8	High risk (H): 9-16	Moderate risk (M): 17-20	Low risk (L): 21-25

4.5 Method

The environmental risk assessment method for the EMP was developed during workshops between senior management, mine managers and operators, environmental managers, legal and environmental advisors. The method used is broadly aligned with the approach adopted in *Guidelines for the Preparation and Submission of an Environmental Plan under the Petroleum (Submerged Lands) (Management of Environment) Regulations 1999* (Department of Industry, Tourism and Resources, 2007), *Environmental Risk Management – Principles and Process Handbook* (Standards Australia HB 203:2006) and *Risk Management* (Standards Australia AS/NZS 4360: 2004).

The main elements of the environmental risk assessment process used for this EMP involves:

- identification of the key *environmental aspects* of the Project (including those relating to its development, operation and closure;
- identification of the potential *sources of risk*, *risk events* and *potential impacts* for each of these environmental aspects;
- an estimation of the *likelihood* of each risk event occurring, the potential environmental *consequences* if it did occur and the subsequent determination of an *inherent risk* rating for each risk event.

The parameters used for the determination of risk event consequence, risk likelihood and inherent risk rating and severity are set out in Tables 8, 9 and 10 respectively. Table 8 was reviewed in consultation with DEC technical officers. Table 11 sets out in summary form the inherent risk applying to each risk event identified for each environmental aspect of the Project.

Further details on the methodology used for the EMP are provided in the sections below.

4.6 Environmental considerations

In undertaking the risk assessment, members of the workshops gave particular consideration to:

- *Darwinia masonii* and *Lepidosperma gibsonii* population distribution;
- *Darwinia masonii* and *Lepidosperma gibsonii* genetics;
- *Darwinia masonii* and *Lepidosperma gibsonii* habitat;
- *Darwinia masonii* and *Lepidosperma gibsonii* morphologies;
- *Darwinia masonii* and *Lepidosperma gibsonii* pollinator characteristics;
- distances of *Darwinia masonii*, *Lepidosperma gibsonii* and *Acacia cerastes* populations from the mining activities;
- use of *Darwinia masonii* and *Lepidosperma gibsonii* as a proxy for the effect of dust deposition on significant floristic communities*;*
- significant flora;
- the relationship between plant mortality and settled dust is unknown;
- ability to re-establish floristic communities;
- ability to re-establish *Darwinia masonii* and *Lepidosperma gibsonii* through research;
- proximity of Malleefowl mounds to the mining activities;
- Malleefowl ecology and population dynamics;
- significant fauna;
- faunal assemblages and habitats;
- presence and ecology of feral animals;
- topography;
- soils and mine waste rock and their physical, chemical and biological properties;

- climate;
- rainfall;
- surface water, including patterns of flow;
- groundwater, including depth to water table;
- plant re-growth or seed germination responses to fire;
- fire, including frequency and intensity;
- weed invasiveness and ecology;
- ambient airborne dust load of the region;
- annual and seasonal surface wind speed and direction; and
- dust dispersion.

4.7 Environmental aspects

During workshops between senior management, mine managers and operators, environmental managers, legal and environmental advisors, common environmental aspects (*Guidelines for the Preparation and Submission of an Environmental Plan under the Petroleum (Submerged Lands) (Management of Environment) Regulations 1999*), which may result in common sources of environmental risk (or hazard) were identified and listed in Table 11.

4.8 Sources of risk

During workshops between senior management, mine managers and operators, environmental managers, legal and environmental advisors, the *sources of risk* resulting from the mining and service corridor activities, which may impact on the environment, were identified and listed in Table 11.

The key sources of risk are described in more detail as follows:

Unauthorised clearing
Vegetation clearing can result in permanent changes to the topography and vegetation of the area. There is potential for unauthorised vegetation clearing to have a direct impact on significant flora (Sections 3.8 and 3.10) or significant floristic communities.

Habitat reduction due to clearing can result in starvation of Malleefowl through a reduction in invertebrates, seeds, flowers and fruits (Benshemesh 2000). Malleefowl may also potentially be affected by unauthorised clearing through direct impacts on nesting mounds.

The loss of habitat will impact on fauna species living in the area. Most of the terrestrial species will be lost during the clearing process. Most birds will move to adjacent areas once clearing commences. This displacement alters the available habitat and will increase competition for resources in adjacent areas until a new balance develops.

Fire ignition
Fire ignition and subsequent spread may present a significant threat to the long term survival of *Darwinia masonii*, which is a re-seeder species. By contrast, *Lepidosperma gibsonii* and *Acacia cerastes* are re-sprouting species and, therefore capable of surviving fire to a greater extent than seeder species. Fire can cause large fluctuations in population size, age of plants and geographical distribution of re-seeder species.

There is no specific information on the impact of fire on significant floristic communities. However frequent or intense fires and the seasonal timing of these are likely to change the composition of the communities.

Fire can reduce the habitat available for terrestrial fauna and may cause competition for limited resources. Malleefowl mounds appear to be concentrated in areas of dense canopy, which historically has more than 20 years between fire occurrences.

Mining activity and the availability of rapid management response to fires may result in a reduction in the area burnt and the fire intensity for a given fire event either natural or mine related.

Weed infestation
Environmental weeds have potential to establish, reproduce and disperse and have a serious impact on natural systems and nature conservation values. Weeds can displace native plants by competing for resources (water, nutrients, light, etc.), and may alter fuel and fire dynamics. The introduction and/or spread of weeds as a result of human activities may result in the decline of significant flora and/or floristic communities. In addition, weeds can also have a significant adverse impact on fauna habitats.

An environmental weed species that is highly invasive will have a high rating for its potential to impact on the environment. Highly invasive weeds often spread rapidly. Species with a fast rate of spread will have a more extensive final distribution. Early action to remove these plants is highly effective in preventing serious weed problems.

No significant weed invasion has been observed to date in the vicinity of significant flora or significant floristic communities in the Project area, but is known to exist in the region (Bennett Environmental Consulting 2000; Paul Armstrong and Associates 2004).

Weeds can be locally prevalent along sections of the service corridor, particularly in the agricultural areas and stringent weed hygiene protocols will be implemented at the farm property level to prevent spread during construction and the rehabilitation process.

Trenching
The trench is created to allow pipes or other services (e.g. optic fibre cable) to be continuously laid and is filled in after the pipe or cable laying. During the period that the trench is open, it is a source of risk to fauna if they should fall into the trench and cannot escape. A reduction in the length of trench, mechanisms for fauna to exit the trench, and a reduction in the time that it is open will reduce the probability of fauna entrapment together with active fauna removal by qualified fauna handlers.

Feral fauna
An increase in human activity is often associated with an increase in the abundance of feral species such as the house mouse (*Mus musculus*), feral cat (*Felis catus*) and fox (*Vulpes vulpes*). This increase may be due to a decline in habitat health, creation of an environment that favours the species, increased road kills and poor putrescible waste disposal practices.

The house mouse, cat and fox were recorded in fauna surveys for the site and are well established in the area. Rabbits are not known to occur in the area. Goats are known to be present in the area to the south of the Mt Gibson Ranges and on Charles Darwin Reserve (White Wells Station), and can cause considerable damage to the native habitat.

Fox (and feral dog) predation is one of the major threats to Malleefowl. Cats and raptors, which mostly prey on chicks, are considered another important threat, although of less importance than foxes and feral dogs. Foxes prey on eggs, chicks and adult birds (Benshemesh and Burton 1997; Benshemesh and Burton 1999; Booth 1987; Brickhill 1987; Frith 1962a; Harlen and Priddel 1992; Priddel and Wheeler 1994; Short 2004) and are probably the most significant threat after large scale vegetation clearing or burning (Short 2004). Discussion with landholders in the region suggests that destocking of the nearby pastoral properties has resulted in a reduction in predator control measures which has in turn resulted in increased numbers of feral dogs and dingoes being observed locally.

Breeding densities for Malleefowl may be reduced by up to 85-90% in areas grazed by herbivores compared to similar non-grazed habitats (Benshemesh 2000; Frith 1962a). Grazing is thought to open up habitats and increase predation. Conversely localised destocking may increase numbers.

Lights
Lighting can change the behaviour of nocturnal and other fauna by altering the availability of insects and light.

Noise and vibrations
Fauna, about the mine site, may move to adjacent habitats as a result of noise and vibrations (Benshemesh 2000).

Generation of fugitive dust
The impacts arising from deposition of dust generated from mining activities on the foliage of *Darwinia masonii* and *Lepidosperma gibsonii* and significant floristic communities is unknown.

It is possible that cumulative settled dust on plant surfaces may reduce the plant's ability to photosynthesise, reproduce or regulate water. Any reduction of plant functions by dust may result in a decline in plant health, and the population.

Dust is likely to be a hazard close to the mine (e.g. less than 1000m) while away from the mine dispersion reduces this hazard for a given wind speed and direction.

It appears that the impact of dust on a population of *Darwinia masonii* or *Lepidosperma gibsonii* is a function of a combination of at least the following variables:

- point source dust suppression success;
- rainfall or removal of dust;
- incident solar radiation;
- wind speed and direction;
- cumulative settled dust (g/m^2) on the plant surfaces;
- duration over which the dust has settled;
- inversely proportional to the distance from the source;
- atmospheric stability;
- vertical settling under gravity; and
- plant morphology and physiology.

The cumulative settled dust on the plant is dependent on the rate of settlement (g/m^2/unit time) and the length of time over which the settling occurs and will be subject to dust removal processes such as rainfall events.

Fauna can also be forced to move to adjacent habitats by dust (Benshemesh 2000) generated from mining activities.

Change to hydrology
Mine activities may affect the surface hydrology, which is characterised by ephemeral flows to which the plants have adapted. The specific mine activity may change the quantity or quality of water available to the populations of significant flora or significant floristic communities.

Darwinia masonii is restricted to the upper slopes, crests and ridges of the nearby hills and is, therefore, unlikely to be impacted by any changes in sheet flow resulting from the mine activity. *Lepidosperma gibsonii* is generally restricted to the steep slopes and gullies of the hills and to areas of breakaways and associated flow lines and is also therefore, unlikely to be impacted by any changes in sheet flow resulting from the project. *Acacia cerastes* is located throughout the hills within the Mt Gibson Ranges and the potential impacts of changed surface hydrology are unknown.

Groundwater levels in the project area are naturally deep and do not support phreatophytic vegetation as the water table lies at 50-120m below ground surface.

Changes to surface hydrology may modify the vegetation, which in turn may change the quality of fauna habitats, and the availability of water sources.

4.9 Potential impacts

During workshops between senior management, mine managers and operators, environmental managers, legal and environmental advisors, *potential impacts* arising from the project were identified and are shown in Table 11.

4.10 Risk assessment

During the workshops, likelihood of event occurring (L), consequence of event occurring (C), risk rating (R), and resulting inherent risk (IR) were also estimated. The results of the risk assessment are outlined in Table 11.

Table 11 Mine site (A: 1-97) and services corridor (B: 98-123) risk assessment: Likelihood of event occurring (L), Consequence of event occurring (C), Risk Rating (R), and resulting Inherent Risk (IR), prior to mitigation

ID	Environmental aspects (in common)	Sources of risk	Risk event	Potential impacts	L	C	R	IR
	A. Mine site							
1	Land disturbance	Unauthorised clearing	Removal of *Darwinia masonii* and *Lepidosperma gibsonii*	Direct loss of *Darwinia masonii* and *Lepidosperma gibsonii*	A	4	10	H
2	Land disturbance	Unauthorised clearing	Removal of suitable fauna habitat	Decrease in fauna numbers and fauna assemblages	C	4	18	M
3	Land disturbance	Unauthorised clearing	Removal of suitable Malleefowl habitat; Disturbance of Malleefowl mounds	Decrease in Malleefowl numbers; Reduction in size of Malleefowl breeding population	B	3	9	H
4	Land disturbance	Vehicle movement	Road kill (fauna)	Decrease in fauna numbers	C	4	18	M
5	Land disturbance	Vehicle movement	Road kill (Malleefowl)	Decrease in Malleefowl numbers; Reduction in size of breeding population	B	4	14	H
6	Land disturbance	Fire ignition	Personnel activity; Vehicle movement	Loss of *Darwinia masonii* and *Lepidosperma gibsonii* and significant floristic communities; Loss of fauna habitat; Direct loss of Malleefowl and significant fauna	C	2	8	E
7	Land disturbance	Weed infestation	Vehicle movement; Creation of potential habitat for weeds	Weeds may outcompete native flora, change plant community composition; and alter fire regime (possibly increase fuel load); Modify fauna habitat	B	2	5	E
8	Earthworks or infrastructure	Generation of fugitive dust	Transport and unloading of fill material from trucks	Fugitive dust deposition may impair health of *Darwinia masonii* and *Lepidosperma gibsonii*	B	3	9	H
9	Earthworks or infrastructure	Weed infestation	Transport and unloading of fill material from trucks	Weeds may outcompete native flora, change plant community composition; and alter fire regime (possibly increase fuel	C	3	13	H

ID	Environmental aspects (in common)	Sources of risk	Risk event	Potential impacts	L	C	R	IR
	A. Mine site							
				load); Modify fauna habitat				
10	Earthworks or infrastructure	Fire ignition	Transport and unloading of fill material from trucks	An altered fire regime may change plant community composition (i.e. detrimental to some species and beneficial to others). The impact of fire on significant flora and floristic communities of banded ironstone areas is currently unknown.	C	2	8	E
11	Earthworks or infrastructure	Fire ignition	Transport and unloading of fill material from trucks	Loss of *Darwinia masonii* and *Lepidosperma gibsonii* and significant floristic communities; Loss of fauna habitat; Direct loss of Malleefowl and significant fauna	E	2	16	H
12	Earthworks or infrastructure	Change to surface hydrology including areas downstream of the mine site	Disturbance of soil materials and altered surface terrain	Reduced availability or quality of water available to, or flooding of adjacent flora; Disturbance to fauna habitat	C	3	13	H
13	Earthworks or infrastructure	Groundwater contamination	Accidental spillage of hydrocarbons and other hazardous substances	Death of *Darwinia masonii* and *Lepidosperma gibsonii* or fauna	D	4	21	L
14	Earthworks or infrastructure	Compaction	Creation of new /unauthorised tracks	Direct loss of *Darwinia masonii* and *Lepidosperma gibsonii* or fauna	C	4	18	M
15	Earthworks or infrastructure	Noise	Equipment operations	Displacement of fauna and Malleefowl	C	5	22	L
16	Water dams	Increased potable water availability	Increase in feral animals	Direct loss of Malleefowl and significant fauna	C	3	13	H
17	Stockpiles (topsoil, vegetation)	Generation of fugitive dust	Wind on dry, exposed surfaces	Fugitive dust deposition may impair health of plants.	D	3	17	M
18	Stockpiles (topsoil, vegetation)	Change to surface hydrology including areas downstream of the mine site	Placement of stockpiles	Reduced availability or quality of water available to adjacent flora	C	4	18	M
19	Stockpiles (topsoil, vegetation)	Vehicle movement	Road kill (Malleefowl)	Decrease in Malleefowl numbers;	C	4	18	M

ID	Environmental aspects (in common)	Sources of risk	Risk event	Potential impacts	L	C	R	IR
	A. Mine site							
				Reduction in size of Malleefowl breeding population; Decrease in fauna population				
20	Stockpiles (topsoil, vegetation)	Fire ignition	Personnel activity; Vehicle movement	Loss of *Darwinia masonii* and *Lepidosperma gibsonii* and significant floristic communities; Loss of fauna habitat; Direct loss of Malleefowl and significant fauna	D	3	17	M
21	Stockpiles (topsoil, vegetation)	Weed infestation	Vehicle movement; Creation of potential habitat for weeds	Weeds may outcompete native flora, change plant community composition; and alter fire regime (possibly increase fuel load); Modify fauna habitat	C	3	13	H
22	Processing plant infrastructure	Groundwater contamination	Accidental spillage of hydrocarbons and other hazardous substances	Loss of *Darwinia masonii* and *Lepidosperma gibsonii* and fauna	D	4	21	L
23	Processing plant infrastructure	Groundwater contamination	Inappropriate disposal of waste	Loss of *Darwinia masonii* and *Lepidosperma gibsonii* and fauna	D	4	21	L
24	Processing plant infrastructure	Hazardous materials (e.g. cement, paints, corrosive inhibitors)	Inappropriate management, storage and/or disposal or accidental spillage of hazardous materials	Loss of *Darwinia masonii* and *Lepidosperma gibsonii* and fauna	C	4	18	M
25	Processing plant infrastructure	Generation of fugitive dust	Transport and unloading of construction materials,	Fugitive dust deposition may impair health of plants; reduce habitat.	C	3	13	H
26	Processing plant infrastructure	Weed infestation	Vehicle movement; Transport and unloading of construction materials	Weeds may outcompete native flora, change plant community composition; and alter fire regime (possibly increase fuel load); Modify fauna habitat	C	3	13	H
27	Processing plant infrastructure	Noise	Plant machinery	Displacement of fauna and Malleefowl	C	5	22	L
28	Processing plant infrastructure	Light	Lighting during night time activity	Decrease in fauna numbers and fauna assemblages	C	5	22	L

ID	Environmental aspects (in common)	Sources of risk	Risk event	Potential impacts	L	C	R	IR
	A. Mine site							
29	Processing plant infrastructure	Fire ignition	Transport and unloading of construction materials; Personnel movement, vehicle operations; 'Hot' work	Loss of *Darwinia masonii* and *Lepidosperma gibsonii* and significant floristic communities; Loss of fauna habitat; Direct loss of Malleefowl and significant fauna	D	3	17	M
30	Blasting	Generation of fugitive dust	Blasting of ore and waste rock blocks causing the generation of dust particles in the air	Fugitive dust deposition may impair health of plants; Reduce habitat.	B	3	9	H
31	Blasting	Noise and vibration	Increased noise levels as a result of blasting	Pollinator movement away from plant communities	C	5	22	L
32	Blasting	Noise and vibration	Increased noise levels as a result of blasting	Displacement of fauna and Malleefowl	C	5	22	L
33	Removal of overburden & excavation of ore	Generation of fugitive dust	Movement of dry soil	Fugitive dust deposition may impair health of plants.	B	3	9	H
34	Removal of overburden & excavation of ore	Groundwater availability and quality	Removal of groundwater from pits	Reduced availability or quality of water available to adjacent flora	D	3	17	M
35	Removal of overburden & excavation of ore	Change to surface hydrology including areas downstream of the mine site	Altered surface terrain	Altered water regime or altered water availability to plants	C	3	13	H
36	Removal of overburden & excavation of ore	Vehicle movement	Road kill (fauna)	Direct loss of fauna	C	4	18	M
37	Removal of overburden & excavation of ore	Vehicle movement	Road kill (Malleefowl)	Direct loss of Malleefowl	C	4	18	M
38	Removal of overburden & excavation of ore	Noise	Equipment operations	Displacement of fauna and Malleefowl	C	5	22	L
39	Removal of overburden & excavation of ore	Fire ignition	Personnel activity; Vehicle movement	Loss of *Darwinia masonii* and *Lepidosperma gibsonii* and significant floristic communities; Loss of fauna habitat;	D	3	17	M

ID	Environmental aspects (in common)	Sources of risk	Risk event	Potential impacts	L	C	R	IR
	A. Mine site							
				Direct loss of Malleefowl and significant fauna				
40	Stockpiling and rehabilitation of waste & tailings	Generation of fugitive dust	Movement of dry soil, site preparation for rehabilitation (i.e. topsoil application, contour ripping)	Fugitive dust deposition may impair health of plants; Reduce habitats.	D	3	17	M
41	Stockpiling and rehabilitation of waste & tailings	Change to surface hydrology including areas downstream of the mine site	Build-up of tailings and waste materials alter surface terrain	Reduced availability or quality of water available to adjacent flora and fauna	C	3	13	H
42	Stockpiling and rehabilitation of waste & tailings	Weed infestation	Soil disturbance promotes the germination and establishment of weed species	Weeds may outcompete native flora, change plant community composition; and alter fire regime (possibly increase fuel load); Modify fauna habitat	C	2	8	E
43	Stockpiling and rehabilitation of waste & tailings	Vehicle movement	Road kill (fauna)	Direct loss of fauna	D	4	21	L
44	Stockpiling and rehabilitation of waste & tailings	Vehicle movement	Road kill (Malleefowl)	Direct loss of Malleefowl	C	4	18	M
45	Stockpiling and rehabilitation of waste & tailings	Noise	Equipment operations	Decrease in fauna numbers and fauna assemblages	C	4	18	M
46	Stockpiling and rehabilitation of waste & tailings	Light	Lighting during night time activity	Decrease in fauna numbers and fauna assemblages	C	5	22	L
47	Stockpiling and rehabilitation of waste & tailings	Fire ignition	Personnel activity; Vehicle movement	Loss of *Darwinia masonii* and *Lepidosperma gibsonii* and significant floristic communities; Loss of fauna habitat; Direct loss of Malleefowl and significant fauna	D	3	17	M
48	Crushing & screening ore	Generation of fugitive dust	Crushing and movement of dry soil	Fugitive dust deposition may impair health of plants.	C	3	13	H
49	Crushing & screening ore	Noise	Equipment operations	Displacement of fauna and Malleefowl	C	5	22	L
50	Crushing & screening ore	Light	Lighting during night time activity	Decrease in fauna numbers and fauna	C	5	22	L

ID	Environmental aspects (in common)	Sources of risk	Risk event	Potential impacts	L	C	R	IR
	A. Mine site							
				assemblages				
51	Power generation	Gaseous emissions	Diesel generator sets, gas generation (e.g. sulphur, particulate matter, NOx, fugitive oils)	Damage health of plants	C	4	18	M
52	Power generation	Noise	Generator operations	Displacement of fauna	D	4	21	L
53	Power generation	Noise	Generator operations	Displacement of Malleefowl	C	5	22	L
54	Power generation	Fire ignition	Generator operations	Loss of *Darwinia masonii* and *Lepidosperma gibsonii* and significant floristic communities; Loss of fauna habitat; Direct loss of Malleefowl and significant fauna	D	2	12	H
55	Iron ore stockpile stacking & reclaiming	Generation of fugitive dust	Movement of dry soil	Fugitive dust deposition may impair health of plants; Reduce habitats	C	3	13	H
56	Iron ore stockpile stacking & reclaiming	Noise	Vehicle movement	Displacement of fauna and Malleefowl	C	5	22	L
57	Iron ore stockpile stacking & reclaiming	Vehicle	Road kill (Malleefowl)	Direct loss of Malleefowl	C	4	18	M
58	ROM	Generation of fugitive dust	Movement of dry soil	Fugitive dust deposition may impair health of plants; Reduce habitats	C	3	13	H
59	ROM	Vehicle	Road kill (Malleefowl)	Direct loss of Malleefowl	C	4	18	M
60	ROM	Noise	Equipment operations	Displacement of fauna and Malleefowl	C	5	22	L
61	Site-wide operations	Unauthorised clearing	Creation of new unauthorised tracks	Direct loss of *Darwinia masonii* and *Lepidosperma gibsonii* and fauna	A	4	10	H
62	Site-wide operations	Domestic waste	Contamination of groundwater	Loss of *Darwinia masonii* and *Lepidosperma gibsonii* and fauna	D	5	24	L

ID	Environmental aspects (in common)	Sources of risk	Risk event	Potential impacts	L	C	R	IR
	A. Mine site							
63	Site-wide operations	Domestic waste	Solid wastes littering the landscape	Detrimental to health of *Darwinia masonii* and *Lepidosperma gibsonii* and fauna; Loss of fauna	B	4	14	H
64	Site-wide operations	Groundwater contamination	Accidental spillage of hydrocarbons and other toxic substances	Loss of *Darwinia masonii* and *Lepidosperma gibsonii* and fauna	D	4	21	L
65	Site-wide operations	Groundwater contamination	Inappropriate disposal of waste	Loss of *Darwinia masonii* and *Lepidosperma gibsonii* and fauna	D	4	21	L
66	Site-wide operations	Feral animals	Increased edible waste and water sources leading to an increase in feral animals	Loss of *Darwinia masonii* and *Lepidosperma gibsonii* pollinators	D	4	21	L
67	Site-wide operations	Feral animals	Increased edible waste and water sources leading to an increase in feral animals	Direct loss of general fauna	B	3	9	H
68	Site-wide operations	Feral animals	Increased edible waste and water sources leading to an increase in feral animals	Direct loss of Malleefowl and significant fauna	B	3	9	H
69	Site-wide operations	Vehicle	Road kill (fauna)	Decrease in fauna numbers and fauna assemblages	D	4	21	L
70	Site-wide operations	Vehicle	Road kill (Malleefowl)	Decrease in Malleefowl numbers; Reduction in size of breeding population	C	4	18	M
71	Site-wide operations	Noise	Equipment operations	Fauna displacement	D	4	21	L
72	Site-wide operations	Noise	Equipment operations	Malleefowl displacement	C	5	22	L
73	Site-wide operations	Light	Equipment operations	Decrease in fauna numbers and fauna assemblages	D	4	21	L
74	Site-wide operations	Fire ignition	Mine operations, maintenance or personnel activity (e.g. smoking, litter)	Loss of *Darwinia masonii* and *Lepidosperma gibsonii* and significant floristic communities; Loss of fauna habitat;	B	2	5	E

ID	Environmental aspects (in common)	Sources of risk	Risk event	Potential impacts	L	C	R	IR
	A. Mine site							
				Direct loss of Malleefowl and significant fauna				
75	Site-wide operations	Weed infestation	Vehicle movement	Weeds may outcompete native flora, change plant community composition; and alter fire regime (possibly increase fuel load); Modify fauna habitat	C	3	13	H
76	Geotechnical stability of engineered structures	Erosion	Slope gradient	Loss of topsoil, loss of suitable habitat for rehabilitation	B	4	14	H
77	Geotechnical stability of engineered structures	Drainage	Changes in hydrology	Reduced availability or quality of water available to adjacent flora and fauna	C	4	18	M
78	Rehabilitation of waste dumps	Rehabilitation	Poor site preparation (e.g. topsoil), topsoil management (e.g. storage application), species selection (e.g. seed quality, viability or mixes)	Poor establishment of vegetation, poor establishment of significant flora	C	3	13	H
79	Rehabilitation of waste dumps	Rehabilitation	Poor site preparation (e.g. topsoil), topsoil management (e.g. storage application), species selection (e.g. seed quality, viability or mixes)	Long term displacement of fauna and fauna assemblages	D	4	21	L
80	Rehabilitation of waste dumps	Vehicle	Road kill (fauna)	Decrease in fauna numbers and fauna assemblages	D	4	21	L
81	Rehabilitation of waste dumps	Vehicle	Road kill (Malleefowl)	Decrease in Malleefowl numbers; Reduction in size of breeding population	C	4	18	M
82	Rehabilitation of waste dumps	Fire ignition	Personnel activity; Vehicle movement	Loss of *Darwinia masonii* and *Lepidosperma gibsonii* and significant floristic communities; Loss of fauna habitat; Direct loss of Malleefowl and significant	D	3	17	M

ID	Environmental aspects (in common)	Sources of risk	Risk event	Potential impacts	L	C	R	IR
	A. Mine site							
				fauna				
83	Rehabilitation of waste dumps	Weed infestation	Vehicle movement; Creation of potential habitat for weeds	Weeds may outcompete native flora, change plant community composition; and alter fire regime (possibly increase fuel load); Modify fauna habitat	B	2	5	E
84	Geochemical stability	Groundwater contamination	Waste and tailings characterisation	Water quality: uptake by *Darwinia masonii* and *Lepidosperma gibsonii*	C	4	18	M
85	Rehabilitation of waste dumps	Site preparation for rehabilitation (i.e. topsoil application, contour ripping)	Generation of fugitive dust	Fugitive dust deposition may impair health of adjacent *Darwinia masonii* and *Lepidosperma gibsonii* and significant floristic communities	C	3	13	H
86	Rehabilitation of roads, tracks, storage facilities, processing plant areas	Site preparation for rehabilitation (i.e. topsoil application, contour ripping)	Generation of fugitive dust	Poor establishment of native flora on adjacent rehabilitated areas	C	3	13	H
87	Rehabilitation of roads, tracks, storage facilities, processing plant areas	Site preparation for rehabilitation (i.e. topsoil application, contour ripping)	Generation of fugitive dust	Fugitive dust deposition may impair health of adjacent *Darwinia masonii* and *Lepidosperma gibsonii* and significant floristic communities	C	3	13	H
88	Rehabilitation of roads, tracks, storage facilities, processing plant areas	Weed infestation	Vehicle movement; Creation of potential habitat for weeds	Weeds may outcompete native flora, change plant community composition; and alter fire regime (possibly increase fuel load); Modify fauna habitat	C	3	13	H
89	Rehabilitation of roads, tracks, storage facilities, processing plant areas	Fire ignition	Vehicle movement; Personnel activity	Loss of *Darwinia masonii* and *Lepidosperma gibsonii* and significant floristic communities; Loss of fauna habitat; Direct loss of Malleefowl and significant fauna	C	3	13	H

ID	Environmental aspects (in common)	Sources of risk	Risk event	Potential impacts	L	C	R	IR
	A. Mine site							
90	Rehabilitation of roads, tracks, storage facilities, processing plant areas	Vehicle	Road kill (fauna)	Decrease in fauna numbers and fauna assemblages	D	4	21	L
91	Rehabilitation of roads, tracks, storage facilities, processing plant areas	Vehicle	Road kill (Malleefowl)	Decrease in Malleefowl numbers; Reduction in size of breeding population	C	4	18	M
92	On-going monitoring	Weed infestation	Vehicle movement	Weeds may outcompete native flora, change plant community composition; and alter fire regime (possibly increase fuel load); Modify fauna habitat	C	4	18	M
93	On-going monitoring	Erosion	Site preparation	Erosion may result in reduced habitat for plant germination, growth and establishment	C	4	18	M
94	On-going monitoring	Fire ignition	Personnel activity; Vehicle movement	Loss of *Darwinia masonii* and *Lepidosperma gibsonii* and significant floristic communities; Loss of fauna habitat; Direct loss of Malleefowl and significant fauna	C	3	13	H
95	On-going monitoring	Vehicle	Road kill (fauna)	Decrease in fauna numbers and fauna assemblages	D	4	21	L
96	On-going monitoring	Vehicle	Road kill (Malleefowl)	Decrease in Malleefowl numbers; Reduction in size of breeding population	D	4	21	L
97	Power transmission	Fire ignition	Collapse of a transmission pole, pole top fire	Loss of *Darwinia masonii* and *Lepidosperma gibsonii* and significant floristic communities; Loss of fauna habitat; Direct loss of Malleefowl and significant fauna	C	2	8	E

ID	Environmental aspects (in common)	Sources of risk	Risk event	Potential impacts	L	C	R	IR
	B. Services corridor							
98	Land disturbance	Unauthorised clearing	Removal of significant flora (*Cryptantha imbricata*, *Podotheca uniseta*, *Psammomoya implexa*, *Grevillea* aff. *yorkrakinensis*)	Direct loss of significant flora (*C. imbricata*, *P. uniseta*, *P. implexa*, *G.* aff. *yorkrakinensis*).	C	3	13	H
99	Land disturbance	Unauthorised clearing	Removal of suitable fauna habitat	Decrease in fauna numbers and assemblages.	C	4	18	M
100	Land disturbance	Unauthorised clearing	Removal of suitable Malleefowl habitat; and Disturbance of Malleefowl mounds	Loss of Malleefowl	C	3	13	H
101	Land disturbance	Fire ignition	Personnel activity; or Vehicle movement	Loss of significant flora (*C. imbricata*, *P. uniseta*, *P. implexa*, *G.* aff. *yorkrakinensis*) Loss of fauna habitat; Direct loss of Malleefowl and significant fauna	D	3	17	M
102	Land disturbance	Weed infestation	Vehicle movement; Creation of potential habitat for weeds	Weeds (in the pastoral areas?) may outcompete native flora, change plant community composition; and alter fire regime (possibly increase fuel load); Modify fauna habitat.	C	3	13	H
103	Land disturbance	Groundwater or surface water contamination	Cutting of the trench into potentially acid forming soils such as Lake Monger and tributaries of the Yarra Yarra Lake.	Loss of flora and fauna associated with lake margins.	C	3	13	H
104	Earthworks or infrastructure	Generation of fugitive dust	Digging of the trench or land excavation.	Fugitive dust deposition may impair metabolic functions of significant flora	C	4	18	M
105	Earthworks or infrastructure	Trenching	Fauna falling into trench	Loss of fauna.	B	3	9	H
106	Earthworks or infrastructure	Weed infestation	Vehicle movement; Creation of potential habitat for weeds.	Weeds may outcompete native flora, change plant community composition; and alter fire regime (possibly increase fuel load);	C	3	13	H

ID	Environmental aspects (in common)	Sources of risk	Risk event	Potential impacts	L	C	R	IR
	B. Services corridor							
				Modify fauna habitat				
107	Earthworks or infrastructure	Fire ignition	Earthmoving or the transport and/or unloading of fill material from trucks; Hot work – welding HDPE Personnel activity; Vehicle movement	Loss of significant flora (*C. imbricata*, *P. uniseta*, *P. implexa*, *G.* aff. *yorkrakinensis*); Loss of fauna habitat; Direct loss of Malleefowl and significant fauna	C	4	18	M
108	Earthworks or infrastructure	Change to surface hydrology	Disturbance of soil materials and altered surface terrain	Reduced availability or quality of water available to, or flooding of adjacent flora; disturbance to fauna habitat; and flooding of the trench.	D	3	17	M
109	Earthworks or infrastructure	Groundwater or surface water contamination	Accidental spillage of hydrocarbons and other hazardous substances; Incorrect storage of hazardous material (hydrocarbons, tyres, sewerage and grey water, putrescible waste, general littering)	Loss of flora or fauna	C	4	18	M
110	Earthworks or infrastructure	Creation of new and unauthorised tracks	Soil compaction along the services corridor	Direct loss of significant flora *C. imbricata*, *P. uniseta*, *P. implexa*, *G.* aff. *yorkrakinensis*)	D	4	21	L
111	Earthworks or infrastructure	Noise	Excessive noise during pipeline construction including piling operations for retaining systems	Displacement of fauna.	C	5	22	L
112	Earthworks or infrastructure	Excavation of soil	Inappropriate segregation and stockpiling of soil	Poor re-sequencing of soils to re-instate the natural profile leading to impacts on vegetation re-establishment; displacement of soils outside of the approved footprint.	D	4	21	L
113	Construction camps	Waste management	Incorrect storage of hazardous	Contamination of soils, surface or ground	C	4	18	M

ID	Environmental aspects (in common)	Sources of risk	Risk event	Potential impacts	L	C	R	IR
	B. Services corridor							
			material (hydrocarbons, tyres, sewerage and grey water, putrescible waste, general littering.	water, visual amenity, impacts to flora or fauna.				
114	Commissioning of infrastructure	Testing of hydrostatic properties of pipelines prior to their operation	Hydrostatic testing of pipelines using approximately 90m^3 of potable water and its disposal.	The control and disposal of hydrostatic test water which may influence surface water and cause surface erosion.	C	4	18	M
115	Pumping stations	Noise	Pumping operation	Sensitive receptors impacted through excessive noise levels.	D	4	21	L
116	Pumping stations	Noise	Pumping operation	Displacement of fauna or Malleefowl	C	5	22	L
117	Pumping stations	Hydrocarbon management	Inappropriate containment or transfer of fuels and oils for maintenance of pumps only.	Loss of flora or or aquatic biota (Yarra Yarra lake tributary proximity).	C	4	18	M
118	Site wide operations	Water or slurry discharge	Pipeline rupture externally caused (e.g. mechanical impact >25t excavator, 80 mm teeth); Structural failure	Erosion; localised flooding; potential contamination from slurry fines; loss of flora.	E	3	20	M
119	Site wide operations	Vehicle movements	Roadkill (fauna)	Loss of Malleefowl and significant fauna	C	4	18	M
120	Rehabilitation	Generation of fugitive dust	Excessive dust generation from inappropriate movement of soils and earth during preparation for rehabilitation (i.e. topsoil application, ripping)	Fugitive dust deposition may impair the health of plants; Impact on fauna habitat or displacement of fauna.	C	4	18	M
121	Rehabilitation	Weed infestation	Vehicle movement; Creation of potential habitat for weeds; Spreading of potential weed contaminated soils in rehabilitation process.	Weeds may outcompete native flora, change plant community composition; and alter fire regime (possibly increase fuel load); Modify fauna habitat	C	3	13	H

ID	Environmental aspects (in common)	Sources of risk	Risk event	Potential impacts	L	C	R	IR
	B. Services corridor							
122	Rehabilitation	Fire ignition	Vehicle movement; Personnel activity	Loss of significant flora (*C. imbricata*, *P. uniseta*, *P. implexa*, *G.* aff. *yorkrakinensis*); Loss of fauna habitat; Direct loss of Malleefowl and significant fauna	D	3	17	M
123	Rehabilitation	Vehicle movements	Roadkill (fauna)	Loss of Malleefowl and significant fauna	C	4	18	M

5.0 Performance Objectives, Standards and Measurement Criteria

5.1 Performance objectives

The environmental performance objectives adopted for the EMP, and shown in Table 12, are those set out in Ministerial Statement No. 753.

5.2 Performance standards

Performance standards are an essential requirement for the risk based environmental management approach used in the EMP. However, agreed environmental performance standards, particularly in regard to significant flora, fauna and floristic communities, weeds, fire and settled dust are not available. The environmental performance standards of Table 12 are derived from current practices elsewhere and can be generally applied to environmental management of MGM and EHPL mining operations. These performance standards have regard of the stated performance objectives.

Nevertheless it is recognised that there are some technical difficulties with the performance standards and that they are not necessarily widely accepted. It is anticipated that the performance standards will be further developed collectively by government and industry, and as a result of new information provided by the implementation of the research plans (Section 7.6).

In selecting the performance standards the following policies, standards and guidelines have been considered.

Policies, standards and guidelines and measurement of plant species and communities
The following publications were reviewed to find appropriate management performance standards and measurements for significant flora and communities:

- IUCN Guidelines for Using the Red List Categories and Criteria (IUCN 2000, 2005);
- Environmental Protection Authority, 2004. Guidance Statement 51 Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia;
- Environmental Protection Authority, 2006. Guidance Statement 6 Rehabilitation of Terrestrial Ecosystems;
- Elzinga, C.L., D.W. Salzer and J.W. Willoughby, 1998. *Measuring and monitoring plant populations*. US Department of Interior, Bureau of Land Management, Technical Reference 1730-1 Denver, Colorado; and
- Keighery's Vegetation Condition Scale (Government of WA, 2000).

The review showed that:
- there is no particular standard or measurement of *Darwinia masonii* or *Lepidosperma gibsonii*;
- there is no particular standard or measurement of significant floristic communities; and
- defining floristic communities by species assemblages is complex and difficult to apply in the context of mining.

For the purposes of this EMP, the performance standards listed in Table 12 have been adopted. These standards may change as a result of the research and recovery plans of Sections 7.6 and 7.7.

***Darwinia masonii* and *Lepidosperma gibsonii* as a proxy for significant communities**
Darwinia masonii and *Lepidosperma gibsonii* have been chosen to act as a proxy for population health and dynamics and dust deposition on plant surfaces of significant floristic communities.
In choosing this proxy, the following were recognised:
- complexity of defining floristic communities (Section 3.11 and 3.12);

- requirement for research (Section 7.6); and
- a lack of any experience of the impact of mining activity on the *in-situ* survival or conservation status of significant floristic communities.

It is important to note that population health and dynamics for all the plant taxa within key significant florisitic communities to be impacted by the Project (defined in Ministerial Statement 753) will be measured in tandem with those measures on *Darwinia masonii* and *Lepidosperma gibsonii.* It is recognised that other species within these communities might be more susceptible to mining related activities and impacts than the current two proxy species. The results of ongoing monitoring may therefore indicate a need to change the bio-indicators (plant taxa as proxies) for indicators of significant community health. MGM and EHPL, as part of the EMS, would then subsequently review the performance standards in collaboration with government at the appropriate time.

Policies, standards and guidelines concerning airborne dust concentrations
Fugitive dust (airborne and settled) management performance standards for the Project are based on a review of the following policies, standards and guidelines:

- *Environmental Protection (Kwinana Atmospheric Wastes) Policy* 1992 (Kwinana EPP) has specified levels of pollutants including airborne particles (dust) in defined zones about Kwinana industrial area, where 90< TSP <290 $\mu g/m^3$ and PM10 <150 $\mu g/m^3$;
- National Environmental Protection Council (NPEC 1998) set health based ambient air quality standards for six pollutants, including airborne particles less than PM10;
- National Pollution Inventory (NPI) emission estimation techniques provide a relationship between total suspended particles (TSP) and PM10 for fugitive dust emissions resulting from blasting, drilling and wind erosion; using the NPI factor PM10=52% of TSP then the Kwinana EPP standards and limits are 47< PM10 <151 $\mu g/m^3$; and
- DEC Pilbara Air Quality Study Port Hedland interim target is total suspended particles (TSP) are approximately TSP<290 $\mu g/m^3$ and PM10<150 $\mu g/m^3$.

The review shows that there are:

- no specific standards or limits applied to fugitive dust throughout Western Australia;
- a significant range of TSP standards or measurement criteria;
- a significant range of PM10 standards or measurement criteria; and
- a significant variation of standards and measurement criteria, which are acceptable to both Commonwealth and State Agencies.

In the absence of a practical standard to measure the effect of settled dust on significant floristic communities, the *Darwinia masonii* and *Lepidosperma gibsonii* standard(s) will be used as a proxy. This will be reviewed with DEC to audit the relevance of these two species as suitable proxies.

Ambient airborne dust concentrations
Ambient dust levels are those measured a long distance from the mine and other mine related activities which may cause airborne dust. Although the area is known to have high ambient dust levels (Section 3.3), long term average values are unknown.

Policies, standards and guidelines concerning fauna and significant fauna species
Fauna species and fauna assemblages' management performance standards for the Project are based on a review of the following policies, standards and guidelines:

- Environmental Protection Authority, 2004. Guidance Statement 56 Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia;
- Rehabilitation and Degradation Index (RDI) (Thompson *et al*. 2007); and
- Landscape Function Analysis / Ecological Function Analysis (LFA/EFA; Ludwig and Tongway, 1995 and 1997).

Policies, standards and guidelines concerning weeds
Weed management performance standards for the Project are based on a review of the following policies, standards and guidelines:

- Environmental Weed Strategy (CALM 1999); and
- A Field Manual for Surveying and Mapping Nationally Significant Weeds (McNaught *et al*. 2006).

Policies, standards and guidelines concerning fire
Fire management performance standards for the Project are based on a review of the following policies, standards and guidelines:

- IUCN Classification Criteria for Species and Communities (IUCN 2000, 2005)

5.3 Measurement criteria

The measurement criteria are shown in Table 12.

The measurement criteria have regard of performance objectives and standards and shall determine if the performance objectives and standards have been met. However, it is recognised that the measurement criteria may change subject to monitoring and research.

Table 12 Performance objectives, standards and measurement criteria

Performance objectives	Performance standards	Biophysical measurement criteria
To facilitate the continued *in situ* survival and improvement of the conservation status of *Darwinia masonii* and *Lepidosperma gibsonii*. (Ministerial Statement 6-1 and 7-1)	Peer review and acceptance of research and scientific methods into the biology and ecology of *Darwinia masonii* and *Lepidosperma gibsonii* IUCN Classification Criteria for Species and Communities (IUCN 2000, 2005) EPA Guidance Statement No. 51 (EPA 2004a)	Measurement criteria are yet to be determined. It is envisaged that the *Darwinia masonii* and *Lepidosperma gibsonii* measurement criteria includes: • population dynamics; • reproduction biology; • habitat requirements; and • other IUCN measures
To maintain (or improve) the conservation status of significant native flora species and significant floristic communities. (Ministerial Statement 8-1)	IUCN Classification Criteria for Species and Communities (IUCN 2000, 2005) EPA Guidance Statement No. 51 (EPA 2004a)	Measurement criteria includes: • population dynamics; • reproduction biology; • habitat requirements; and • other IUCN measures
	Keighery's Vegetation Condition Scale (Government of WA, 2000)	Measurement criteria includes: • presence or absence of weeds; • presence or absence of grazing; • loss of vegetation; • other Keighery's scale measures; and • transects or quadrats.
	The standards for settled dust on significant floristic communities are not established; therefore it is assumed that the *Darwinia masonii* and *Lepidosperma gibsonii* are a proxy for significant floristic communities in regard to settled dust on plant surfaces. The standards for settled dust on *Darwinia masonii* and *Lepidosperma gibsonii* are not established. In the absence of a standards and adopting other practices, it is assumed a suitable standard for deposited dust on *Darwinia masonii* and *Lepidosperma gibsonii* in quadrats shall be <4 g/m^2/month.	Measurement criteria for *Darwinia masonii* and *Lepidosperma gibsonii* are not established. Measurement criteria includes: • cumulative settled dust; • no measurable loss of *Darwinia masonii* or *Lepidosperma gibsonii* as a result of fugitive dust deposition in the fixed monitoring quadrats; and • no measurable change of health of *Darwinia masonii* and *Lepidosperma gibsonii* as a result of fugitive dust deposition in the fixed monitoring quadrats.

Performance objectives	Performance standards	Biophysical measurement criteria
Ensure that mining and other activities of the mine, particularly the generation of dust, do not lead to a further decline in the local population of the species. (Ministerial Statement 6-1(5), 7-1(5) and 8-1)	The standards for settled dust on *Darwinia masonii* and *Lepidosperma gibsonii* are not established. In the absence of a standards and adopting other practices, it is assumed a suitable standard for deposited dust on *Darwinia masonii* and *Lepidosperma gibsonii* in quadrats shall be <4 g/m^2/month.	Measurement criteria for *Darwinia masonii* and *Lepidosperma gibsonii* are not established. Measurement criteria includes: • cumulative settled dust; • no measurable loss of *Darwinia masonii* or *Lepidosperma gibsonii* as a result of fugitive dust deposition in the fixed monitoring quadrats; and • no measurable change of health of *Darwinia masonii* and *Lepidosperma gibsonii* as a result of fugitive dust deposition in the fixed monitoring quadrats.
Prevent the spread of existing weeds within the mine site caused by the activities of the proponent. (Ministerial Statement 9-1)	Classification criteria of Environmental Weed Strategy (EWS) (CALM 1999)	Measurement criteria includes: • number of weed species; • weed distribution; and • biodiversity impact rating of weed species in the Project tenements.
Prevent the establishment of new weeds within the mine site caused by the activities of the proponent. (Ministerial Statement 9-1)	Classification criteria of Environmental Weed Strategy (EWS) (CALM 1999)	Measurement criteria includes: • number of weed species; • weed distribution; and • biodiversity impact rating of weed species in the Project tenements.
Control and/or eradicate weeds within the mine site. (Ministerial Statement 9-1)	Classification criteria of Environmental Weed Strategy (EWS) (CALM 1999)	Measurement criteria includes: • number of weed species; • weed distribution; and • biodiversity impact rating of weed species in the Project tenements.

Performance objectives	Performance standards	Biophysical measurement criteria
Minimise the potential for the impact of weeds and weed management on significant flora identified in Condition 8. (Ministerial Statement 9-1)	IUCN Classification Criteria for Species and Communities (IUCN 2000, 2005) Classification criteria of Environmental Weed Strategy (EWS) (CALM 1999) (Note: the standard for weeds on significant floristic communities is not established. It is assumed that *D. masonii* and *L. gibsonii* are a proxy for significant floristic communities in regard to weeds)	Measurement criteria includes: • population dynamics; • reproduction biology; • habitat requirements; and • other IUCN measures; • distribution of weeds in proximity of *Darwinia masonii* and *Lepidosperma gibsonii*; • no measurable loss of *Darwinia masonii* and *Lepidosperma gibsonii* as a result of weed species in fixed monitoring quadrats; and • biodiversity impact rating of weed species in the Project tenements.
To reduce the risk of unplanned fires and provide contingency measures to minimise the impacts of fires on the local environment. (Ministerial Statement 10-1)	IUCN Classification Criteria for Species and Communities (IUCN 2000, 2005) (Note: Number of Malleefowl is measured by the proxy of number of active mounds) (Note: It is assumed that *D. masonii* and *L. gibsonii* are a proxy for significant floristic communities in regard to fire)	Measurement criteria includes: • population dynamics; • reproduction biology; • habitat requirements; and • other IUCN measures; • number of active and inactive Malleefowl mounds; and • number of fires as a result of mine operations.
To maintain the abundance, diversity, geographic distribution and productivity of the Malleefowl (*Leipoa ocellata*) through mitigation of adverse impacts and improvements in knowledge. (Ministerial Statement 11-1)	IUCN Classification Criteria for Species and Communities (IUCN 2000, 2005) (Note: Number of Malleefowl is measured by the proxy of number of active mounds) No standard for noise or dust has been established for Malleefowl.	Measurement criteria includes: • population dynamics; • reproduction biology; • habitat requirements; and • other IUCN measures; • number of Malleefowl mounds; and • number of tethered baits taken.

Performance objectives	Performance standards	Biophysical measurement criteria
To maintain the abundance, diversity, geographic distribution and productivity of native fauna through mitigation of adverse impacts and improvements in knowledge. (Ministerial Statement 12-1)	EPA Guidance Statement No. 56 (EPA 2004b) Landscape Function Analysis/ Ecological Function Analysis (LFA/EFA, Ludwig and Tongway 1995 and 1997) In the absence of a fauna standard the use of the Rehabilitation and Degradation Index (RDI) (Thompson *et al*. 2007) shall be considered.	Measurement criteria includes: • number of scats, nesting hollows and nests; • number of tethered baits taken; • number of native vertebrate fauna species; and • other LFA/EFA measures; and • other EPA Guidance Statement measures.

Note 1 An initial review of Performance objectives, Performance standards and Biophysical Measurement Criteria to be undertaken with DEC on or around 12 months from the commencement of mining operations.

Note 2 Further reviews to be conducted at intervals to be determined at time of initial review.

6.0 Management Strategy

6.1 Systems, practices and procedures

Management systems, practices and procedures are summarised in the Extension Hill and Extension Hill North Environmental Management System. These practices and procedures are managed through the MGM and EHPL's EMS.

6.2 Roles and responsibilities

Responsibilities and accountabilities for the implementation of the management strategy are assigned to MGM CEO, EHPL Managing Director, Registered Mine Manager and Environmental Officer, as appropriate.

The Managing Director of EHPL or CEO of MGM or authorised officers of MGM or EHPL will be responsible for ensuring that the Project is developed and operated in accordance with the approval granted by Ministerial Statement No. 753.

6.3 Training and competencies

Subject to their roles and responsibilities, all personnel working on the Project shall be trained in the management of environmental impacts and risks.

6.4 Monitoring, audit, management of non conformance and review

Monitoring, audit, management of non conformance and review procedures are in place to improve the management of impacts and risks against the performance objectives, standards and measurement criteria.

Monitoring, auditing and review
Monitoring and auditing of the environmental performance of the activities in relation to the standards and measurement criteria of each objective shall be implemented.

Monitoring and measurement of environmental performance shall be systematically recorded as appropriate. For example this may include spot checks, agenda items, inspections, or audit reports and completion check list.

Environmental audits shall be used to:

- ensure all significant environmental impacts and risks are managed to meet the environmental objectives and standards;
- ensure performance objectives are achieved by the application of performance standards and that performance objectives, performance standards and measurement are reviewed;
- identify non compliance and opportunities for improvement;
- ensure that timely reviews of monitoring and management data are undertaken; and
- ensure all environmental completion criteria have been met before suspending or decommissioning the proposed mine operation.

Compliance reporting
Management of non conformance and review procedures are summarised in the EMS (Section 7.4).

Any corrective or preventative actions taken shall be commensurate with the magnitude of the non conformances identified. Arrangements for the tracking and close out of action items are in the EMS.

Performance review
The environmental impacts and risks will be reviewed annually by a qualified person.

6.5 Emergency response and incident reporting

Emergency response and incident assessment and reporting procedures are in the Environmental Management System. The incident assessment and corrective action process does include a reassessment of the risk under the EMS.

6.6 Record keeping

Record keeping procedures are in the EMS.

6.7 Communication and consultation

Effective communication and consultation are important components of the risk management process. An on-going dialogue with internal and external stakeholders (including DEC) will ensure that those responsible for implementing risk management actions, and those with a vested interest, understand the basis on which decisions are made and why particular actions are taken.

MGM and EHPL have undertaken an extensive consultation program with stakeholders as part of developing the Project, which is summarised in the PER (ATA Environmental 2006a). The views of the different stakeholders will vary due to differences in expertise, values, needs and concerns. These views will have a significant impact on how decisions are made and will be integrated into the decision making process. Communication and consultation processes are contained within the EMS.

MGM and EHPL shall undertake future consultation. Examples of future consultation are shown in schedule 2 of Ministerial Statement No. 753.

7.0 Environmental Management Actions

7.1 Management actions of risk, mine closure and recovery and research plans

This section presents management actions concerning environmental risk, preliminary mine closure, and *Lepidosperma gibsonii* and *Darwinia masonii* Recovery and Research plans.

These preliminary management actions have, as far as practical, full regard of the following:

- applicable environmental legislation and regulatory requirements;
- both proponents' corporate policies, management and rehabilitation commitments;
- existing environment summarised in Section 3.0;
- potential environment impacts summarised in Section 4.9;
- risk assessment described in Section 4.10;
- relevant performance objectives, standards and measurement described in Section 5.0; and,
- management strategy described in Section 6.0.

The environmental risk assessment for the mine and service corridor is discussed in Section 4.0, where Table 11 lists the environmental aspect of the mine operations, sources of risk, the risk assessment, rating and severity. The risk severity varied from extreme to low. The high and extreme risks of Table 11 were selected for management action and are discussed in Section 7.2. The management procedures are shown in Section 7.3.

Environmental incidents resulting from unplanned events are discussed in Section 7.4.

Management actions related to the mine closure, and *Lepidosperma gibsonii* and *Darwinia masonii* Research and Recovery plans are presented in Sections 7.5, 7.6 and 7.7.

7.2 Management of risk events

Environmental aspects were classified according to risk rating and severity of Table 10. The inherent risk rating fell within the range 5-24 for the mine site and 9-22 for the service corridor. The inherent risk rating numbers were then ranked in descending order for both the mine site and service corridor i.e. prior to any management action or mitigation.

Workshops were held between executives of both companies, mine management, environmental consultants and legal advisors. Key management actions were planned for sources of risk or risk events which had inherent risk ratings in the range 5-16 about the mine site and 9-13 for the services corridor. In effect 47 line items prioritised by their extreme and high risk ratings were identified for management. These higher risk areas provide the focus for management actions, however the moderate and low risk areas are also mitigated by the management actions implemented to address the high risks.

The risk was reassessed assuming the key management actions were in place (Table 13). The residual risk severity and rating about the mine site showed the environmental impact was generally reduced to a severity of moderate or low with residual risk ratings in the range of 14-24.

The risk assessment process identified that the generation of dust by blasting activities remained a high residual risk. Following best practice mining techniques there are no management actions that can be put in place to mitigate the generation of dust from blasting. The risk to the DRF is not the generation of dust from blasting but the effect that this fugitive dust has on the surrounding DRF. The result of identifying this high risk puts more emphasis on monitoring and managing settled dust to detect and minimise any potential impact on these high value assets. Best intentions will be used to carry out blasting at times when the prevailing wind direction minimises dust fall out on DRF. Table 12

contains the performance objectives to be achieved for settled fugitive dust (which is inclusive of dust generated from blasting activities) and Table 8 sets out the consequence trigger levels for management actions in Table 14.

The residual risk severity and rating about the services corridor showed the environmental impact was generally reduced to a severity of moderate or low with residual risk ratings in the range of 18-24.

Key management actions are contained within MGM and EHPL company environmental procedures (Section 7.3).

As the mine plans and services corridor are further developed, or the mine is in operation, these actions shall be reviewed, and as appropriate adapted throughout the lifecycle of the mine.

Moderate and low risk severity shall be managed by routine mining procedures.

Table 13 Mine site (A) and services corridor (B) preliminary environmental management action of inherent extreme and high risks (likelihood of event occurring (L), consequence of event occurring (C), risk rating (R), inherent risk (IR) prior to mitigation, and residual risk (RR) after key control measures

ID	Environmental aspects (in common)	Sources of risk	Risk event	Potential impacts	L	C	R	IR	Key management actions[2] (or control measures)	L	C	R	RR
A.	Mine site												
7	Land disturbance	Weed infestation	Vehicle movement; Creation of potential habitat for weeds	Weeds may outcompete native flora, change plant community composition and alter fire regime (possibly increase fuel load); Modify fauna habitats	B	2	5	E	Weed management procedures; Site clearance protocol; Site access protocol; and Induction.	D	4	21	L
74	Site-wide operations	Fire ignition	Mine operations, maintenance or personnel activity (e.g. smoking, litter)	Loss of *Darwinia masonii, Lepidosperma gibsonii* and significant floristic communities; Loss of fauna habitat; Direct loss of Malleefowl and significant fauna	B	2	5	E	Fire management procedures; Site clearance protocol; Site access protocol; and Induction.	C	4	18	M
83	Rehabilitation of waste dumps	Weed infestation	Vehicle movement; Creation of potential habitat for weeds	Weeds may outcompete native flora, change plant community composition and alter fire regime (possibly increase fuel load); Modify fauna habitats	B	2	5	E	Weed management procedures; Site clearance protocol; Site access protocol; and Induction.	C	4	18	M
6	Land disturbance	Fire ignition	Personnel activity; Vehicle movement	Loss of *Darwinia masonii, Lepidosperma gibsonii* and significant floristic communities; Loss of fauna habitat; Direct loss of Malleefowl and	C	2	8	E	Fire management procedures; Site clearance protocol; Site access protocol; and Induction.	D	4	21	L

[2] Details for each control measure are provided in Section 7.3.

ID	Environmental aspects (in common)	Sources of risk	Risk event	Potential impacts	L	C	R	IR	Key management actions[2] (or control measures)	L	C	R	RR
A.	Mine site												
				significant fauna									
10	Earthworks & infrastructure	Fire ignition	Transport and unloading of fill material from trucks	Loss of *Darwinia masonii, Lepidosperma gibsonii* and significant floristic communities; Loss of fauna habitat; Direct loss of Malleefowl and significant fauna	C	2	8	E	Fire management procedures; Site clearance protocol; Site access protocol; Induction	D	4	21	L
42	Stockpiling & rehabilitation of waste and tailings	Weed infestation	Soil disturbance promotes the germination and establishment of weed species	Weeds may outcompete native flora, change plant community composition and alter fire regime (possibly increase fuel load); Modify fauna habitats	C	2	8	E	Weed management procedures; Site clearance protocol; Site access protocol; Induction	D	4	21	L
97	Power transmission	Fire ignition	Collapse of a transmission pole, pole top fire	Loss of *Darwinia masonii, Lepidosperma gibsonii* and significant floristic communities; Loss of fauna habitat; Direct loss of Malleefowl and significant fauna	C	2	8	E	Fire management procedures; Site clearance protocol; Site access protocol; Induction	D	3	17	M
3	Land disturbance	Unauthorised clearing	Removal of suitable Malleefowl habitat; Disturbance of Malleefowl mounds	Decrease in Malleefowl numbers; Reduction in size of Malleefowl breeding population	B	3	9	H	Induction; Site access protocol; Site clearance protocol; Demarcation of clearing boundaries	D	4	21	L
8	Earthworks & Infrastructure	Generation of fugitive dust	Transport and unloading of fill material from trucks	Fugitive dust deposition may impair health of *Darwinia masonii, Lepidosperma*	B	3	9	H	Dust management procedure; Vegetation management	D	4	21	L

ID	Environmental aspects (in common)	Sources of risk	Risk event	Potential impacts	L	C	R	IR	Key management actions[2] (or control measures)	L	C	R	RR
A.	Mine site												
				gibsonii and significant floristic communities					procedure; Site clearance protocol; Induction				
30	Mining of ore & waste	Generation of fugitive dust	Blasting of ore blocks causing the generation of dust particles in the air.	Fugitive dust deposition may impair health of *Darwinia masonii, Lepidosperma gibsonii* and significant floristic communities	B	3	9	H	Dust management procedure; Vegetation management procedure;	B	4	14	H
33	Removal of overburden & excavation of ore	Generation of fugitive dust	Movement of dry soil	Fugitive dust deposition may impair health of *Darwinia masonii, Lepidosperma gibsonii* and significant floristic communities	B	3	9	H	Dust management procedure; Vegetation management procedure; Site clearance protocol; Induction	D	4	21	L
67	Site-wide operations	Feral animals	Increased edible waste and water sources leading to an increase in feral animals	Direct loss of general fauna.	B	3	9	H	Feral animal management procedure; Fauna management procedures; Waste management procedures; Induction	D	4	21	L
68	Site-wide operations	Feral Animals	Increased edible waste and water sources leading to an increase in feral animals	Direct loss of Malleefowl and significant fauna	B	3	9	H	Feral animal management procedure; Fauna management procedures; Waste management procedures; Induction	D	4	21	L
1	Land disturbance	Unauthorised clearing	Removal of Darwinia masonii	Direct loss of Darwinia masonii	A	4	10	H	Induction;	D	4	21	L

ID	Environmental aspects (in common)	Sources of risk	Risk event	Potential impacts	L	C	R	IR	Key management actions[2] (or control measures)	L	C	R	RR
A.	Mine site												
			and Lepidosperma gibsonii	and Lepidosperma gibsonii)					Site access protocol; Site clearance protocol; Demarcation of clearing boundaries				
61	Site-wide operations	Unauthorised clearing	Creation of new unauthorised tracks	Direct loss of Darwinia masonii, Lepidosperma gibsonii and Malleefowl	A	4	10	H	Induction; Site access protocol; Site clearance protocol;	D	4	21	L
54	Power generation	Fire ignition	Generator operations	Loss of *Darwinia masonii, Lepidosperma gibsonii* and significant floristic communities; Loss of fauna habitat; Direct loss of Malleefowl and significant fauna	D	2	12	H	Fire management procedures; Site clearance protocol; Site access protocol; Induction	E	4	23	L
9	Earthworks & infrastructure	Weed infestation	Transport and unloading of fill material from trucks	Weeds may outcompete native flora, change plant community composition and alter fire regime (possibly increase fuel load); Modify fauna habitats	C	3	13	H	Weed management procedures; Site clearance protocol; Site access protocol; Induction	D	4	21	L
12	Site-wide operations	Change to surface hydrology	Disturbance of soil materials and altered surface terrain	Reduced availability or quality of water available to, or flooding of adjacent flora;	C	3	13	H	Surface water management procedure; Vegetation management procedure;	D	3	17	M
16	Water dams	Increased potable water availability	Increased potable water sources leading to an increase in feral animals	Direct loss of Malleefowl and significant fauna;	C	3	13	H	Feral animal management procedure ; Fauna management procedure.	D	5	24	L

ID	Environmental aspects (in common)	Sources of risk	Risk event	Potential impacts	L	C	R	IR	Key management actions[2] (or control measures)	L	C	R	RR
A.	Mine site												
21	Stockpiles (topsoil, vegetation)	Weed infestation	Vehicle movement; Creation of potential habitat for weeds	Weeds may outcompete native flora, change plant community composition and alter fire regime (possibly increase fuel load); Modify fauna habitats	C	3	13	H	Weed management procedures; Site clearance protocol; Site access protocol; Induction	D	4	21	L
24	Processing plant infrastructure	Hazardous materials (e.g. cement, paints, corrosion inhibitors)	Inappropriate management, storage and / or disposal or accidental spillage of hazardous materials	Death of *Darwinia masonii* and *Lepidosperma gibsonii* and fauna	C	4	18	M	Implement waste management procedures, implement fugitive dust management procedures	D	4	21	L
25	Processing plant infrastructure	Generation of fugitive dust	Transport and unloading of construction materials	Fugitive dust deposition may impair health of plants; reduce habitat.	C	3	13	H	Dust management procedure; Vegetation management procedure; Site clearance protocol; Induction	D	4	21	L
26	Processing plant infrastructure	Weed infestation	Vehicle movement; Transport and unloading of construction materials	Weeds may outcompete native flora, change plant community composition and alter fire regime (possibly increase fuel load); Modify fauna habitats	C	3	13	H	Weed management procedures; Site clearance protocol; Site access protocol; Induction	D	4	21	L
35	Removal of overburden & excavation of ore	Change to surface hydrology	Altered surface terrain	Reduced availability of water to adjacent flora	C	3	13	H	Surface water management procedure; Vegetation management procedure;	D	4	21	L
41	Stockpiling and rehabilitation of waste and tailings	Change to surface hydrology	Build-up of tailings and waste materials alter surface terrain	Reduced availability or quality of water to adjacent flora	C	3	13	H	Surface water management procedure; Vegetation management; procedure;	D	4	21	L

ID	Environmental aspects (in common)	Sources of risk	Risk event	Potential impacts	L	C	R	IR	Key management actions[2] (or control measures)	L	C	R	RR
A.	Mine site												
48	Crushing & screening ore	Generation of fugitive dust	Crushing and movement of dry soil	Fugitive dust deposition may impair health of *Darwinia masonii, Lepidosperma gibsonii* and significant floristic communities	C	3	13	H	Dust management procedure; Vegetation management procedure; Site clearance protocol; Induction	D	4	21	L
55	Iron ore stockpile stacking & reclaiming	Generation of fugitive dust	Movement of dry soil	Fugitive dust deposition may impair health of *Darwinia masonii, Lepidosperma gibsonii* and significant floristic communities	C	3	13	H	Dust management procedure; Vegetation management procedure; Site clearance protocol; Induction	D	4	21	L
58	ROM	Generation of fugitive dust	Movement of dry soil	Fugitive dust deposition may impair health of *Darwinia masonii, Lepidosperma gibsonii* and significant floristic communities	C	3	13	H	Dust management procedure; Vegetation management procedure; Site clearance protocol; Induction	D	4	21	L
75	Site-wide operations	Weed infestation	Vehicle movement	Weeds may outcompete native flora, change plant community composition and alter fire regime (possibly increase fuel load); Modify fauna habitats	C	3	13	H	Weed management procedures; Site clearance protocol; Site access protocol; Induction	D	4	21	L
78	Rehabilitation of waste dumps	Rehabilitation	Poor site preparation (e.g. topsoil), topsoil management (e.g. storage application), species selection (e.g. seed quality, lack of seed, seed viability, seed mixes)	Poor establishment of *Darwinia masonii*, *Lepidosperma gibsonii* and significant floristic communities	C	3	13	H	Rehabilitation management procedures; *Darwinia masonii* and *Lepidosperma gibsonii* research and recovery plans	D	4	21	L
85	Rehabilitation of	Site preparation for	Generation of fugitive dust	Fugitive dust deposition may	C	3	13	H	Dust management procedure;	D	4	21	L

ID	Environmental aspects (in common)	Sources of risk	Risk event	Potential impacts	L	C	R	IR	Key management actions[2] (or control measures)	L	C	R	RR
A.	Mine site												
	waste dumps	rehabilitation (i.e. topsoil application, contour ripping)		impair health of adjacent *Darwinia masonii, Lepidosperma gibsonii* and significant floristic communities					Vegetation management procedure; Site clearance protocol; Induction				
86	Rehabilitation of roads, tracks, storage facilities, processing plant areas	Site preparation for rehabilitation (i.e. topsoil application, contour ripping)	Generation of fugitive dust	Poor establishment of native flora on adjacent rehabilitated areas	C	3	13	H	Rehabilitation management procedures; *Darwinia masonii* and *Lepidosperma gibsonii* research and recovery plan	D	4	21	L
87	Rehabilitation of roads, tracks, storage facilities, processing plant areas	Site preparation for rehabilitation (i.e. topsoil application, contour ripping)	Generation of fugitive dust	Fugitive dust deposition may impair health of adjacent *Darwinia masonii, Lepidosperma gibsonii* and significant floristic communities	C	3	13	H	Implement rehabilitation management procedures, *Darwinia masonii* and *Lepidosperma gibsonii* research and recovery plan	D	4	21	L
88	Rehabilitation of roads, tracks, storage facilities, processing plant areas	Weed infestation	Vehicle movement; Creation of potential habitat for weeds	Weeds may outcompete native flora, change plant community composition and alter fire regime (possibly increase fuel load); Modify fauna habitats	C	3	13	H	Weed management procedures; Site clearance protocol; Site access protocol; Induction	D	4	21	L
89	Rehabilitation of roads, tracks, storage facilities, processing plant areas	Fire ignition	Vehicle movement; Personnel activity	Loss of *Darwinia masonii, Lepidosperma gibsonii* and significant floristic communities; Loss of fauna habitat; Direct loss of Malleefowl and significant fauna	C	3	13	H	Fire management procedures; Site clearance protocol; Site access protocol; Induction	D	4	21	L
94	On-going monitoring	Fire ignition	Personnel activity; Vehicle movement	Loss of *Darwinia masonii, Lepidosperma gibsonii* and	C	3	13	H	Fire management procedures; Site clearance protocol;	D	4	21	L

ID	Environmental aspects (in common)	Sources of risk	Risk event	Potential impacts	L	C	R	IR	Key management actions[2] (or control measures)	L	C	R	RR
A.	Mine site												
				significant floristic communities; Loss of fauna habitat; Direct loss of Malleefowl and significant fauna					Site access protocol; Induction				
5	Land disturbance	Vehicle movement	Road kill	Direct loss of Malleefowl and significant fauna;	B	4	14	H	Induction; Fauna management procedure.	C	4	18	M
63	Site-wide operations	Domestic waste	Solid wastes littering the landscape	Domestic waste may impair health of *Darwinia masonii, Lepidosperma gibsonii* and significant fauna; Direct loss of Malleefowl and significant fauna;	B	4	14	H	Waste management procedures; Induction	D	4	21	L
76	Geotechnical stability of engineered structures	Erosion	Slope gradient	Loss of topsoil, loss of suitable habitat for rehabilitation	B	4	14	H	Rehabilitation management procedures	D	4	21	L
11	Earthworks & infrastructure	Fire ignition	Transport and unloading of fill material from trucks	Loss of *Darwinia masonii, Lepidosperma gibsonii* and significant floristic communities; Loss of fauna habitat; Direct loss of Malleefowl and significant fauna	E	2	16	H	Fire management procedures; Site clearance protocol; Site access protocol; Induction	E	4	23	L

ID	Environmental aspects (in common)	Sources of risk	Risk event	Potential impacts	L	C	R	IR	Key management actions[3] (or control measures)	L	C	R	RR
B.	**Services corridor**												
105	Earthworks & infrastructure	Trenching	Fauna falling into trench	Decrease of fauna numbers and fauna assemblages.	B	3	9	H	Induction; Fauna management procedure; Engineering constraints; Physical barriers and controls (exit ramps).	C	4	18	M
98	Land disturbance	Unauthorised clearing	Removal of significant flora (*Cryptantha imbricata*, *Podotheca uniseta*, *Psammomoya implexa*, *Grevillea* aff. *yorkrakinensis*)	Direct loss of significant flora (*C. imbricata*, *P. uniseta*, *P. implexa*, *G.* aff. *yorkrakinensis*).	C	3	13	H	Induction; Site access protocol; Site clearance protocol; Demarcation of site clearance boundaries.	D	4	21	L
100	Land disturbance	Unauthorised clearing	Removal of suitable Malleefowl habitat; and Disturbance of Malleefowl mounds	Decrease in Malleefowl numbers; Reduction in size of Malleefowl breeding population	C	3	13	H	Induction; Site access protocol; Site clearance protocol; Demarcation of site clearance boundaries; Malleefowl management procedure; Fauna management procedure.	E	4	23	L
102	Land disturbance	Weed infestation	Vehicle movement; Creation of potential habitat for weeds	Weeds in the pastoral areas may outcompete native flora, change plant community composition; and alter fire regime (possibly increase fuel	C	3	13	H	Induction; Site access protocol; Site clearance protocol; Vegetation management	D	3	17	M

[3] Details for each control measure are provided in Section 7.3.

ID	Environmental aspects (in common)	Sources of risk	Risk event	Potential impacts	L	C	R	IR	Key management actions[3] (or control measures)	L	C	R	RR
B.	Services corridor												
				load); Modify fauna habitat					procedure; Weed management procedure.				
103	Land disturbance	Contamination of surface and/or ground water	Cutting of the trench into potentially acid forming soils at Lake Monger and tributaries of the Yarra Yarra Lake.	Loss of flora and fauna associated with lake margins.	C	3	13	H	Induction; Site access protocol; Assessment of acid sulphate soil potential prior to disturbance; Vegetation management procedure.	D	5	24	L
106	Earthworks & infrastructure	Weed infestations	Vehicle movement	Weeds may outcompete native flora, change plant community composition; and alter fire regime (possibly increase fuel load)	C	3	13	H	Induction; Site access protocol; Weed management procedure.	D	4	21	L
121	Rehabilitation	Weed infestations	Vehicle movements spreading weeds; disturbed soils favouring weed introduction over endemics; spreading of weed contaminated soils in rehabilitation process.	Weeds may outcompete native flora, change plant community composition; and alter fire regime (possibly increase fuel load); Changed fauna habitat	C	3	13	H	Induction; Site access protocol; Vegetation management procedure; Weed management procedure; Property management procedure.	D	4	21	L

7.3 Key management actions

The key management actions of Table 13 shall be implemented through MGM environmental management procedures. Various management actions are common to mitigating the risk concerning environmental aspect, source of risk and risk event. A selected combination of management actions have been used to mitigate a particular source of risk or risk event.

For this EMP, fourteen separate management procedures and protocols have been identified and developed to manage the risks, they are:

- dust management procedure;
- fauna management procedure;
- feral animal management procedure;
- fire management procedures;
- induction;
- malleefowl management procedure;
- property management procedure;
- rehabilitation management procedure;
- site access protocol;
- site clearance protocol;
- surface water management procedure;
- vegetation management procedure;
- waste management procedure; and
- weed management procedures.

Some of these procedures and protocols are related. The important elements within each management procedure and protocol are summarised by the following lists and included within the EMS.

Dust management procedure
The principles, parameters, and reporting in relation to dust monitoring on vegetation, and monitoring in the vegetation management procedure, shall be agreed with the DEC through the EMS.

Dust management procedure to include:

- identification of airborne dust;
- active response to non-fixed dust sources;
- depositional dust monitoring
- dust control systems on fixed plant;
- incident response; and
- prevailing weather considerations in blast schedule.

Fauna management procedure (mine site)
Fauna management procedure over the life of the mine (approximately 20 years) to include:

- restricted access areas;
- monitoring of *Leipoa ocellata* (Malleefowl) and selected fauna species;
- significant fauna considerations in site clearance protocol;
- recording of animal deaths and significant species sightings;
- fauna handling and translocation procedures, including protocol for injured wildlife; and
- traffic management including vehicle speed limits.

Fauna management procedure (services corridor)
Fauna management procedure for the services corridor to also include:

- compliance to Ministerial Statement No. 753 Condition 13;
- open trench limits for the Service Corridor;
- fauna trench exit ramp frequency and design criteria; and
- inspection and fauna removal criteria from Service Corridor construction trenches.

Feral animal management procedure
Feral animal management procedure to include:
- monitor presence of feral animals;
- reference to waste management procedure;
- baiting programs; and
- participation in regional baiting program.

Fire management procedures
Fire management procedures to include:
- training of emergency response personnel in fire fighting;
- site based fire fighting equipment;
- vehicle maintenance including safety check to reduce fire hazards.
- fire suppression systems on selected plant and equipment;
- locating fire breaks;
- fire break maintenance;
- fire reporting system in line with legislative requirements;
- incident control;
- installed fire fighting tanks on service corridor (EHPL services corridor);
- fire cause investigation and analysis; and
- liaison with neighbours and FESA with regard to bushfires.

Induction
The site induction presentation, to protect the environment and prevent pollution, to include:
- *Darwinia masonii*, *Lepidosperma gibsonii*, significant flora species and floristic communities;
- Malleefowl and other significant fauna;
- feral animals;
- bush fire prevention, detection and action;
- weeds;
- waste management;
- site clearance protocol;
- site access protocol;
- property management procedures (EHPL services corridor);
- soil management (EHPL services corridor);
- restricted areas;
- noise and vibration;
- speed limits; and
- individual company requirements..

Malleefowl management procedure
Malleefowl management procedure to include:
- restricted areas;
- traffic management, including speed limits;
- seasonality constraints;
- mound assessment guidelines;
- reference to feral animal management procedures;
- monitoring;

- mounds to be identified by survey and included in site procedures; and
- consultation with the Malleefowl Preservation Group to explore opportunities for involvement.

Property management procedure
Property management procedure specific to the services corridor will deal with landholder issues on a property by property scale but generically include:
- site access requirements both generic (protocol) and at a landholder scale;
- reference to site clearance protocol;
- land use data;
- soil management;
- weed management;
- waste management;
- existing services (roads, dams, pipelines, infrastructure);
- restricted access;
- hazardous chemicals (herbicides, insecticides) and materials (asbestos);
- fencing, temporary and permanent;
- existing copping systems versus remnant vegetation and pasture systems (certified – organic, none genetically modified);
- rehabilitation criteria;
- monitoring of rehabilitation; and
- stakeholder communications.

Rehabilitation management procedure
Rehabilitation management procedure to include:
- rehabilitation / closure criteria;
- criteria for the collection and storage of topsoil and vegetative material;
- progressive rehabilitation of disturbed areas wherever possible; and
- consideration of slope, substrate, specific soil replacement methodology;
- pre-disturbance and post rehabilitation topography;
- reference to Dust management procedure;
- reference to Weed management procedure;
- reference to site access protocol;
- work area survey control;
- seed source and appropriateness;
- reference to Surface water management procedure;
- soil compaction;
- restricted areas; and
- monitoring.

Site access protocol
A site access protocol to include:
- site induction;
- permit to access restricted areas;
- restricted areas around *Darwinia masonii, Lepidosperma gibsonii*, and Malleefowl mounds;
- defined restricted areas on properties along service corridor (contaminated areas, certified organic and genetically modified free crop areas) (EHPL services corridor);
- defined weed areas;
- fire risk management and control;
- a requirement for incoming vehicles and equipment to be weed-free;
- a vehicle inspection procedure;
- designated wash down facilities at defined areas on the services corridor (construction) (EHPL services corridor);
- restricted access signage;
- a wash down facility available for vehicles on the mine site; and
- communication and notification requirements for adjoining pastoral and farm properties outside of mining operations.

Site clearance protocol
A site clearance protocol to include:
- identification of proposed disturbance area;
- reason for clearing;
- restricted areas around *Darwinia masonii* and *Lepidosperma gibsonii* and significant flora and significant floristic communities;
- restricted areas around Malleefowl mounds;
- Malleefowl breeding season;
- significant fauna species habitat areas;
- consideration of weeds;
- consideration of soil depth;
- fire risks, management and control;
- dust controls;
- consideration of natural drainage contours;
- stockpile location for vegetation and topsoil removal;
- a sign off process prior to clearing; and
- compliance with statutory requirements.

Surface water management procedure
Surface water management procedure to include:
- surface water controls around planned infrastructure;
- identification of natural drainage prior to mining;
- systems of physical drainage control to prevent erosion and disruption to flows;
- installation of culverts where required to prevent water damming;
- containment of poor quality runoff water from mining activities;
- consideration of water quality and quantity down catchment;
- identification of temporary surface water diversion controls during construction of the service corridor trench (EHPL services corridor); and
- erosion monitoring, as required.

Vegetation management procedure
Vegetation management procedure to include:
- visual inspection of *Darwinia masonii* and *Lepidosperma gibsonii*;
- visual inspection of significant floristic communities at the mine site;
- monitoring of *Darwinia masonii* and *Lepidosperma gibsonii*;
- monitoring of significant flora *Cryptandra imbricata* , *Podotheca uniseta* , *Psammomya implexa* and *Chamelaucium* sp. Yalgoo (EHPL services corridor);
- assessment of the health of *Darwinia masonii* and *Lepidosperma gibsonii* and significant floristic communities;
- restricted access areas;
- reference to weed management procedure;
- monitoring of fire affected populations of *Darwinia masonii* and *Lepidosperma gibsonii* and significant flora;
- monitoring dust affects on populations of *Darwinia masonii* and *Lepidosperma gibsonii*; and
- incident response.

Waste management procedure
Waste management procedure to include:
- minimising waste through the promotion of the waste management hierarchy;
- recycling of material where practical (licensed recyclers);
- physical barrier around landfill to inhibit feral animal scavenging;
- management of putrescible landfill compliant with legislative requirements for rural landfills;
- caged or covered waste transport to landfill;
- regular maintenance of landfill area; and
- rubbish and recyclable collection posts identified around the site.
- removal of all wastes on the services corridor to municipal landfills (EHPL services corridor);

Weed management procedure
Weed management procedure to include:

- reference to site access protocol;
- weed identification and recording (identified as part of other floristic surveys);
- identification of herbicide resistant weeds (EHPL services corridor)
- restricted access to areas with weed infestations of high biodiversity impact rating;
- description and pictures of weed species likely to be problematic;
- weed eradication program taking into consideration the proximity significant flora;
- weed eradication program taking into consideration farm cropping systems (EHPL services corridor);
- monitoring to assess the effectiveness of control; and
- consideration of weed eradication prior to disturbance of land (cropping areas) (EHPL services corridor).

7.4 Incidents and triggers

Incidents and triggers of unplanned environmental impacts are defined by the consequence classification of Table 8. The subsequent reporting and management action is set out against each consequence classification in.

Any potential unplanned impact (i.e. incident) identified through the environmental risk assessment process having a consequence level falling within the moderate to catastrophic category shall be a reportable incident.

Table 14 Management actions and reporting time for potential unplanned impacts based on environmental consequence

Consequence (Table 8)	Regulatory reporting	Reporting system	Management action
Catastrophic	Immediately or as soon as practicable	Resident or General Manager notified and immediately verbally notifies company CEO and CEO DEC followed by written report	Cease all affected work immediately; ICAM investigation; review risks and associated procedures; and implement crisis management system.
Major	Within 24 hours	Resident or General Manager notified and verbally notifies company CEO as soon as practical and CEO DEC followed by written report	Consider ceasing all affected work; ICAM investigation; review risks and associated procedures; review implementation of corrective actions and undertake additional follow up if required; and consider implementing emergency management team.
Moderate	Within 24 hours	Resident or General Manager notified and verbally notifies company CEO and local DEC followed by written report	ICAM recommended and to be considered; formal review of risks; manage by routine procedures; review implementation of corrective actions; and review associated procedures if necessary and site statistics.
Minor	Annually, or as per regulatory requirements, or in the case of DRF within 24 hrs	Reported to supervisor and site environmental department prior to end of shift, and if there is regulatory requirement to report, to the relevant regulator and also to the local DEC. In the case of DRF, report to local DEC.	Site Incident report completed; recorded in site statistics which are to be reviewed periodically by Departmental or Area Manager; review incident corrective actions; and manage by routine procedures. In the case of DRF, report to local DEC.
Insignificant	Annually, or as per regulatory requirements, or in the case of DRF within 24 hrs	Reported to Supervisor prior to end of shift, and if there is regulatory requirement to report, to the relevant regulator and also to the local DEC. In the case of DRF, report to local DEC.	Site incident report completed; recorded in site statistics; and manage by routine procedures. In the case of DRF, report to local DEC.

(ICAM Incident Causal Analysis Method – Incident investigation method)

7.5 Preliminary closure plan

MGM and EHPL recognise that mining is a temporary land use which should be integrated with or followed by, other forms of land use.

Conceptual closure objectives, design criteria and activities for various aspects of the project in regard to mine closure as outlined in Appendix 9 of the PER (ATA Environmental, 2006a) are included in Appendix D.

The primary objectives for the closure of the Mt Gibson Iron Ore Mine and Infrastructure Project have been based on the Strategic Framework for Mine Closure (ANZMEC/MCA 2000) (see Appendix C)and are to:

- establish a safe, non-polluting and stable post-mining land surface which supports vegetation growth and is erosion resistant over the long term;
- re-establish a self sustaining ecosystem comprising local native vegetation, which resembles the surrounding environment as closely as practical;
- undertake the removal of plant and infrastructure that is not required for post operational use in the Project area such that the site is left in a safe, stable, non-polluting and tidy condition;
- minimise downstream impacts on vegetation due to interruption of drainage;
- identify any potential long term soil, surface water or groundwater pollution associated with the project and develop an action plan to manage this;
- develop a stakeholder consultation group prior to the onset of closure to facilitate discussion of closure planning; and
- continue to monitor environmental performance during the decommissioning, rehabilitation and post closure stages of the project and take appropriate action until the approved completion criteria are met leading to ultimate lease relinquishment.

Location rationale

During the development of the PER (ATA Environmental 2006a) the Proponents evaluated a number of alternatives to minimise the environmental impacts of the project. The alternatives related to the transportation of ore, the location of the tailings storage facility, the number and size of pits and associated waste rock dumps, the location of the accommodation village and the location of material handling and ship loading facilities within Geraldton Port.

The proponents' decision to defer plans to mine the Iron Hill deposit (located approximately 2km south of Extension Hill) was based, in part, on the cumulative potential environmental impact of mining both the Extension Hill and Iron Hill deposits on the Declared Rare Flora species, *Darwinia masonii*.

The site of the accommodation village was selected to minimise impacts on environmental and heritage constraints and to ensure a sufficient separation distance from the pit and plant site.

The proponents considered several options for the location of the tailings storage facility and the waste rock dump prior to finalising the option to construct a co-located waste rock and tailings facility. Two alternative locations for the waste rock dump and/or tailings storage were considered, including the playa located to the south of the project area and an area west of the Great Northern Highway. The environmental constraints associated with these options, such as topography, groundwater, visual amenity (due to the proximity to the Great Northern Highway and Wanarra Road) and land use issues deemed them unsuitable. The assessment considered that the co-located waste rock and tailings facility option would be ideally situated on the eastern flank of Extension Hill.

The service corridor route was selected to traverse through mostly pastoral and agricultural land in order to minimise direct impacts to native vegetation, avoid significant flora and floristic communities, and habitat of significant fauna.

Final land use and landform

The post-mining landform will replicate the pre-mining landform as closely as practicable. Therefore, a significant part of closure activities will focus on rehabilitation and the establishment of pre-mining vegetation communities. Decommissioning of plant, equipment and infrastructure will occur prior to rehabilitation earthworks that will prepare disturbed areas for revegetation.

Rehabilitation earthworks will include the re-establishment of stable landforms with drainage patterns or structures with erosion protection measures implemented where necessary.

The Pit will remain as a permanent void upon the cessation of mining and will be partially filled with water from the natural process of groundwater inflow. Baseline modelling by Rockwater (2005a, 2005b) indicated that the salinity of the water in the void is likely to increase with time after dewatering

ceases, probably to hypersaline levels (100,000 mg/L TDS after 34 years). The water level in the pit is expected to remain shallow as groundwater inflow and evaporation will be approximately equal at about 290,000 kL per year. The investigations indicated that water will not move into the surrounding aquifers since the pit water level will be below the static groundwater level. The aquifer associated with the pit is not considered to be hydraulically connected to the palaeochannel or other surrounding aquifers (Rockwater 2005a). Therefore, the final mine void is not anticipated to impact on the regional groundwater table (Rockwater 2005a, 2005b).

A section of the Great Northern Highway will be realigned. The 'old' Great Northern Highway will be remediated.

Discussions with key stakeholders shall be undertaken during the mine closure planning process regarding the final landform and long term land-use for the Project. An agreed approach will be finalised in the Final Mine Closure Plan at least two years prior to scheduled closure.

Rehabilitation
The rehabilitation program will include the development of rehabilitation and revegetation criteria in consultation with stakeholders.

Rehabilitation of the services corridor and disturbed areas related to the Great Northern Highway realignment will be undertaken immediately following completion of construction. Rehabilitation of the combined waste dump and dry tailings facility will be undertaken progressively throughout the life of the mine and will be based on industry best practice.

Rehabilitation activities will include:

- provenance seed collection;
- ripping of compacted areas;
- progressive establishment of stable landforms with erosion protection where necessary for long-term stability;
- integration of rehabilitation in the life of mine planning processes to optimise mine waste and soil material movements to maximise rehabilitation outcomes;
- construction of post mining landforms that resemble the pre mining landscape as closely as practicable;
- rehabilitation of significant flora and communities, subject to research and recovery plans;
- replacement of soils where practicable to assist in the development of florisitic communities;
- capping and rehabilitation of exploration drill holes, pads and access tracks that are no-longer required;
- spreading of vegetation debris to return organic matter to the area, and provide an additional seed source; and
- additional seeding and planting of seedlings from local provenance species if regeneration from topsoil is insufficient.

Rehabilitated areas will require ongoing monitoring to assess the effectiveness of the rehabilitation works. Monitoring will commence prior to the disturbance for mining activities and continue at control sites throughout the life of the project. Monitoring results will be used to assess the effectiveness of progressive rehabilitation and where remedial works may be required.

Research and development (Section 7.6) will be undertaken to provide valuable information that will be used to guide rehabilitation efforts.

Risk assessment
Potential risk events associated with mine closure aspects have been identified in the Risk Assessment (Section 4.10, Table 11).

Completion criteria

Preliminary completion criteria have been developed (Appendix 9, PER). However, it is expected the completion criteria will be reviewed throughout the life of the project based on the results of monitoring and rehabilitation activities, research and changing government and community expectations.

A final closure plan shall be submitted to the EPA at least two years prior to the anticipated date of closure.

7.6 *Darwinia masonii* and *Lepidosperma gibsonii* research plan

The Ministerial Statement No. 753, Conditions 6-1 and 7-1, specify that the objective of the Research and Recovery Plan is to facilitate the continued *in-situ* survival and improvement in the conservation status of *Darwinia masonii* and *Lepidosperma gibsonii.*

A draft Research Plan titled 'Conservation and Restoration Research Proposal *Darwinia masonii* and *Lepidosperma gibsonii*: An integrated research program into the *ex-situ* and *in-situ* conservation, restoration and translocation of *Darwinia masonii* and *Lepidosperma gibsonii'* has been prepared in accordance with the Ministerial Statement No. 753, Conditions 6.1 and 7.1.

The draft research plan focuses on *in-situ* conservation efforts, which form the bulk of the research, and aimed at understanding natural variability, understanding responses to natural and anthropogenically-induced changes, and developing and implementing strategies to successfully alleviate detrimental effects to ultimately ensure long-term sustainability of the rare species.

The draft Research Plan has been developed by MGM and EHPL on advice of the EPA and DEC to the requirements of the Minister for Environment. There is a commercial arrangement between MGM, EHPL and Botanic Gardens and Parks Authority (BGPA). BGPA has commenced the first phase of the research in 2006/07 and continued through to present. Preliminary results of the research show that *Darwinia masonii* can be translocated leading to successful re-establishment and seeding of mature plants.

The monitoring designs for the research plans, and for the recovery plans discussed in the next section, will be developed in consultation with DEC and BGPA, and will be submitted to the EPA for endorsement.

7.7 *Darwinia masonii* and *Lepidosperma gibsonii* interim recovery plans

The Ministerial Statement No. 753, Conditions 6-1 and 7-1, specify that the objective of the Research and Recovery Plan is to facilitate the continued *in-situ* survival and improvement in the conservation status of *Darwinia masonii* and *Lepidosperma gibsonii*.

An Interim Recovery Plan for *Lepidosperma gibsonii*, titled *Lepidosperma gibsonii* Interim Recovery Plan 2008-2012' has been prepared in accordance with Ministerial Statement No. 753, Condition 7.2.

An interim Recovery Plan for Darwinia masonii, titled 'Mason's Darwinia *Darwinia masonii* Interim Recovery Plan 2008-2012' has been prepared in accordance with Ministerial Statement No. 753, Condition 6.2.

In consultation with the EPA and DEC, the focus of the interim recovery plan for both species includes:

- Coordination of the management actions (Section 7.3);
- Implementation of the research program (Section 7.6);
- Implementation of the monitoring program;
- Implement fire management procedures (Section 7.3);
- Management of potential sources of risk and risk events likely to affect both species (Section 7.2);
- Undertaking of translocation trials of both species as part of the Research Program (Section 7.6);
- Maintenance of seed/germplasm and cutting collections; and
- Promotion and awareness of both species and Recovery Plan initiatives.

A full recovery plan shall be developed by 2012, to the requirements of the Minister for the Environment (Ministerial Statement No. 753, Condition 7.3).

8.0 Reporting

The Managing Director of EHPL or CEO of MGM or an authorised officer of EHPL or MGM will be responsible (respectively) for the reporting conditions in the Ministerial Statement.

8.1 Regular reporting

Regular environmental reporting processes are in the EMS.

Appropriate environmental reports for environmental objectives, standards and measurement criteria, (Table 12) which relate to routine activities of significant importance, shall be made on a regular basis.

8.2 Reportable incidents

Any potential unplanned impact (that is accident or incident) identified through the environmental risk assessment process having a consequence level falling within either a major or catastrophic category shall be a reportable incident. An appropriate report shall be provided to the EPA and the DEC.

Refer to Section 7.4.

8.3 Annual reporting

An appropriate annual report shall be provided to the EPA and the DEC. The annual report shall demonstrate that the performance objectives are being met. The Managing Director of EHPL or CEO of MGM or an authorised officer of EHPL and MGM (respectively) will be responsible for the annual report, Condition 4 in the Ministerial Statement.

8.4 Five yearly reporting

The Managing Director of EHPL or CEO of MGM or an authorised officer of EHPL or MGM (respectively) will be responsible for the five yearly report in the Ministerial Statement, Condition 5.

8.5 Publication of plans

Ministerial Statement No. 753 requires that certain plans shall be made publicly available. These plans shall be placed on the MGM web site as soon as reasonably practicable after approval of the EMP and placed on the EHPL web site when their web site is created.

9.0 References

ATA Environmental (2004) *Targeted Search at Mt Gibson for the Declared Rare Flora Darwinia masonii.* Report No. 2004/227 Version 1. Unpublished report prepared for Mount Gibson Mining Ltd. December 2004.

ATA Environmental (2005a) *Mt Gibson Magnetite Project Supplementary Vegetation and Flora Surveys*. Report No 2005/149 Version 2. Unpublished report for Mount Gibson Mining Limited, Perth.

ATA Environmental (2005b) *Fauna Assessment Mount Gibson*. Version 4. Unpublished report for Mount Gibson Mining Limited, Perth.

ATA Environmental (2005c) *Malleefowl Assessment, Mount Gibson*. Version 2. Unpublished report for Mount Gibson Mining Limited, Perth.

ATA Environmental (2006a) *Mt Gibson Iron Ore Mine and Infrastructure Project Public Environmental Review* Report No 2004/246. Prepared for Mount Gibson Mining Limited. April 2006.

ATA Environmental (2006b) *A Targeted Survey at Mt Gibson for a Lepidosperma species: Lepidosperma sp. Mt Gibson.* Version 2 Report No 2006/090. Unpublished report prepared for Mount Gibson Mining. August 2006.

Beard, J. S. (1990) *Plant Life of Western Australia*. Kangaroo Press.

Belbin, Lee (1989). PATN Technical Reference. CSIRO Division of Wildlife and Ecology, P.O. Box 84, Lyneham, ACT, 2602. 167p.

Bennett Environmental Consulting (2000) *Flora and Vegetation of Mt Gibson*. Unpublished report prepared for Mt Gibson Iron Ltd. Dec 2000.

Benshemesh, J. (2000) *National Recovery Plan for Malleefowl*. Department of Environment and Heritage, available from http:// www.environment.gov.au/ biodiversity/threatened/publications/recovery/malleefowl/index.html

Benshemesh, J. and Burton, P. (1997) *Fox predation on Malleefowl after the spread of RCD in Victoria: The first Malleefowl breeding season*. Unpublished report for Parks Victoria and Department of Natural Resources and Environment, Mildura.

Benshemesh, J. and Burton, P. (1999) *Fox predation on Malleefowl three years after the spread of RCD in Victoria*. Unpublished report for Parks Victoria and Department of Natural Resources and Environment, Mildura.

Booth, D.T. (1987) Home range and hatching success of Malleefowl, *Leipoa ocellata* Gould (Megapodiidae), in Murray mallee near Renmark, S.A. *Australian Wildlife Research* 14: 95-104.

Botanical Gardens and Parks Authority (2005a) Research Benchmarks for Conservation of *Darwinia masonii* at Mt Gibson: Stage 1. Unpublished Report.

Botanical Gardens and Parks Authority (2005b) *Conservation Biology and Restoration Ecology of Darwinia masonii at Mt Gibson.* Stage *2 Program: Six monthly summary, December 2005.* Unpublished Paper.

Botanic Gardens and Parks Authority (2008) – pers. comm.

Brickhill, J. (1987) Breeding success of Malleefowl *Leipoa ocellata* in central New South Wales. *Emu* 87: 42-45.

Brown A, Thomas-Dans, C. and Marchant, N. (1998) *Western Australian Threatened Flora*. Department of Conservation and Land Management, Perth.

Bureau of Meteorology (2007). Western Australian Climate Averages – Paynes Find. Accessed electronically at http://www.bom.gov.au/climate/averages/tables/ca_wa_names.shtml

CALM (Department of Conservation and Land Management) (1999) *Environmental Weed Strategy for Western Australia*. Environmental Protection Branch, Department of Conservation and Land Management.

CALM (Department of Conservation and Land Management) (2004) *Declared Rare and Priority Flora List for Western Australia*. Publicly available list prepared by the Department of Conservation and Land Management.

CALM (Department of Conservation and Land Management) (2005) *Declared Rare and Priority Flora List for Western Australia*. Publicly available list prepared by the Department of Conservation and Land Management.

Coffey Environments (2008). Letter to Asia Iron Group regarding locations of *Lepidosperma gibsonii.* 15 January 2008.

Environmental Protection (Kwinana Atmospheric Wastes) Policy 1992

Department of Industry, Tourism and Resources (2007) Guidelines for the Preparation and Submission of an Environmental Plan Under the Petroleum (Submerged Lands) (Management of the Environment) Regulations 1999 as amended 20 December 2005. Draft Working Document as at 5 October 2007.

Copley, P. and Williams, S. (1995) Distribution, relative abundance and conservation of Malleefowl in South Australia. *Working Papers of the National Malleefowl Forum*, Adelaide.

Environmental Protection Authority (EPA, 2004a) Guidance Statement 51 Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia.

Environmental Protection Authority (EPA, 2004b) Guidance Statement 56 Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia.

Environmental Protection Authority (EPA, 2006) Guidance Statement 6 Rehabilitation of Terrestrial Ecosystems.

Environmental Protection Authority (2006) Mt Gibson Iron Ore Mine and Infrastructure Project. Report and Recommendations of the Environmental Protection Authority. Bulletin 1242. November 2006.

Frith, H.J. (1959) Breeding of the Mallee Fowl, *Leipoa ocellata* Gould (Megapodiidae). *Wildlife Research* 4: 31-60.

Frith, H.J. (1962a) Conservation of the Mallee Fowl, *Leipoa ocellata* Gould (Megapodiidae). *Wildlife Research* 7: 33-49.

Frith, H.J. (1962b) *The Mallee Fowl*. Angus and Robertson, Sydney.

Griffin & Associates (2005) *PATN Analysis of Mt Gibson Sites*. Unpublished report for ATA Environmental.

Griffin & Associates (2006) *Numerical Analysis of Floristic Data in Mt Gibson Area* Supplement. Unpublished report prepared for ATA Environmental. May 2006.

Griffin & Associates (2007) *Supplementary Analysis of Floristic data in Mt Gibson Area*. Unpublished report prepared for ATA Environmental. June 2007.

Harlen, R. and Priddel, D. (1992) *Assessment of potential food resources available to Malleefowl* Leipoa ocellata*. Report 2. Monthly abundance of food resources*. NSW National Parks and Wildlife Service, Sydney.

Harlen, R. and Priddel, D. (1996) Potential food resources available to malleefowl *Leipoa ocellata* in marginal mallee lands during drought. *Australian Journal of Ecology* 21: 418-428.

Harold, G. and Dennings, S. (1998) *The First Five Years. Malleefowl Preservation Group*, Ongerup W.A.

ICS Group (2006) A Fire Management Plan for Charles Darwin Reserve. Unpublished report prepared for Australian Bush Heritage Fund. June 2006.

IUCN (2000). *IUCN red list categories prepared by the IUCN Species Survival Commission*, as approved by the 51st meeting of the IUCN Council. Gland, Switzerland.

IUCN (2005) Guidelines for using the IUCN Red List Categories and Criteria April 2005. Prepared by the Standards and Petitions Subcommittee of the IUCN SSC Red List Program Committee.

Kentish, B. and Westbrooke, M. (1994) Crop and gizzard contents of a road-dead Malleefowl. *Emu* 93: 130-132.

Ludwig, J.A. and Tongway, D.J. (1995). Spatial organisation of landscapes and its function in semi-arid woodlands, Australia. Lands. Ecol. 10: 51-63.

Ludwig, J.A. and Tongway, D.J. (1997). A Landscape approach to Rangeland Ecology, In 'Landscape Ecology Function and Management: Principles from Australia's Rangelands.' (Eds J. Ludwig, D. Tongway, D. Freudenberger, J.C. Noble and K. Hodgkinson). CSIRO, Melbourne, pp. 1-12.

Maslin B. R. (2001) *Acacia cerastes* Maslin. In: *Flora of Australia*. Volume 11A. Mimosaceae, Acacia Part 1 (eds. A.E. Orchard & A.J.G. Wilson). CSIRO, Melbourne p539.

Maslin B.R. (2002) The role and relevance of taxonomy in the conservation and utilisation of Australian Acacias. *Conservation Science Western Australia* 4 (3):19.

McKenzie N.L., May J.E and McKenna S. (2003) *Bioregional Summary of the 2002 Biodiversity Audit for Western Australia*. Department of Conservation and Land Management, Perth.

Meissner R. & Caruso Y (2006) *Flora and vegetation of banded ironstone formations of the Yilgarn Craton: Mt Gibson and surrounding area.* In Preparation.

Mount Gibson Limited Extension Hill and Extension Hill North Environmental Management Plan February 2008.

Muir Environmental (1995) *Observations on the Presence and Distribution of Rare Flora, especially Darwinia masonii, near Mt Gibson*. Unpublished report prepared for Asia Iron Ltd. Report ME95-039-001. May 1995.

National Environment Protection Council (1998) National Environment Protection Measure for Ambient Air Quality.

Paul Armstrong & Associates (2004) *Vegetation Assessment and Rare Flora Search between Perenjori and Mt Gibson*. Unpublished report prepared for Mt Gibson Iron Ltd. March 2004.

Payne A.L., Van Vreeswyk, A.M.E, Pringle, H.J.R, Leighton K.A and Henning P. (1998) An Inventory and vegetation Condition Survey of the Sandstone-Yalgoo-Paynes Find Area. Western Australia. Technical Bulletin No 90. Agriculture Western Australia, South Perth.

Priddel, D. (1989) Conservation of rare fauna: the Regent Parrot and the Malleefowl. In: *Mediterranean Landscapes in Australia: Mallee Ecosystems and Their Management*. (eds. J.C. Noble and R.A. Bradstock). CSIRO, Melbourne, pp. 243-249.

Priddel, D. and Wheeler, R. (1994) Mortality of captive-raised Malleefowl, *Leipoa ocellata*, released into a mallee remnant within the wheat-belt of New South Wales. *Wildlife Research* 21: 543-552.

Priddel, D. and Wheeler, R. (2003) Nesting activity and demography of a isolated population of Malleefowl (*Leipoa ocellata*). Wildlife Research, 30, 451-464.

Priddel, D. and Wheeler, R. (2005). Fecundity, eggs size and the influence of rainfall an isolated population of Malleefowl (*Leipoa ocellata*). Wildlife Research, 32: 639-648.

Reichelt, R.C. and May, T.W. (1997) Malleefowl eating fungi and orchid tubers. *Victorian Naturalist* 114: 198.

Short, J. (2004) Conservation of Malleefowl: are there lessons from the successful conservation of native mammals by intensive fox control. *Proceedings of the National Malleefowl Forum,* Mildura, Victorian Malleefowl Recovery Group.

Standards Australia (HB 203:2006) Environmental Risk Management – Principles and Process.

Standards Australia (2004) AS/NZS 4360 Risk Management.

Vital Options Consulting (2004) *Nyingarn – Ninghan Indigenous Protected Area Plan of Management 2004*. Pindiddy Aboriginal Corporation.

Woinarski, J.C.Z. (1989b). *The vertebrate fauna of Broombush* Melaleuca uncinata *vegetation in north-western Victoria, with reference to effects of broombush harvesting. Australian Wildlife Research* 16: 217-238.

N

0 250 500 750 1000m

SCALE 1 : 30 000 at A3 (MGA)

E59-1179

Mt Gibson Spring

L 3114/ 602 NINGHL 04280

Proposed Deviation of Great Northern Highway

G59-30

Artefact Scatter 02

Rock Shelter Complex

Emu Proof Fence
Lepidosperma - 160 plants

L 3114/ 602 NINGHL 04280

Gnamma Hole

Co-located Waste Dump/ Dry Tailings Storage Facility

Area burnt at time of assessment but is likely to correspond to FCT10-2

Extension Hill/03

FCT10-3

Extension Hill North
Darwinia - 545 plants
Lepidosperma - 777 plants

L59-63

ROM Pad

FCT10-2

Extension Hill/North

FCT10-3

FCT10-4

EH4P

WB1

Reserve 36657 NINGHL 04219

Extension Hill/02

L 398/ 616 NINGHL 04282

VCL

Wanarra Road

G59-32

Extension Hill Pit

FCT10-2

Extension Hill
Darwinia - 1924 plants
Lepidosperma - 7424 plants

EH3P

FCT10-1

FCT10-2

Extension Hill

Extension Hill/01

6 728 000mN

L 398/ 616 NINGHL 03572

Service Corridor

Hematite Plant & Infrastructure

M59-339

Extension Hill South
Darwinia - 1874 plants
Lepidosperma - 4307 plants

L59-67

PB3

Proposed Airstrip

FCT10-2

Extension Hill South

VCL

L 398/ 616 NINGHL 04282

M59-338

L 398/ 616 NINGHL 03543

Population E
Lepidosperma - 4030 plants

L 398/ 616 NINGHL 03544

EH2P

Concentrator Plant Site and Ancillary Services

EH1P

L 398/ 616 NINGHL 03572

Mt Gibson
Darwinia - 7021 plants
Lepidosperma - 3617 plants

PB2

Population C
Lepidosperma - 5225 plants

Population F
Lepidosperma - 10352 plants

Highway

L 398/ 616 NINGHL 04282

Iron Hill North
Darwinia - 586 plants
Lepidosperma - 265 plants

FCT10-1

FCT10-1

6726 000mN

Iron Hill North
Darwinia - 370 plants

Iron Hill North

Iron Hill East

Mt Gibson

G59-34

M59-455

FCT10-3

FCT10-3

PB1

Camp Services Corridor

M59-526

Iron Hill East
Darwinia - 70 plants
Lepidosperma - 675 plants

Mt Gibson South
Darwinia - 324 plants
Lepidosperma - 435 plants

M59-454

M59-550

LGE 1288242 NINGHL 04397 Reserve 17367

L59-68

FCT10-3

Iron Hill

Iron Hill South
Darwinia - 1601 plants
Lepidosperma - 118 plants

M59-609

FCT10-1

Mt Gibson South

Population D
Lepidosperma - 3244 plants

Camp Area

Iron Hill South

South Mt Gibson South
Lepidosperma - 4384 plants

LGE 1288242 NINGHL 04397 Reserve 17367

G59-33

L59-69

516 000mE

518 000mE

6724 000mN

G59-35

G59-31

Great Northern Highway

LGE 1288242 NINGHL 04397 Reserve 17367

512 000mE

514 000mE

LEGEND

- Magnetite Project Layout
- Hematite Project Layout
- Project Layout
- Cadastral Boundary
- Tenement Boundary
- Heritage Site
- Bore (Extension Hill Project)
- Production Bore (Oroya Mining)
- Baseline Fauna Monitoring Location
- Fauna Survey Site

Malleefowl Legend

- Inactive Malleefowl Mound
- Active Malleefowl Mound
- Live Malleefowl Location
- Fresh Killed Malleefowl Location
- 250m Inactive Malleefowl Mound Buffer
- 250m Active Malleefowl Mound Buffer

FLORA LEGEND

- *Podotheca uniseta* (P3)
- *Acacia cerastes* (P1)
- *Personia pentasticha* (P2)

Locations of *Darwinia masonii* (DRF)

- 1 Plant
- 2 - 5 Plants
- 6 - 20 Plants
- 21 - 50 Plants
- >50 Plants

Locations of *Lepidosperma gibsonii* (DRF)

- 1 Plant
- 2 - 5 Plants
- 5 - 15 Plants
- 16 - 50 Plants
- 51 - 100 Plants
- Approximate Population Boundary

Locations of *Acacia cerastes* (P1)

- 1 Plant
- 2 - 5 Plants
- 6 - 15 Plants
- 16 - 50 Plants
- 51 - 100 Plants

Locations of *Chamelaucium* sp Yalgoo (P1)

- 10 - 15 Plants

Significant Floristic Communities

- Floristic Community 1 (group 10)
- Floristic Community 2 (group 10)
- Floristic Community 3 (group 10)
- Floristic Community 4 (group 10)

ehm-EMP-f01.dgn

PINPOINT CARTOGRAPHICS (08) 9277 7763

Mount Gibson Mining

ENVIRONMENTAL MANAGEMENT PLAN

ENVIRONMENTAL CONSTRAINTS

Drawn: B. Sadlo	Date: 10-01-08
Revised: P. Davidson	Date: 18-04-08
FIGURE 1	

514 000mE

516 000mE

518 000mE

6 728 000mN

6 726 000mN

Area burnt at time of assessment but is likely to correspond to FCT10-2

FCT10-3

FCT10-4

FCT10-2

Extension Hill North

FCT10-3

Co-located Waste Dump/ Dry Tailings Storage Facility

ROM Pad

Extension Hill Pit

FCT10-2

FCT10-1

FCT10-2

Extension Hill

Concentrator Plant Site and Ancillary Services

FCT10-2

Extension Hill South

FCT10-1

Iron Hill North

FCT10-3

Iron Hill East

FCT10-1

FCT10-3

Mt Gibson

FCT10-3

Iron Hill

FCT10-1

Mt Gibson South

Iron Hill South

Camp Area

LEGEND

FCT10-1 - # Sites	**68**
Allocasuarina acutivalvis subsp *prinsepiana*	67
Melaleuca conothamnoides x nematophylla	65
Grevillea obliquistigma subsp *obliquistigma*	64
Philotheca sericea	54
Acacia assimilis subsp *assimilis*	52
Calycoplus paucifolius	50
Grevillea paradoxa	48
Aluta aspera	44
Hibbertia hypercoides	42
FCT10-2 - # Sites	**19**
Allocasuarina acutivalvis subsp *prinsepiana*	19
Acacia assimilis subsp *assimilis*	18
Aluta aspera	17
Enekbatus stowardii	17
Melaleuca fabri	17
Acacia aneura var *aneura*	13
Acacia stereophylla var *sterophylla*	10
Grevillea paradoxa	10
FCT10-3 - # Sites	**22**
Allocasuarina acutivalvis subsp *prinsepiana*	21
Calycopeplus paucifolius	18
Philotheca sericea	17
Dodonaea inaequifolia	13
Eremohila clarkei	12
Acacia tetragonophylla	11
Grevillea paradoxa	11
FCT10-4 - # Sites	**4**
Austrostipa ? nodosa	4
Acacia andrewsii	3
Alyxia buxifolia	3
Olearia muelleri	3
Ptilotus obovatus	3
Acacia acuminate	2
Callistris columellaris	2
Dodonaea inaequifolia	2

N

0 200 400 600 800 1000m

SCALE 1 : 20 000 at A3 (MGA)

Mount Gibson Mining

ENVIRONMENTAL MANAGEMENT PLAN

SIGNIFICANT FLORISTIC COMMUNITIES IN THE MT GIBSON RANGES AT THE GROUP 10 LEVEL

Drawn: M. Scheltema	Date: 13-08-07
Revised: M. Scheltema	Date: 18-04-08
	FIGURE 2

PINPOINT CARTOGRAPHICS (08) 9277 7763 ehm-EMP-402.dgn

N

0 250 500 750 1000m

SCALE 1 : 30 000 at A3 (MGA)

LEGEND

- Magnetite Project Layout
- Hematite Project Layout
- Project Layout
- Cadastral Boundary
- Tenement Boundary
- Heritage Site
- Bore (Extension Hill Project)
- Production Bore (Oroya Mining)
- Baseline Fauna Monitoring Location
- Fauna Survey Site

Malleefowl Legend

- Inactive Malleefowl Mound
- Active Malleefowl Mound
- Live Malleefowl Location
- Fresh Killed Malleefowl Location
- 250m Inactive Malleefowl Mound Buffer
- 250m Active Malleefowl Mound Buffer

FLORA LEGEND

- *Podotheca uniseta* (P3)
- *Acacia cerastes* (P1)
- *Personia pentasticha* (P2)

Locations of *Darwinia masonii* (DRF)

- 1 Plant
- 2 - 5 Plants
- 6 - 20 Plants
- 21 - 50 Plants
- >50 Plants

Locations of *Lepidosperma gibsonii* (DRF)

- 1 Plant
- 2 - 5 Plants
- 5 - 15 Plants
- 16 - 50 Plants
- 51 - 100 Plants
- Approximate Population Boundary

Locations of *Acacia cerastes* (P1)

- 1 Plant
- 2 - 5 Plants
- 6 - 15 Plants
- 16 - 50 Plants
- 51 - 100 Plants

Locations of *Chamelaucium* sp Yalgoo (P1)

- 10 - 15 Plants

Significant Floristic Communities

- Floristic Community 1 (group 10)
- Floristic Community 2 (group 10)
- Floristic Community 3 (group 10)
- Floristic Community 4 (group 10)

E59-1179
Mt Gibson Spring
L 3114/ 602 NINGHL 04280
Proposed Deviation of Great Northern Highway
G59-30
Artefact Scatter 02
Rock Shelter Complex
Emu Proof Fence
Lepidosperma - 160 plants
Gnamma Hole
Co-located Waste Dump/ Dry Tailings Storage Facility
Area burnt at time of assessment but is likely to correspond to FCT10-2
Extension Hill/03
FCT10-3
Extension Hill North
Darwinia - 545 plants
Lepidosperma - 777 plants
L59-63
ROM Pad
FCT10-2
FCT10-3
FCT10-4
Extension Hill/North
EH4P
WB1
Reserve 36657 NINGHL 04219
Extension Hill/02
L 398/ 616 NINGHL 04282
VCL
Wanarra Road
G59-32
Extension Hill Pit
EH3P
FCT10-1
FCT10-2
Extension Hill
Extension Hill/01
Extension Hill
Darwinia - 1924 plants
Lepidosperma - 7424 plants
6 728 000mN
L 398/ 616 NINGHL 03572
Service Corridor
Hematite Plant & Infrastructure
M59-339
Extension Hill South
Darwinia - 1874 plants
Lepidosperma - 4307 plants
L59-67
PB3
Proposed Airstrip
L 398/ 616 NINGHL 03543
Population E
Lepidosperma - 4030 plants
L 398/ 616 NINGHL 03544
L 398/ 616 NINGHL 04282
M59-338
EH2P
Concentrator Plant Site and Ancillary Services
EH1P
L 398/ 616 NINGHL 03572
PB2
Population C
Lepidosperma - 5225 plants
Population F
Lepidosperma - 10352 plants
Highway
Iron Hill North
Darwinia - 586 plants
Lepidosperma - 265 plants
FCT10-1
Mt Gibson
Darwinia - 7021 plants
Lepidosperma - 3617 plants
6726 000mN
G59-34
Iron Hill North
Darwinia - 370 plants
Iron Hill North
Iron Hill East
M59-455
Mt Gibson
FCT10-3
PB1
Camp Services Corridor
M59-526
Iron Hill East
Darwinia - 70 plants
Lepidosperma - 675 plants
Mt Gibson South
Darwinia - 324 plants
Lepidosperma - 435 plants
M59-550
LGE 1288242 NINGHL 04397 Reserve 17367
Population D
Lepidosperma - 3244 plants
L59-68
Iron Hill South
Darwinia - 1601 plants
Lepidosperma - 118 plants
Iron Hill
M59-609
FCT10-1
Mt Gibson South
Iron Hill South
South Mt Gibson South
Lepidosperma - 4384 plants
Camp Area
G59-33
LGE 1288242 NINGHL 04397 Reserve 17367
L59-69
516 000mE
518 000mE
6724 000mN
G59-35
G59-31
Great Northern Highway
512 000mE
514 000mE

ehmEMP-f03.dgn

PINPOINT CARTOGRAPHICS (08) 9277 7763

Mount Gibson Mining

ENVIRONMENTAL MANAGEMENT PLAN

SIGNIFICANT FLORA SPECIES AND SIGNIFICANT FLORISTIC COMMUNITIES IN THE MT GIBSON RANGES AT THE GROUP 10 LEVEL

Drawn: B. Sadlo	Date: 10-01-08
Revised: P. Davidson	Date: 18-04-08
FIGURE 3	

N

0 250 500 750 1000m

SCALE 1 : 30 000 at A3 (MGA)

LEGEND

- Cadastral Boundary
- Topographic Contour (m AHD, 5m interval)
- Tenement Boundary

E59/1179

M59/339

G59/30

G59/32

G59/34

G59/33

L59/67

L59/68

L59/69

M59/338

Proposed Deviation of Great Northern Highway

Existing Airstrip

ROM Pad

Co-located Waste Dump/ Dry Tailings Storage Facility

Extension Hill Pit

Extension Hill North

Extension Hill

Extension Hill South

Hematite Plant & Infrastructure

Service Corridor

Proposed Airstrip

Concentrator Plant Site and Ancillary Services

Camp Services Corridor

Camp Access Road

Camp Area

Wanarra Road

Highway

Northern Great

Iron Hill North

Iron Hill East

Iron Hill

Iron Hill South

Mt Gibson

Mt Gibson South

L 3114/ 602 NINGHL 04280

L 398/ 616 NINGHL 03543

L 398/ 616 NINGHL 03544

L 398/ 616 NINGHL 04282

L 398/ 616 NINGHL 03572

Reserve 36657 NINGHL 04219

LGE 1288242 NINGHL 04397 Reserve 17367

VCL

6 730 000mN

6 728 000mN

6 726 000mN

512 000mE

514 000mE

516 000mE

518 000mE

520 000mE

Legend

- Area Burnt in 1969
- Area Burnt in 1972
- Area Burnt in 2003
- Area Burnt in 2005

ehm-EMP-104.dgn

PINPOINT CARTOGRAPHICS (08) 9277 7763

Mount Gibson Mining

ENVIRONMENTAL MANAGEMENT PLAN

INDICATIVE FIRE HISTORY IN THE MT GIBSON RANGES

Drawn: M. Scheltema	Date: 18-04-08
Revised: --	Date: --

FIGURE 4

N

0 10 20 30 40km

SCALE 1 : 700 000 at A3 (MGA)

Legend

- Gas, Return Water with Bore Water and Slurry Pipeline
- Gas, Slurry and Return Water Pipelines
- Bore Water Pipeline
- Slurry and Return Water Pipelines
- DBNGP
- Bioregion Boundary

GERALDTON SANDPLAINS

YALGOO

AVON WHEATBELT

Mullewa

GERALDTON

Mingenew

Morawa

Slurry Pump Station

Perenjori

Three Springs

MT GIBSON

TATHRA BOREFIELD

OCEAN

BASE SOURCE: AUSLIG 1 : 250,000 National Mapping Topographic Series.

Mount Gibson Mining

ENVIRONMENTAL MANAGEMENT PLAN

SERVICES CORRIDOR

Drawn: M. Scheltema	Date: 18-04-08
Revised: --	Date: --
FIGURE 5	

ehm-EMP-105.dgn
PINPOINT CARTOGRAPHICS (08) 9277 7763

Appendix A
Ministerial Statement No 753 conditions and relevant EMP sections

Ministerial Statement No 753 Condition No	Subject	Are the conditions addressed?	Location in EMP
4	**Compliance Reporting**	YES	8.3
5	**Performance Review**	YES	8.4
6-1	***D. masonii* Research Plan**	YES	7.6
6-1 (1)	monitoring	YES	7.6
6-1 (2)	maintaining or improving population viability	YES	7.6
6-1 (3)	robust analysis of habitat requirements	YES	7.6
6-1 (4)	Offset direct impacts (regeneration, re-establishment or translocation)	YES	7.6
6-1 (5)	provide information	YES	7.6
6-2	***D. masonii* Interim Recovery Plan**	YES	7.7
6-2 (1)	locate and report additional populations	YES	7.7
6-2 (2)	enhance survival of existing populations	YES	**7.7**
6-2 (3)	expand existing populations or establish new populations	YES	7.7
6-9	**Research Plan: Publicly available**	YES	8.5
6-10	**Interim Recovery Plan: Publicly available**	YES	8.5
6-11	**Recovery Plan: Publicly available.**	YES	8.5
7-1	***L. gibsonii* Research Plan**	YES	7.6
7-1 (1)	monitoring	YES	7.6
7-1 (2)	maintaining or improving population viability	YES	7.6
7-1 (3)	robust analysis of habitat requirements	YES	7.6
7-1 (4)	offset direct impacts (regeneration, re-establishment or translocation)	YES	7.6
7-1 (5)	provide information	YES	7.6
7-2	***L. gibsonii* Interim Recovery Plan**	YES	7.7
7-2 (1)	Locate and report additional populations	YES	7.7
7-2 (2)	Enhance survival of existing populations	YES	7.7
7-2 (3)	Expand existing populations or	YES	7.7

Ministerial Statement No 753 Condition No	Subject	Are the conditions addressed?	Location in EMP
	establish new populations		
7-9	**Research Plan: Publicly available.**	YES	8.5
7-10	**Interim Recovery Plan: Publicly available.**	YES	8.5
7-11	**Recovery Plan: Publicly available.**	YES	8.5
8	**Significant Flora and Floristic Communities Management Plan**		
8-1 (1)	Results of surveys	YES	3.8-3.10
8-1 (2)	Details of monitoring and management activities	YES	4.0-7.0
8-1 (3)	Management actions	YES	4.0-7.0
8-1 (4)	Impacts on vegetation downstream of the mine site	YES	4.0-7.0
8-1 (5)	Monitoring parameters, methods, criteria	YES	4.0-7.0
8-1 (6)	Regeneration or revegetation strategies	YES	7.5
8-1 (7)	Management actions	YES	7.3
8-1 (8)	Further investigations	YES	7.7
8-5	**Plan: Publicly available**	YES	8-5
9	**Weed Management Plan**		
9-1 (1)	Identify location & number of weed species	YES	3.13
9-1 (2)	Weeds of environmental significant	YES	3.13
9-1 (3)	Map the presence of target weeds	YES	3.14, 7.3
9-1 (4)	Implement hygiene practices	YES	3.13, 7.3
9-1 (5)	Control and eradicate	YES	7.3
9-1 (6)	Performance indicators	YES	5.0
9-1 (7)	Monitor success of weed control	YES	5.3
9-5	**Plan: Publicly available.**	YES	8.5
10	**Bush Fires**		
10-1 (1)	Prevent bushfires	YES	7.2, 7.3
10-1 (2)	Detect bushfires	YES	7.2, 7.3
10-1 (3)	Train personnel	YES	7.2, 7.3
10-1 (4)	Respond to emergencies	YES	7.2, 7.3
10-5	**Plan: Publicly available.**	YES	8.5
11	**Malleefowl**		
11-1 (1)	Identify distribution and abundance	YES	3.16
11-1 (2)	Identify threats	YES	4.8, 4.9, 4.10
11-1 (3)	Management objectives and actions	YES	7.0, 5.3

Ministerial Statement No 753 Condition No	Subject	Are the conditions addressed?	Location in EMP
11-1 (4)	Identify a monitoring program	YES	5.0
11-1 (5)	Identify measures for community involvement	YES	6.7
11-5	**Plan: Publicly available.**	YES	8.5
12	**Fauna Management at the Mine Site**		
12-1 (1)	Effects of clearing, noise, light etc are minimised	YES	4.0-7.0
12-1 (2)	Management and monitoring of skink, falcon, cockatoo and bee-eater	YES	4.0-7.0
12-5	**Plan: Publicly available.**	YES	8.5
13	**Fauna along the services corridor**	YES	4.0-7.0
14-1	**Preliminary Mine Closure Plan**	YES	7.5
14-1 (1)	rationale	YES	7.5
14-1 (2)	Conceptual description and design	YES	7.5
14-1 (3)	Long-term management of groundwater and surface water systems	YES	also 4.0-7.0
14-1 (4)	Management of noxious materials	YES	also 4.0-7.0
14-1 (5)	Rehabilitation program	YES	7.5
14-1 (6)	Monitoring and response to progress: Re-establishment of floristic communities, Including studies on the composition of the floristic communities	YES	4.0-7.0 3.9, 3.10
14-2	**Plan: Publicly available**	YES	8.5

Published on 24 October 2007 Statement No. 753

STATEMENT THAT A PROPOSAL MAY BE IMPLEMENTED (PURSUANT TO THE PROVISIONS OF THE ENVIRONMENTAL PROTECTION ACT 1986)

MT GIBSON IRON ORE MINE & INFRASTRUCTURE PROJECT
SHIRE OF YALGOO

Proposal: To mine and process iron ore from Extension Hill and Extension Hill North, within the Mt Gibson Ranges, construct a pipeline to transport the magnetite slurry to Geraldton Port, and construct infrastructure at the port to strip the ore from the slurry for export.

Proponent: Mount Gibson Mining Limited

Proponent Address: Level 1, 7 Havelock Street, WEST PERTH WA 6872

Assessment Number: 1538

Report of the Environmental Protection Authority: Bulletin 1242

The proposal referred to in the above report of the Environmental Protection Authority may be implemented. The implementation of that proposal is subject to the following conditions and procedures:

1 Proposal Implementation

1-1 The proponent shall implement the proposal as documented and described in schedule 1 of this statement subject to the conditions and procedures of this statement.

2 Proponent Nomination and Contact Details

2-1 The proponent for the time being nominated by the Minister for the Environment under sections 38(6) or 38(7) of the *Environmental Protection Act 1986* is responsible for the implementation of the proposal.

2-2 The proponent shall notify the Chief Executive Officer of the Department of Environment and Conservation (CEO) of any change of the name and address of the proponent for the serving of a notice or other correspondence within 30 days of such change.

3 Time Limit of Authorisation

3-1 The authorisation to implement the proposal provided for in this statement shall lapse and be void within five years after the date of this statement if the proposal to which this statement relates is not substantially commenced.

3-2 The proponent shall provide the CEO with written evidence which demonstrates that the proposal has substantially commenced on or before the expiration of five years from the date of this statement.

4 Compliance Reporting

4-1 The proponent shall submit to the CEO environmental compliance reports annually reporting on the previous twelve-month period, unless required by the CEO to report more frequently.

4-2 The environmental compliance reports shall address each element of an audit program approved by the CEO and shall be prepared and submitted in a format acceptable to the CEO.

4-3 The environmental compliance reports shall:

1. be endorsed by signature of the proponent's Managing Director or a person, approved in writing by the CEO, delegated to sign on behalf of the proponent's Managing Director;

2. state whether the proponent has complied with each condition and procedure contained in this statement;

3. provide verifiable evidence of compliance with each condition and procedure contained in this statement;

4. state whether the proponent has complied with each key action contained in any environmental management plan or program required by this statement;

5. provide verifiable evidence of conformance with each key action contained in any environmental management plan or program required by this statement;

6. identify all non-compliances and non-conformances and describe the corrective and preventative actions taken in relation to each non-compliance or non-conformance;

7. provide an assessment of the effectiveness of all corrective and preventative actions taken; and

8. describe the state of implementation of the proposal.

4-4 The proponent shall make the environmental compliance reports required by condition 4-1 publicly available in a manner approved by the CEO.

5 Performance Review

5-1 The proponent shall submit a Performance Review report every five years after the start of ground-disturbing activities to the Environmental Protection Authority, which addresses:

1. the major environmental issues associated with implementing the project; the environmental objectives for those issues; the methodologies used to achieve these; and the key indicators of environmental performance measured against those objectives;

2. the level of progress in the achievement of sound environmental performance, including industry benchmarking, and the use of best available technology where practicable;

3. significant improvements gained in environmental management, including the use of external peer reviews;

4. stakeholder and community consultation about environmental performance and the outcomes of that consultation, including a report of any on-going concerns being expressed; and

5. the proposed environmental objectives over the next five years, including improvements in technology and management processes.

5-2 The proponent shall make the Performance Review reports required by condition 5-1 publicly available in a manner approved by the CEO.

6 *Darwinia masonii* Research and Recovery Plans

6-1 Prior to the commencement of ground-disturbing activities for the mine site, the proponent shall prepare a *Darwinia masonii* Research Plan to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority and the and the Department of Environment and Conservation.

The objective of this Plan is to facilitate the continued *in situ* survival and improvement in the conservation status of *Darwinia masonii* over time through targeted research which assists development of a recovery plan for the species.

This Plan shall set out a timetable, objectives and methodologies for research and measures to:

1. monitor the numbers of individuals of the species, their health, and reproductive success;

2. investigate the requirements for maintaining or improving the viability of the population through genetic and ecological factors relating to the conservation, management, restoration, propagation and translocation of the species;

3. provide a scientifically robust analysis of the habitat requirements of the species;

4. offset the direct impacts of the proposal on the local population of the species by regeneration, re-establishment or translocation of additional plants or sub-populations on suitable un-impacted areas of banded ironstone formations in the Mt Gibson area; and

5. provide information which, combined with the results of monitoring activities required by condition 8, assists in ensuring that mining and other activities of the proposal, particularly the generation of dust, do not lead to a further decline in the local population of the species.

6-2 Prior to the commencement of ground-disturbing activities for the mine site, the proponent shall prepare an Interim Recovery Plan for *Darwinia masonii*, to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority and the Department of Environment and Conservation.

The objective of this Plan is to maintain or improve the conservation status of *Darwinia masonii* during the development of the Recovery Plan required by condition 6-3.

This Plan shall include a timetable for and actions to:

1. locate and report any additional populations of the species;

2. enhance the survival of existing populations of the species; and

3. expand the existing populations or establish new populations;

based on currently available information and the results of early research and experimentation undertaken in accordance with condition 6-1.

6-3 Within four years following the commencement of ground-disturbing activities for the mine site, the proponent shall prepare a Recovery Plan for *Darwinia masonii* to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority and the Department of Environment and Conservation.

The objective of this Plan is to maintain, and ultimately improve, the conservation status of *Darwinia masonii* such that its conservation status is more secure in the Mt Gibson area.

This Plan shall identify:

1. habitats which are critical to the survival of the species and the actions needed to protect those habitats;

2. threats to the species, and areas and populations under threat;

3. objectives to be achieved;

4. criteria against which achievement of the objectives is to be measured;

5. management actions, based on the outcomes of the implementation of the Research Plan referred to in Condition 6-1 and the Interim Recovery Plan referred to in Condition 6-2 that will remediate the impacts of the project and provide for a net improvement on the pre-mining conservation status of the species; and

6. further research required into the management or recovery of the species,

and shall be consistent with the requirements of the current version of the "Recovery Plan Guidelines for Nationally Listed Threatened Species and Ecological Communities under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*" (published on the Commonwealth Department of Environment and Heritage website).

6-4 The proponent shall implement the *Darwinia masonii* Research Plan required by condition 6-1.

6-5 The proponent shall implement the Interim Recovery Plan for *Darwinia masonii* required by condition 6-2.

6-6 The proponent shall implement the Recovery Plan for *Darwinia masonii* required by condition 6-3.

6-7 The proponent shall review and revise the *Darwinia masonii* Research and Recovery Plans required by conditions 6-1, 6-2 and 6-3 as and when directed by the CEO.

6-8 The proponent shall implement revisions of the *Darwinia masonii* Research and Recovery Plans required by condition 6-7.

6-9 The proponent shall make the *Darwinia masonii* Research Plan required by condition 6-1 and revisions required by condition 6-7 publicly available in a manner approved by the CEO.

6-10 The proponent shall make the Interim Recovery Plan for *Darwinia masonii* required by condition 6-2 and revisions required by condition 6-7 publicly available in a manner approved by the CEO.

6-11 The proponent shall make the Recovery Plan for *Darwinia masonii* required by condition 6-3 and revisions required by condition 6-7 publicly available in a manner approved by the CEO.

7 *Lepidosperma* sp. Mt Gibson - Research and Recovery Plans

7-1 Prior to the commencement of ground-disturbing activities for the mine site, the proponent shall prepare a *Lepidosperma* sp. Mt Gibson Research Plan to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority and the Department of Environment and Conservation.

The objective of this Plan is to facilitate the continued *in situ* survival and improvement in the conservation status of *Lepidosperma* sp. Mt Gibson over time through targeted research which assists development of a recovery plan for the species.

This Plan shall set out a timetable, objectives and methodologies for research and measures to:

1. monitor the numbers of individuals of the species, their health, and reproductive success;

2. investigate the requirements for maintaining or improving viability of the population through genetic and ecological factors relating to the conservation, management, restoration, propagation and translocation of the species;

3. provide a scientifically robust analysis of the habitat requirements of the species;

4. offset the direct impacts of the proposal on the local population of the species by regeneration, re-establishment or translocation of additional plants or sub-populations on suitable un-impacted areas of banded ironstone formations in the Mt Gibson area; and

5. provide information which, combined with the results of monitoring activities required by condition 8, assists in ensuring that mining and other activities of the proposal, particularly the generation of dust, do not lead to a further decline in the local population of the species.

7-2 Prior to the commencement of ground-disturbing activities for the mine site, the proponent shall prepare an Interim Recovery Plan for *Lepidosperma* sp. Mt Gibson, to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority and the Department of Environment and Conservation.

The objective of this Plan is to maintain or improve the conservation status of *Lepidosperma* sp. Mt Gibson during the development of the Recovery Plan required by condition 7-3.

This Plan shall include a timetable for and actions to:

1. locate and report any additional populations of the species;

2. enhance the survival of existing populations of the species; and

3. expand the existing populations or establish new populations;

based on currently available information and the results of early research and experimentation undertaken in accordance with condition 7-1.

7-3 Within four years following the commencement of ground-disturbing activities for the mine site, the proponent shall prepare a Recovery Plan for *Lepidosperma* sp. Mt Gibson to the requirements of the Minister for the Environment on advice of the Environment Protection Authority and the Department of Environment and Conservation.

The objective of this Plan is to maintain, and ultimately improve, the conservation status of *Lepidosperma* sp. Mt Gibson such that its conservation status is more secure in the Mt Gibson area.

This Plan shall identify:

1. habitats which are critical to the survival of the species and the actions needed to protect those habitats;

2. threats to the species, and areas and populations under threat;

3. objectives to be achieved;

4. criteria against which achievement of the objectives is to be measured;

5. management actions, based on the outcomes of the Research Plan referred to in Condition 7-1 and the Interim Recovery Plan referred to in Condition 7-2 that will to remediate the impacts of the project and provide for a net improvement on the pre-mining conservation status of the species; and

6. further research required into the management or recovery of the species,

and shall be consistent with the requirements of the current version of the "Recovery Plan Guidelines for Nationally Listed Threatened Species and Ecological Communities under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*" (published on the Commonwealth Department of Environment and Heritage website).

7-4 The proponent shall implement a *Lepidosperma* sp. Mt Gibson Research Plan required by condition 7-1.

7-5 The proponent shall implement the Interim Recovery Plan for *Lepidosperma* sp. Mt Gibson required by condition 7-2.

7-6 The proponent shall implement the Recovery Plan for *Lepidosperma* sp. Mt Gibson required by condition 7-3.

7-7 The proponent shall review and revise the *Lepidosperma* sp. Mt Gibson Research and Recovery Plans required by conditions 7-1, 7-2 and 7-3 as and when directed by the CEO.

7-8 The proponent shall implement revisions of the *Lepidosperma* sp. Mt Gibson Research and Recovery Plans required by condition 7-7.

7-9 The proponent shall make the *Lepidosperma* sp. Mt Gibson Research Plan required by condition 7-1 and revisions required by condition 7-7 publicly available in a manner approved by the CEO.

7-10 The proponent shall make the Interim Recovery Plan for *Lepidosperma* sp. Mt Gibson required by condition 7-2 and revisions required by condition 7-7 publicly available in a manner approved by the CEO.

7-11 The proponent shall make the Recovery Plan for *Lepidosperma* sp. Mt Gibson required by condition 7-3 and revisions required by condition 7-7 publicly available in a manner approved by the CEO.

8 Conservation of Significant Flora and Communities

8-1 Prior to the commencement of ground-disturbing activities, the proponent shall prepare a Significant Flora Species and Communities Management Plan to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority and the Department of Environment and Conservation.

Note: "Significant flora species" include: Declared Rare Flora; Priority Listed Flora; geographically restricted flora; and newly discovered and undescribed flora.

The following species shall be addressed in the Plan:

- *Darwinia masonii*;
- *Lepidosperma* sp. Mt Gibson;
- *Acacia cerastes*;
- *Grevillea aff. yorkrakinensis*;
- *Cryptandra imbricata*;
- *Podotheca uniseta*; and
- *Psammomoya implexa*.

Note: "Significant communities" include: Threatened Ecological Communities; Priority Ecological Communities; and geographically restricted ecological communities.

The objectives of this Plan are to:

- maintain the conservation status of significant native flora species and communities through the avoidance or management of adverse impacts of the proposal (other than those within the approved area of direct disturbance set out in schedule 1), including dust, and through improvements in knowledge of their distribution and ecology; and

- ensure compliance with the requirements of the *Wildlife Conservation Act 1950* and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* for significant flora species and communities.

This Plan shall:

1. provide the results of targeted flora and vegetation surveys where surveys have not been completed or where the result of previous surveys are no longer current, to provide further information on the conservation and baseline conservation status of each of the significant flora species and communities within the project area;

2. describe details of monitoring and management activities to ensure that the proposal does not lead, directly or indirectly, to the taking of significant flora beyond the approved area of direct disturbance, including:

    - monitoring of the numbers and population distribution of *Darwinia masonii* and *Lepidosperma* sp. Mt Gibson, their health and reproductive success; and

- a detailed risk management plan setting out monitoring and management procedures, parameters, and schedules, and defining response triggers and acceptable performance criteria for the avoidance and management of potential indirect impacts of mining activities, including, the impacts of dust deposition, fire, weeds, altered hydrology and unauthorised disturbance, on the populations of *Darwinia masonii* and *Lepidosperma* sp. Mt Gibson outside the mining footprint;

Note: See also Weed Management Plan (condition 9) and Bush Fire Management Plan (condition 10).

3. describe measures to ensure that direct and indirect impacts on significant flora species and communities within the mine site and along the services corridor are minimised;

4. describe measures to manage impacts of the mining operation on vegetation downstream of the mine site;

5. set out monitoring parameters, methods and criteria for establishing impact on significant flora species and communities within the mine site and along the services corridor;

6. outline the regeneration or revegetation strategies which may be required for significant flora species and components of communities, including completion criteria to be met;

7. outline management or mitigation actions required to address any failure to achieve regeneration completion criteria arising from item 6 above; and

8. outline further investigations into the regeneration and reproductive ecology of affected significant flora species and components of communities, in order to determine appropriate regeneration methodologies, if the completion criteria are not being achieved.

8-2 The proponent shall implement the Significant Flora Species and Communities Management Plan required by condition 8-1.

8-3 The proponent shall review and revise the Significant Flora Species and Communities Management Plan required by condition 8-1 as and when directed by the CEO.

8-4 The proponent shall implement revisions of the Significant Flora Species and Communities Management Plan required by condition 8-3.

8-5 The proponent shall make the Significant Flora Species and Communities Management Plan required by condition 8-1 and revisions required by condition 8-3 publicly available in a manner approved by the CEO.

9 Weeds

9-1 Prior to the commencement of ground-disturbing activities, the proponent shall prepare, in consultation with the Department of Environment and Conservation and the Department of Agriculture and Food, a Weed Management Plan.

The objectives of this Plan are to:

- prevent the spread of existing weeds within the mine site and along the services corridor caused by the activities of the proponent;
- prevent the establishment of new weeds within the mine site and along the services corridor caused by the activities of the proponent;
- control and/or eradicate weeds within the mine site and along the services corridor; and
- minimise the potential for the impact of weeds and weed management on significant flora identified in condition 8.

This Plan shall:

1. identify the location and approximate number of each weed species recorded within the mine site and along the services corridor, during previous vegetation surveys, while having regard for weed species outside the project area;
2. identify weeds of environmental significance in the project area as target weeds in collaboration with the Department of Environment and Conservation;
3. map the presence of target weeds;
4. implement appropriate hygiene practices for all plant and vehicle equipment operated by the proponent;
5. control and eradicate target weeds during construction and operation of the mine site and construction of the services corridor;
6. identify performance indicators for weed management; and
7. monitor the success of weed control.

9-2 The proponent shall implement the Weed Management Plan required by condition 9-1.

9-3 The proponent shall review and revise the Weed Management Plan required by condition 9-1 as and when directed by the CEO.

9-4 The proponent shall implement revisions of the Weed Management Plan required by condition 9-3.

9-5 The proponent shall make the Weed Management Plan required by condition 9-1 and

revisions required by condition 9-3 publicly available in a manner approved by the CEO.

10 Bush Fires

10-1 Prior to the commencement of ground-disturbing activities, the proponent shall prepare, in consultation with the Department of Environment and Conservation and the relevant Local Governments, a Bush Fire Management Plan.

The objective of this Plan is to reduce the risk of unplanned fires and provide contingency measures to minimise the impacts of fires on the local environment.

This Plan shall set out the provision of resources and measures to:

1. prevent bushfires in the vicinity of the mine site;
2. detect bushfires in the vicinity of the mine site;
3. train personnel to fight fires in the vicinity of the mine site; and
4. respond to bush fire emergencies.

10-2 The proponent shall implement the Bush Fire Management Plan required by condition 10-1.

10-3 The proponent shall review and revise the Bush Fire Management Plan required by condition 10-1 as and when directed by the CEO.

10-4 The proponent shall implement revisions of the Bush Fire Management Plan required by condition 10-3.

10-5 The proponent shall make the Bush Fire Management Plan required by condition 10-1 and revisions required by condition 10-3 publicly available in a manner approved by the CEO.

11 Malleefowl *Leipoa ocellata*

11-1 Prior to the commencement of ground-disturbing activities, the proponent shall prepare, in consultation with the Department of Environment and Conservation, a Malleefowl Conservation Plan.

The objective of this Plan is to maintain the abundance, diversity, geographic distribution and productivity of the Malleefowl *Leipoa ocellata* through mitigation of adverse impacts and improvements in knowledge.

This Plan shall:

1. identify the distribution and abundance of *Leipoa ocellata* (Malleefowl) within and around the project area, including the services corridor;

2. identify the threats to the Malleefowl populations in the areas identified in item 1 above;

3. identify management objectives and actions to minimise impacts on Malleefowl from the threats identified in item 2 above, including feral animal control and investigations into avoiding mounds being used by Malleefowl;

4. identify a monitoring program to assess the Malleefowl population and any impacts as a result of the proposal; and

5. identify measures for community involvement in Malleefowl conservation.

11-2 The proponent shall implement the Malleefowl Conservation Plan required by condition 11-1.

11-3 The proponent shall review and revise the Malleefowl Conservation Plan required by condition 11-1 as and when directed by the CEO.

11-4 The proponent shall implement revisions of the Malleefowl Conservation Plan required by condition 11-3.

11-5 The proponent shall make the Malleefowl Conservation Plan required by condition 11-1 and revisions required by condition 11-3 publicly available in a manner approved by the CEO.

12 Fauna Management at the Mine Site

12-1 Prior to the commencement of ground-disturbing activities for the mine site, the proponent shall prepare in consultation with the Department of Environment and Conservation, a Mine Site Fauna Management Plan.

The objective of this Plan is to maintain the abundance, diversity, geographic distribution and productivity of native fauna through mitigation of adverse impacts and improvements in knowledge.

This Plan shall address management and monitoring to:

1. demonstrate that the effects of vegetation clearing, noise and vibration, light overspill and vehicle movement on fauna are minimised; and

2. in particular, management and monitoring of *Egernia stokesii badia* (Western spiny-tailed skink); *Falco peregrinus* (Peregrine Falcon); *Cacatua leadbeateri* (Major Mitchell's Cockatoo); and *Merops ornatus* (Rainbow Bee-eater).

Note: The management of Malleefowl is considered in a separate Malleefowl Conservation Plan (condition 11).

12-2 The proponent shall implement the Mine Site Fauna Management Plan required by condition 12-1.

12-3 The proponent shall review and revise the Mine Site Fauna Management Plan required by condition 12-1 as and when directed by the CEO.

12-4 The proponent shall implement revisions of the Mine Site Fauna Management Plan required by condition 12-3.

12-5 The proponent shall make the Mine Site Fauna Management Plan required by condition 12-1 and revision required by condition 12-3 publicly available in a manner approved by the CEO.

13 Fauna Management along the Services Corridor

13-1 Prior to ground-disturbing activities of the Services Corridor, the proponent shall clearly delineate on the ground the boundaries of the services corridor, being up to 20 metres wide from Geraldton Port to Monger's Lake (agricultural section) and up to 15 metres wide from Monger's Lake to the mine site (pastoral section).

13-2 The proponent shall not cause or allow disturbance of vegetation outside the delineated services corridor referred to in condition 13-1, unless authorised by the Minister for the Environment.

13-3 The proponent shall undertake open trench works in the pastoral section of the services corridor from April to September (inclusive) unless otherwise authorised by the CEO.

13-4 Prior to vegetation clearing, the proponent shall mark significant habitat trees of sufficient age to form nesting hollows for hollow-nesting birds and mammals, and Malleefowl mounds, in consultation with the Department of Environment and Conservation.

13-5 The proponent shall not fell marked trees or disturb mounds referred to in condition 13-4, except in the case where habitat trees or mounds occur in the direct line of the proposed pipeline and cannot reasonably be avoided.

13-6 The proponent shall limit the length of open trench to a maximum length of 10 kilometres at any time in the pastoral section and 20 kilometres at any time in the agricultural section of the services corridor.

13-7 No part of the trench shall remain open for more than seven days, unless authorised by the CEO.

13-8 The proponent shall install ramps at intervals of 500 metres along the entire route of the open trench to allow trapped animals to escape, except in remnant vegetation patches in the agricultural section, where each remnant vegetation patch shall have at least one ramp.

13-9 The proponent shall employ at least two "fauna clearing persons" per ten kilometres of open trench to remove fauna from the trench. The "fauna clearing persons" shall be able to demonstrate suitable experience to obtain a fauna handling licence issued by the Department of Environment and Conservation.

13-10 The open trenches shall be inspected by the "fauna clearing persons" for trapped fauna each day by no later than three hours after sunrise and half an hour prior to backfilling of the trench.

13-11 In the event of significant rainfall, the proponent shall, following the clearing of fauna from the trench, pump out any pooled water in the open trench (with the exception of groundwater) and discharge it via a mesh (to dissipate energy) to adjacent areas.

Note: "Fauna clearing persons" means employees whose responsibility is to daily walk the open trench to recover and record fauna found within the trench.

13-12 The proponent shall produce monthly performance monitoring reports on fauna management. These reports shall include a Fauna Register on the fauna found in the trenches, and fatalities. These reports are to be provided to the Department of Environment and Conservation each month, and made publicly available.

14 Closure

14-1 Prior to ground-disturbing activities, the proponent shall prepare a Preliminary Closure Plan in consultation with the Department of Environment and Conservation, the Department of Industry and Resources, the Department of Water, the Australian Bush Heritage Fund, the Australian Wildlife Conservancy, the Pindiddy Aboriginal Corporation and the relevant Local Governments, which describes the framework to ensure that the mine area and the services corridor are left in an environmentally acceptable condition, and provides:

1. the rationale for the siting and design of plant and infrastructure as relevant to environmental protection;

2. a conceptual description and design of the final landform at closure;

3. for the long-term management of groundwater and surface water systems affected by the mining operations and services corridor;

4. for the management of noxious materials to avoid the creation of contaminated areas (including acid-generating materials);

5. a rehabilitation program, which aims to restore the original vegetation communities to areas disturbed by the mining operations and construction within the services corridor, and includes completion criteria to be met; and

6. for the monitoring and response to the progress towards the re-establishment of the floristic communities as part of the rehabilitation of the area, including studies on the composition of the floristic communities on Extension Hill North.

14-2 The proponent shall make the Preliminary Closure Plan required by condition 14-1 publicly available in a manner approved by the CEO.

14-3 At least two years prior to the anticipated date of closure, or at a time agreed with the Environmental Protection Authority, the proponent shall prepare a Final Closure Plan, to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.

The objectives of this Plan are to:

- achieve construction of landforms which are stable, non-polluting and aesthetically compatible with the surrounding landscape; and

- ensure that closure planning and rehabilitation are carried out in a coordinated, progressive manner and are integrated with development planning, consistent with current best practice, and the agreed end land uses.

The Final Closure Plan shall set out details and measures for:

1. removal or, if appropriate, retention of plant and infrastructure in consultation with relevant stakeholders;

2. final landforms and the extent of the mine void;

3. long-term management of groundwater and surface water systems affected by the waste rock dumps, the mine void and the services corridor;

4. identification of contaminated areas, including provision of evidence of notification and proposed management measures to relevant statutory authorities; and

5. rehabilitation of all disturbed areas, including the mine area and the services corridor, to ensure establishment of sustainable vegetation communities with local species and local provenance, consistent with the reconstructed landscape and surrounding vegetation and in accordance with the completion criteria.

14-4 The proponent shall implement the Final Closure Plan required by condition 14-3 until such time as the Minister for the Environment determines, on advice of the CEO, that the proponent's closure responsibilities have been fulfilled.

14-5 The proponent shall make the Final Closure Plan required by condition 14-3 publicly available, in a manner approved by the CEO.

15 Performance Bond

15-1 As security for the due and punctual observance and performance by the proponent of the requirement to rehabilitate that part of the services corridor that lies outside mining tenure, as required by conditions 14-1(5) and 14-3(5), the proponent shall lodge with the CEO on demand prior to commencement of operations of the mine, an irrevocable Unconditional Performance Bond as nominated and approved by the CEO in his sole unfettered discretion to a cash value and in a form acceptable to the CEO ("the Security") which Security at the date hereof being $5,000 per hectare of disturbance from Geraldton Port to Mongers Lake (agricultural section) and $7,000 per hectare of disturbance from Mongers Lake to the mining tenure at the Mt Gibson mine site (pastoral section).

The proponent shall lodge with the CEO an Unconditional Performance Bond executed by a Bank or other approved financial institution for due compliance with the environmental conditions in the sum of $576,000.

15-2 The CEO may review the Security required by condition 15-1 at any time or times and if, on such review, the CEO considers that a security has ceased to be acceptable to the CEO, then the CEO may, with the approval of the Minister for the Environment, require the proponent to furnish replacement or additional security for performance by the proponent of its obligations to rehabilitate that part of the services corridor that lies outside mining tenure, as required by conditions 14-1(5) and 14-3(5).

15-3 The proponent shall within fourteen days after written request by the CEO furnish replacement or additional security in such sum as the CEO shall nominate, in a form and upon terms and conditions approved by the CEO, which approval shall not be unreasonably withheld. On receipt of approved replacement security the CEO shall release and discharge the original security.

Note:

1. In the preparation of advice to the CEO in relation to conditions 15-1, 15-2 and 15-3, the Environmental Protection Authority expects that the advice of the Department of Environment and Conservation and the Department of Industry and Resources will be obtained.
2. The rehabilitation of the services corridor referred to in conditions 15-1 and 15-2 is required by conditions 14-1(5) and 14-3(5).

16 Offsets

16-1 The proponent shall implement the offset package set out in Schedule 2 to the requirements of the Minister for the Environment on advice of the Department of Environment and Conservation.

Notes

1. Where a condition states "on advice of the Environmental Protection Authority", the Environmental Protection Authority will provide that advice to the Department of Environment and Conservation for the preparation of written notice to the proponent.

2. The Environmental Protection Authority may seek advice from other agencies or organisations, as required, in order to provide its advice to the Department of Environment and Conservation.

3. The Minister for the Environment will determine any dispute between the proponent and the Environmental Protection Authority or the Department of Environment and Conservation over the fulfilment of the requirements of the conditions.

4. The proponent is required to apply for a Works Approval and Licence for this project under the provisions of Part V of the *Environmental Protection Act 1986*.

David Templeman MLA
MINISTER FOR THE ENVIRONMENT; CLIMATE CHANGE; PEEL

Schedule 1

The Proposal (Assessment No. 1538)

General Description

The proposal is to mine and process iron ore (hematite and magnetite) from Extension Hill and Extension Hill North and to construct an underground pipeline, within a services corridor, to transport the magnetite slurry to Geraldton Port, and infrastructure at the port to strip the magnetite ore from the slurry for export. Extension Hill and Extension Hill North are part of a ridge of banded ironstone formations within the Mt Gibson Ranges. The banded ironstone formation contains hematite, and the underlying magnetite. The mine site is located approximately 350 kilometres north-east of Perth (Figure 1).

Details of the proposal are provided in the proponent's *Mt Gibson Iron Ore Mine and Infrastructure Project Public Environmental Review*, April 2006.

Summary Description

A summary of the key proposal characteristics is presented in Table 1.

Table 1 – Summary of the Key Proposal Characteristics

Element	Description
Project life	Approximately 20 years
Ore quantity	Magnetite approximately 230 Million tonnes Hematite approximately 13 Million tonnes
Waste management	Overburden will be stockpiled in a dump to the east of the pit. Tailings from magnetite processing will be combined with the overburden dump.
Processing requirements	• Dry and wet processing of magnetite to produce approximately 5 Million tonnes per annum of magnetite concentrate • Dry processing of hematite
Size of final pit	Approximately 2,400 metres long and 700 metres wide
Depth of final pit	Not more than 350 metres below the ground level (approximately 220 metres below the groundwater level)
Dewatering	Approximately 2,500 cubic metres per day
Mine water supply	• Dewater for potable and domestic supplies: 80 cubic metres per day • Dewater for dust suppression: 2,055 cubic metres per day • Process water and slurry transportation water: 5,424 cubic metres per day from the Tathra borefield (piped 168 kilometres to the mine site) and drying of tailings
Vegetation disturbance	Not more than 880 hectares at the mine site (152 hectares for the mine pit and 552 hectares for the waste dump) Not more than 90 hectares along the services corridor
Underground pipelines within	• Slurry pipeline from the mine site to Geraldton Port

the services corridor	• Return water pipelines from Geraldton Port to Three Springs, from Three Springs to the mine site, and from the Tathra Borefield to the return water pipeline near Three Springs • Pumping stations for the water • Gas pipeline from Main Line Valve 92 on the Dampier-Bunbury Natural Gas Pipeline to the mine site
Width of services corridor	• Not more than 15 metres in pastoral section (from Monger's Lake to the mine site) • Not more than 20 metres in the agricultural section (from Geraldton Port to Monger's Lake)

Figures (attached):

Figure 1 - Regional location
Figure 2 - Mt Gibson Ranges and pit
Figure 3 - Mine site layout
Figure 4 - Location of services corridor
Figure 5 - Facilities at Geraldton Port
Figure 6 - *Darwinia masonii*, *Lepidosperma* sp. Mt Gibson and floristic vegetation communities at Mt Gibson.

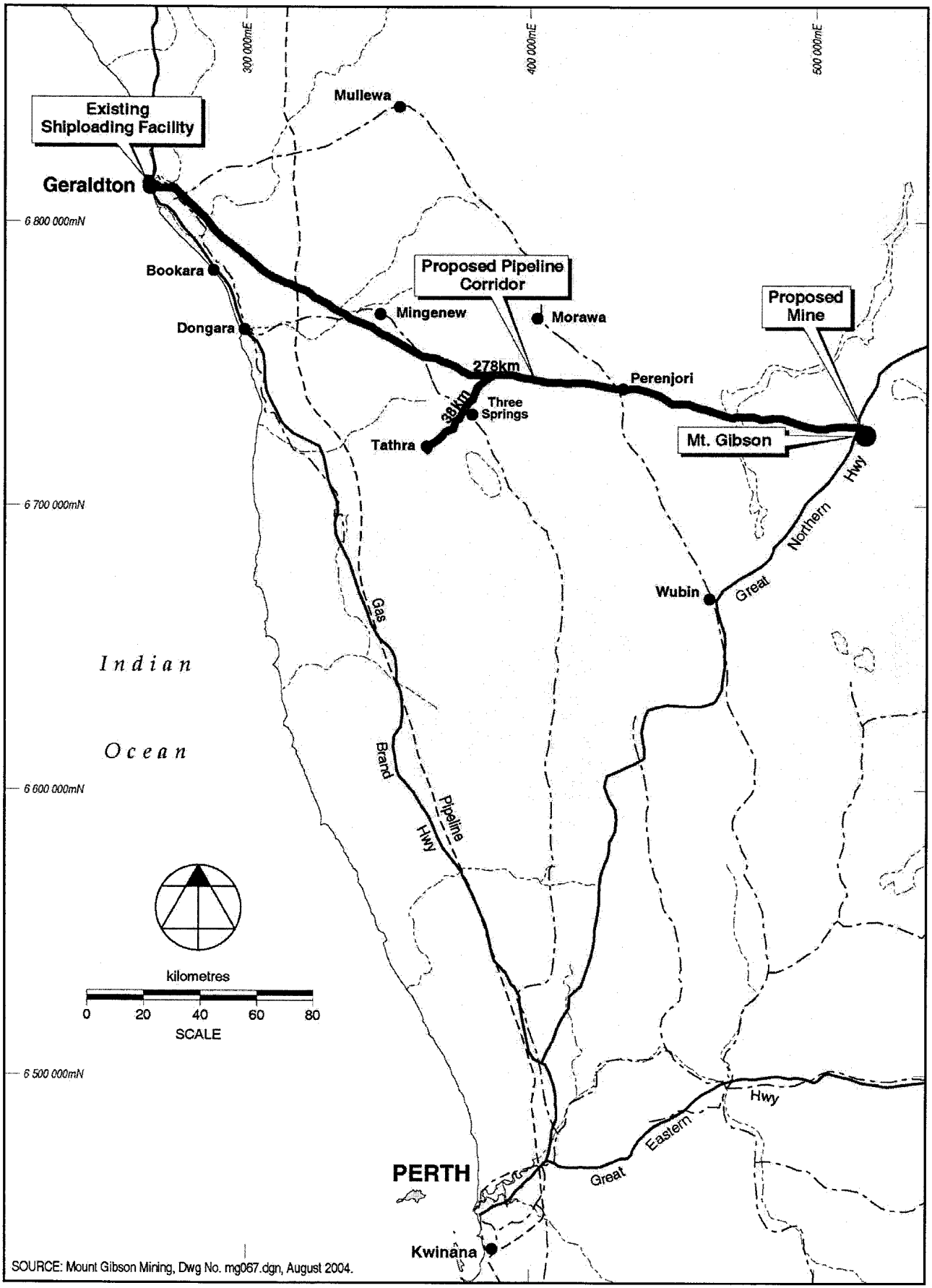

Figure 1: Regional location

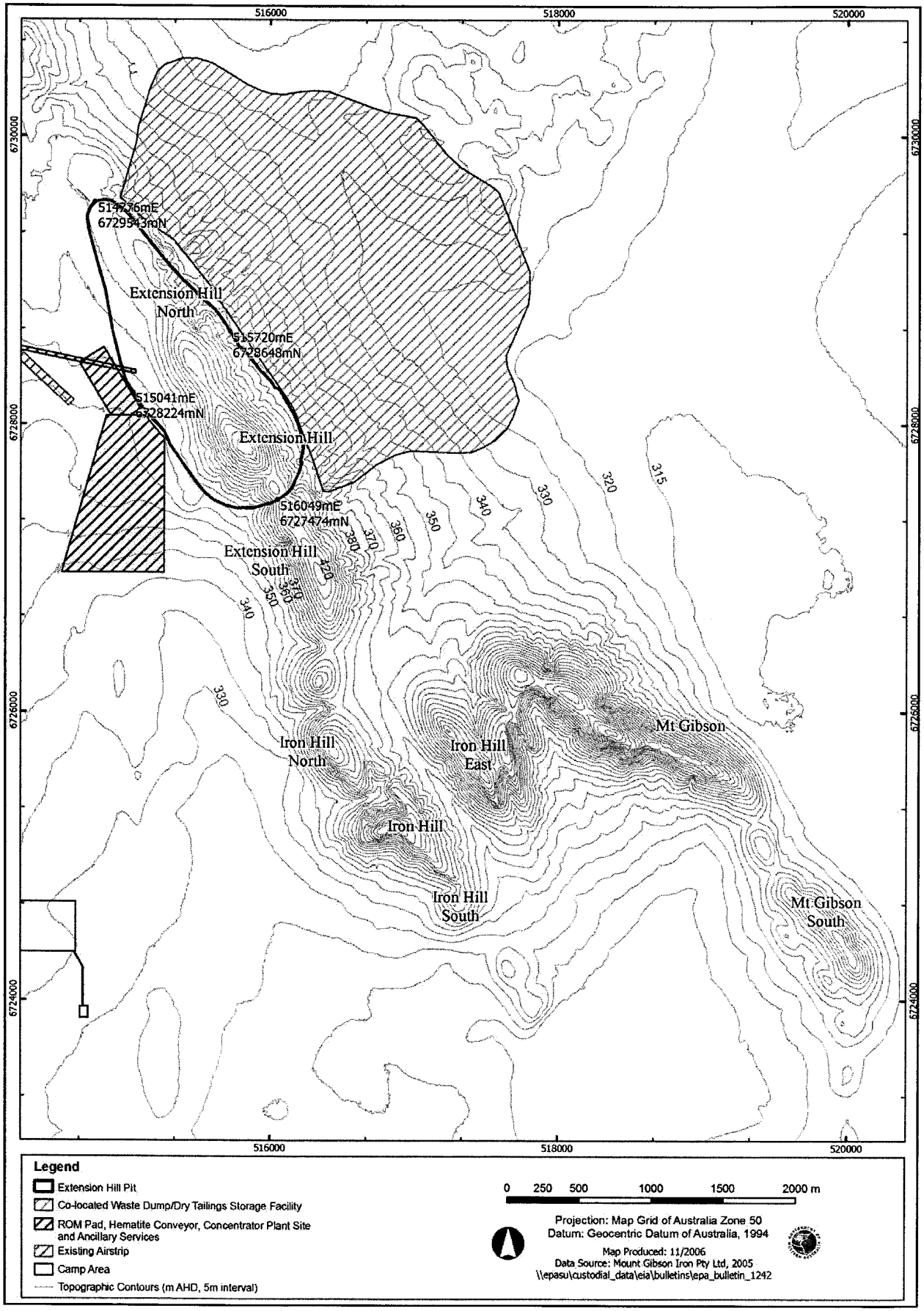

Figure 2: Mt Gibson Ranges and pit

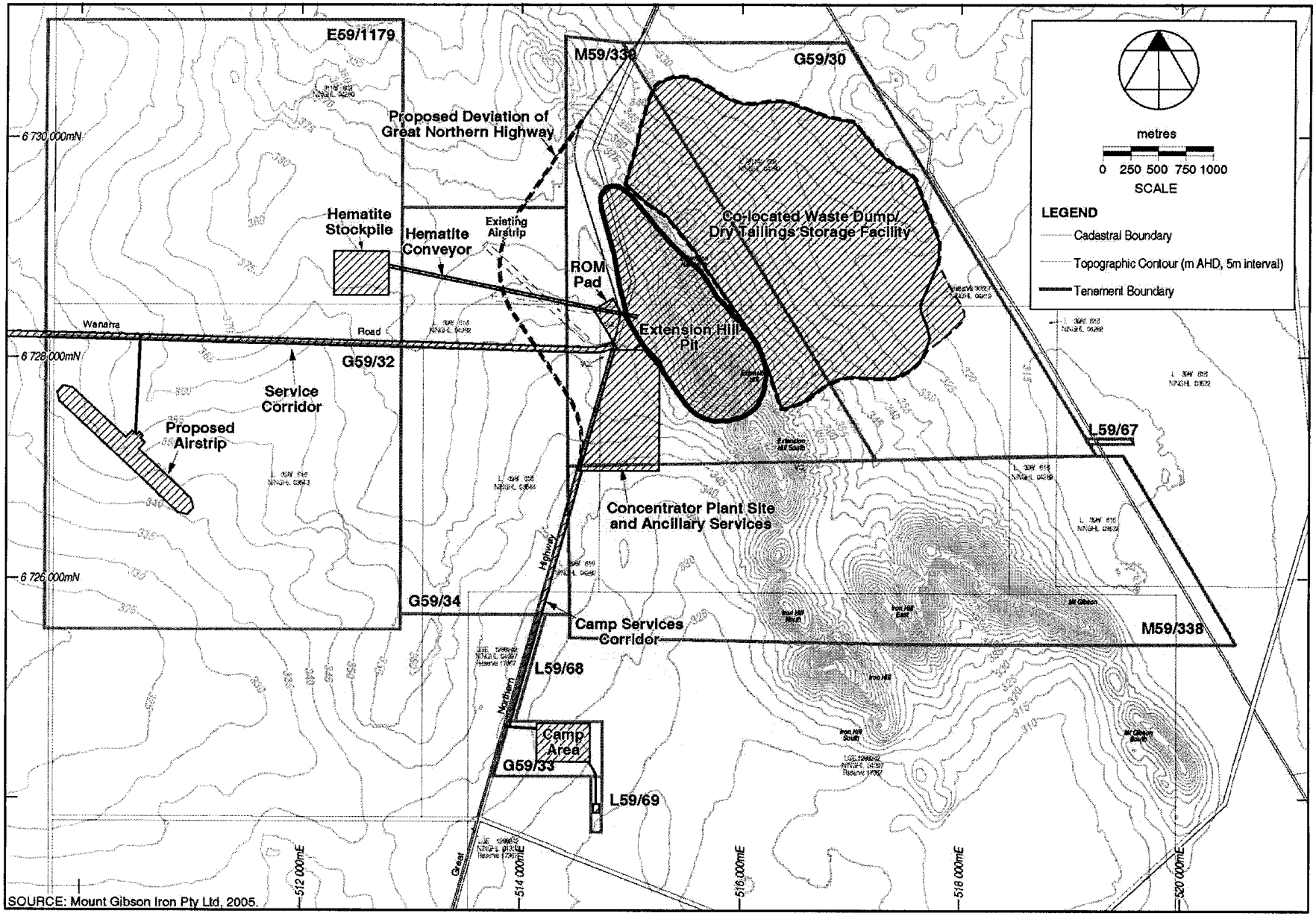

Figure 3: Mine site layout – NOTE: This hatched area defines the 'mine site' as referred to in the conditions

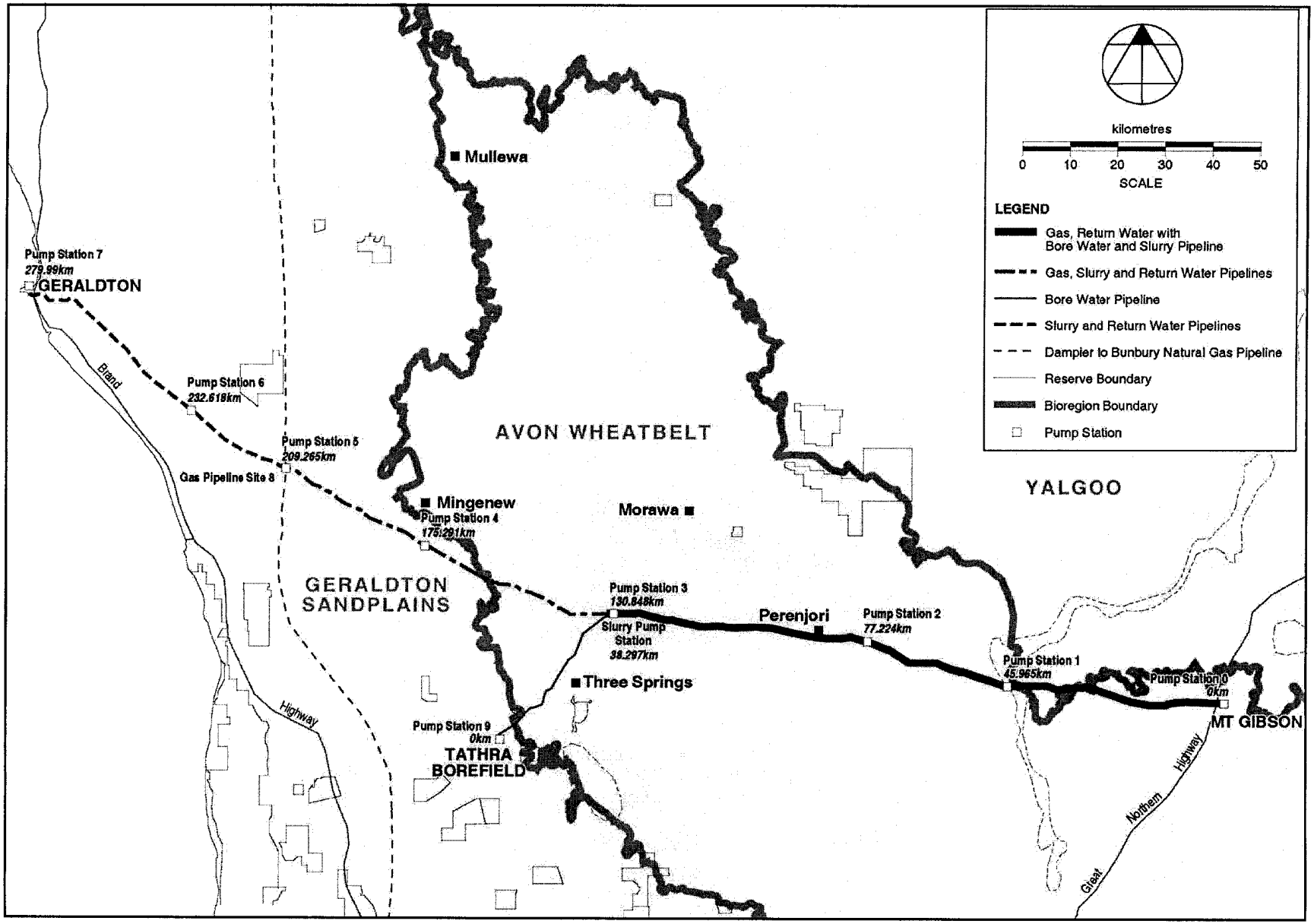

Figure 4: Location of services corridor

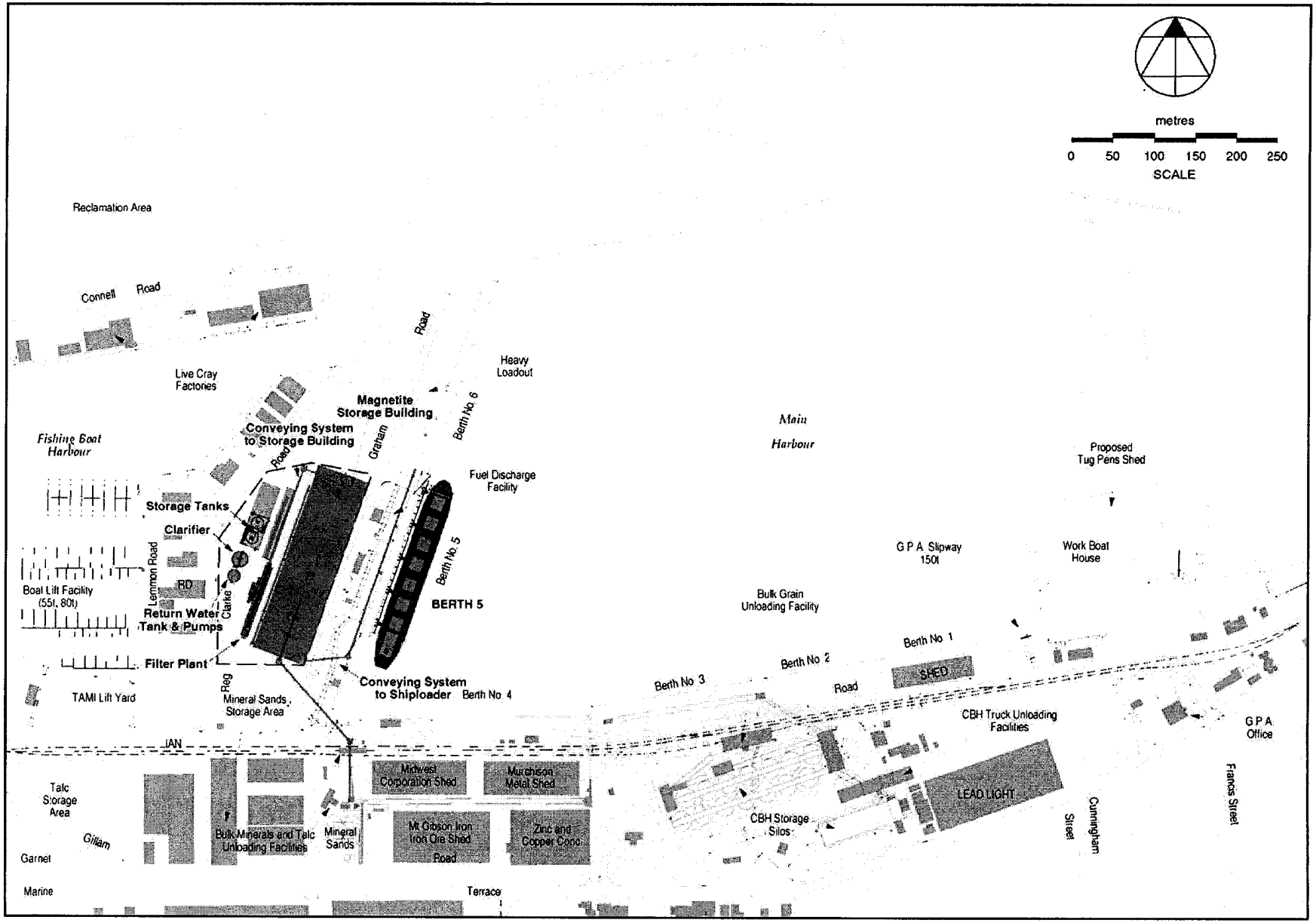

Figure 5: Facilities at Geraldton Port

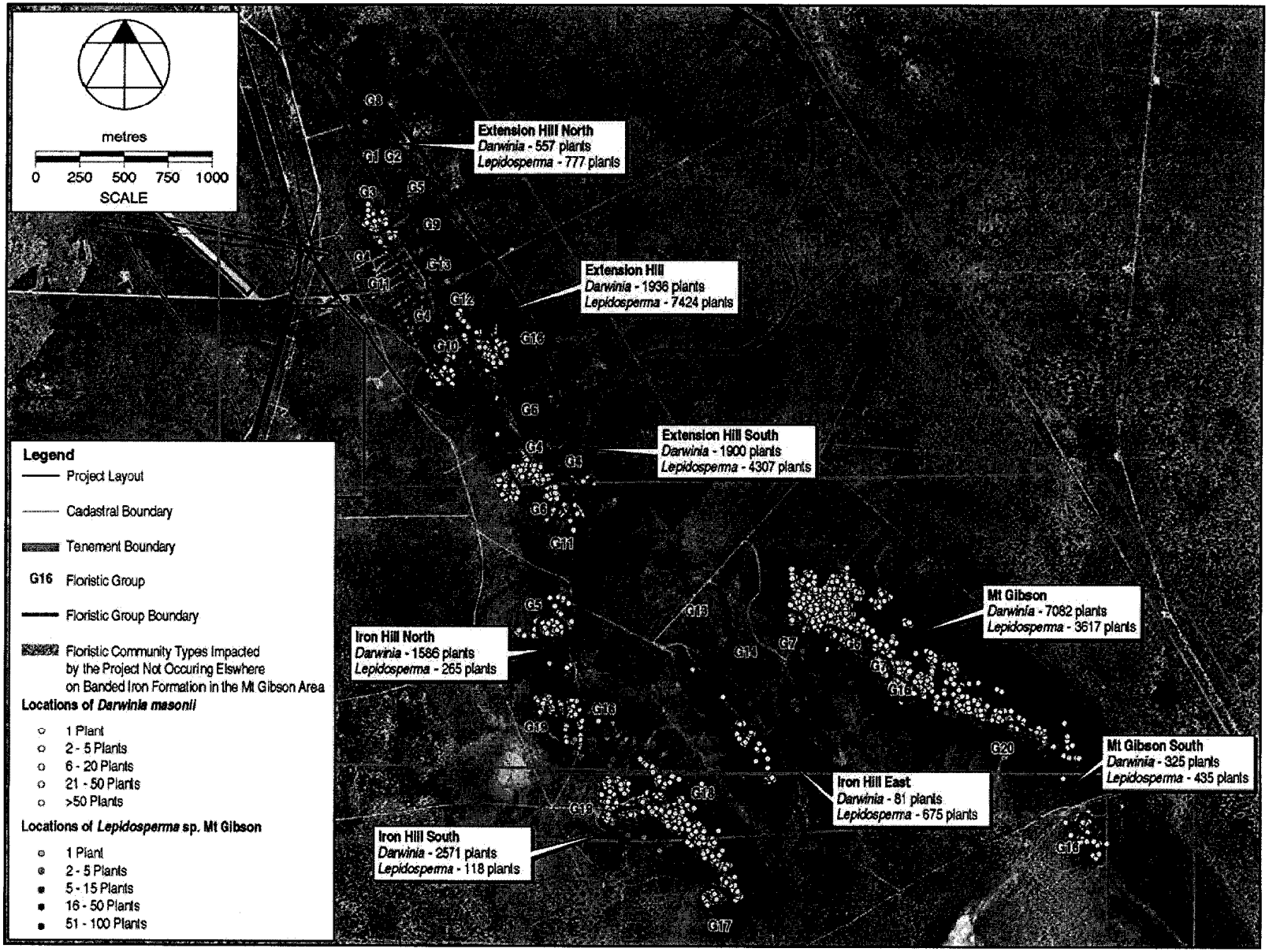

Figure 6: Darwinia masonii, Lepidosperma **sp. Mt Gibson and floristic vegetation communities at Mt Gibson**

Schedule 2

Schedule: Summary of Proponent Offsets

Offset	Governance	Timeline	Value
Support for a 3 year plus (Stage 2) research program to be undertaken by BGPA leading to the preparation & implementation of a Recovery Plan for the DRF *Darwinia masonii* (already commenced).	BGPA commissioned to undertake this work To the requirements of the Minister for the Environment on advice of the EPA	Three years or as required to meet objectives of the Research Plan. Stage 1 of the Research Plan completed. Stage 2 of the Research Plan commenced in May 2007	Stage 1 = $215,900 (already completed) Stage 2 of combined research program = $1.11 million
Support for a 3 plus year (Stage 2) research program to be undertaken by BGPA leading to the preparation and implementation of a Recovery Plan for the DRF *Lepidosperma* sp Mt Gibson (already commenced).	BGPA commissioned to undertake this work To the requirements of the Minister for the Environment on advice of the EPA	Three years or as required to meet objectives of the Research Plan. Stage 2 of the Research Plan commenced in May 2007	
Management of the Proponent's mining tenements in the Mt Gibson Ranges in accordance with the: (i) Significant Flora Species and Communities Management Plan (Condition 8) (ii) Weed Management Plan (Condition 9) (iii) Fire Management Plan (Condition 10) (iv) Malleefowl Management Plan (Condition 11); (v) Minesite Fauna Management Plan(Condition 12) ; (vi) Fire Management Plan (Condition 10) ; and Preliminary Closure Management Plan (Condition 14).	To the requirements of the Minister for the Environment on the advice of the EPA, DEC, DAF, DOIR, DoW	Ongoing for the life of the project	
Funding of $110,000 pa for the position of a DEC officer(s) during the life of the proposal. The funding is to be directed towards the achievement of environmental objectives detailed below and will cease in the event of any type of conservation reserve being imposed on the all or part of the Proponents Non Project land by any government agency. The role of the DEC position will be limited to • Assist with the development and implementation of the	Expenditure of funds to be agreed between Proponent and DEC's Regional Manager for the Midwest by 30 Nov each year DEC to provide an annual report to the Proponent by the end of September in each year which addresses performance in that role in the previous 12 months to assist in Proponents annual environmental reporting requirements	Ongoing for the life of the project	$2.2 million ($110,000pa)

interim and full recovery plans for *Lepidosperma* sp Mt Gibson and *Darwinia masonii;* • Coordinating the management of threatening processes in relation to *Lepidosperma* sp Mt Gibson and Darwinia masonii; • Oversee the development and implementation of a Malleefowl Management Plan; and • Other environmental target areas in DEC's Midwest Region as agreed by the Proponent and the DEC Manager for the Mid West Region on an annual basis			
Provide support of $50,000 pa each to ABHF, AWC and Pindiddy for predominately on-ground projects aimed at enhancing biodiversity and regional sustainability values on White Wells, Mt Gibson and Ninghan Stations respectively.	Simple contract between Pindiddy, AWC, ABHF and the Proponent Reporting by each organisation on expenditure of funds & works undertaken. Included in Proponents annual compliance reporting	Ongoing for the life of the project	$3 million ($150,000pa)
Establishment of and support for a Regional Conservation Association with the objectives of enhancing biodiversity and regional sustainability values. Funding of $100,000pa for projects in the northern Avon Wheatbelt and Southern Yalgoo IBRA bioregions generally focusing on an 2,600,000 ha area between Morawa and Beacon (200km west – east) and Wubin to Paynes Find (approximately 130km north – south). Provision of $100,000 seed funding on receipt of all State and Commonwealth approvals to establish the organisation	In accordance with the Proponents Biodiversity Offset Management Plan Articles of Association of the Regional Conservation Association determined by the members Annual reporting by Association on financial expenditure and the success of the various projects to the Proponent Proponent will report on allocation of monies in Progress and Compliance reporting Operation of the Association will be	Ongoing for the life of the project	$2 million ($100,000 pa

	reviewed triennially by a current member of the EPA		
Contribute to a regional feral animal control program (in particular foxes)	Proponent, DEC, AWC, ABHF and Pindiddy to agree scope and implementation	On- going, for the life of the project	

Strategic Framework for
Mine Closure

Australian and New Zealand Minerals and Energy Council

Minerals Council of Australia

This publication was produced jointly by the Australian and New Zealand Minerals and Energy Council and the Minerals Council of Australia.

The **Australian and New Zealand Minerals and Energy Council** (ANZMEC) consists of the Commonwealth Minister for Industry, Science and Resources, State and Territory Ministers with responsibility for minerals and energy and the New Zealand Minister for Energy. The Papua New Guinea Ministers for Mining and Petroleum and Energy have observer status. ANZMEC's mission is to promote the general welfare and progressive development of the Australian mining and minerals industry, and to consult on the nation's energy needs, resources and policies.

The **Minerals Council of Australia** represents companies involved in mineral exploration, mining and processing of minerals. Its activities are funded entirely by its member companies which, between them, produce about 90 percent of Australia's mineral output. The Mission of the Council is to promote the development of a framework that encourages safe, profitable and environmentally responsible minerals exploration, production, processing and marketing capable of sustaining an internationally competitive minerals industry attuned to community expectations.

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Table of Contents

BOXES

Introduction

The concepts and standards underlying mine rehabilitation and closure today are much more demanding and stringent than they were just a few years ago and reflect changing public priorities and environmental imperatives. The Australian mining industry fully accepts the concept and responsibility of minesite rehabilitation and decommissioning. At issue is the development of an effective and efficient approach to the funding of closure that enables mine rehabilitation and other environmental objectives to be achieved and also facilitates and encourages industry to comply with the requirements of Government and the community.

Mine rehabilitation is an ongoing programme designed to restore the physical, chemical and biological quality or potential of air, land and water regimes disturbed by mining to a state acceptable to the regulators and to post-mining land users (WMI, 1994). The objective of mine closure is to prevent or minimise adverse long-term environmental impacts, and to create a self-sustaining natural ecosystem or alternate land use based on an agreed set of objectives.

More recently, the emphasis for management of the environmental aspects of mine closure and decommissioning has shifted towards the idea of "planning for closure" (Sassoon, 1996). Mine closure is a continuous series of activities that begins with pre-planning prior to the project's design and construction and ends with the achievement of long-term site stability and the establishment of a self-sustaining ecosystem (WMI, 1994). Not only will the implementation of this concept result in a more satisfactory environmental conclusion, but it can also reduce the financial burden of mine closure and rehabilitation.

The objective of this *Strategic Framework for Mine Closure* is to encourage the development of comprehensive Closure Plans that return all mine sites to viable, and wherever practicable, self-sustaining ecosystems, and that these plans are adequately financed, implemented and monitored within all jurisdictions.

The Strategic Framework

This *Strategic Framework for Mine Closure* has evolved as a cooperative development between the Australian and New Zealand Minerals and Energy Council (ANZMEC) and the Australian Minerals Industry (represented by the Minerals Council of Australia (MCA)). It is designed to provide a broadly consistent framework for mine closure across the various Australian jurisdictions.

The Strategic Framework is not a detailed set of guidelines for mine closure. It is anticipated that both government and industry will develop complementary regulations and guidelines to further advance the process of effective mine closure. It is hoped that these initiatives will reflect, and further develop, the principles outlined in this document.

The Strategic Framework is designed to cover a broad range of mining and mining related activities. Exploration (which entails lower levels of impact and is often transitory in nature) and mineral processing are considered part of the broader mining function. While it is acknowledged that the focus of the Strategic Framework is primarily on improving closure related activities at operating mines, the principles are relevant to a broad range of activities.

The Strategic Framework does not address the issue of abandoned mines. Historically, mine sites have not been rehabilitated to standards that would be considered acceptable today. While acknowledging the importance of this issue, it was considered more important to address existing mines in an attempt to limit future problems.

Structure of the Report

The *Strategic Framework for Mine Closure* is structured around a set of objectives and principles grouped under six key areas (stakeholder involvement, planning, financial provision, implementation, standards and relinquishment). The principles are summarised at the beginning of the report, and then expanded on in subsequent sections.

The Strategic Framework also contains a number of Boxes which are designed to amplify particular topics which, in the authors' opinion, required additional explanation. The treatment of these topics is not exhaustive, but is provided as additional guidance.

The Strategic Framework concludes with a listing of Supporting Documentation which includes Standards and Guidelines, References and Definitions. The inclusion of the list of definitions is an attempt to standardise the often confusing and ambiguous terminology surrounding the closure debate.

Regulatory Setting

Regulation to meet growing community expectations of environmental management is increasing in all Australian jurisdictions. The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, which came into effect in July 2000, has established a new and nationally consistent framework for environmental assessment of new projects and variations to existing projects, based on consultative agreements between the Commonwealth and State and Territory Governments. Issues related to mine closure are an important consideration in the assessment process for mining proposals.

Appropriate planning and adequate provision for mine closure are issues to be addressed by both the regulators and the minerals industry across Australia. Australian State and Territory Governments (and in some cases local government) are responsible for the regulation and management of mine closure and rehabilitation requirements on industry. All States and Territories have mine closure policies requiring site-specific post-mining rehabilitation plans developed by companies for approval by the respective mining agencies in each jurisdiction. State and Territory Governments also require some form of security bond, usually in the form of a bank guarantee or a cash payment for smaller operations, but the calculation process for bonds varies between jurisdictions.

For its part, the mining industry has responded directly to changing community environmental standards through the development of mechanisms such as the Australian Mining Industry (2000) *Code for Environmental Management* and through the adoption of international environmental performance standards such as ISO 14001. The Code encourages self-regulation by the industry, with mine closure as a key component, to:

- ensure resources are adequate to implement environmental plans during operations and closure; and
- plan for closure in the feasibility and design phases of a project and regularly reviewing plans to consider changes in site conditions, technology and community expectations.

This *Strategic Framework for Mine Closure* is intended to promote a nationally consistent approach to mine closure management in all Australian jurisdictions. It will not necessarily result in identical legislation in each State and Territory. But it will establish principles for mine closure that are agreed between regulating authorities and the mining industry, and which can be applied with greater consistency to the development of regulations by government and mine closure programmes by industry.

Objectives and Principles

Stakeholder Involvement

Objective

To enable all stakeholders to have their interests considered during the mine closure process.

Principles

1. **Identification** of stakeholders and interested parties is an important part of the closure process.
2. **Effective consultation** is an inclusive process which encompasses all parties and should occur throughout the life of the mine.
3. A **targeted communication strategy** should reflect the needs of the stakeholder groups and interested parties.
4. **Adequate resources** should be allocated to ensure the effectiveness of the consultation process.
5. Wherever practical, **work with communities** to manage the potential impacts of mine closure.

Planning

Objective

To ensure the process of closure occurs in an orderly, cost-effective and timely manner.

Principles

1. Mine closure should be **integral** to the whole of mine life plan.
2. A **risk-based approach** to planning should reduce both cost and uncertainty.
3. **Closure plans** should be developed to reflect the status of the project or operation.
4. **Closure planning** is required to ensure that closure is technically, economically and socially feasible.
5. The dynamic nature of closure planning requires **regular and critical review** to reflect changing circumstances.

Financial Provision

Objective

To ensure the cost of closure is adequately represented in company accounts and that the community is not left with a liability.

Principles

1. A **cost estimate** for closure should be developed from the closure plan.
2. Closure cost estimates should be **reviewed regularly** to reflect changing circumstances.
3. The **financial provision** for closure should reflect the real cost.
4. **Accepted accounting standards** should be the basis for the financial provision.
5. **Adequate securities** should protect the community from closure liabilities.

Implementation

Objective

To ensure there is clear accountability, and adequate resources, for the implementation of the closure plan.

Principles

1. The **accountability** for resourcing and implementing the closure plan should be clearly identified.
2. **Adequate resources** must be provided to assure conformance with the closure plan.
3. The **on-going management** and monitoring requirements after closure should be assessed and adequately provided for.
4. A closure **business plan** *provides the basis for implementing the Closure Plan.*
5. The **implementation** of the Closure Plan should reflect the status of the operation.

Standards

Objective

To establish a set of indicators which will demonstrate the successful completion of the closure process.

Principles

1. **Legislation** should provide a broad regulatory framework for the closure process.
2. It is in the interest of all stakeholders to develop **standards** that are both acceptable and achievable.
3. **Completion criteria** are specific to the mine being closed, and should reflect its unique set of environmental, social and economic circumstances.
4. An agreed set of **indicators** should be developed to demonstrate successful rehabilitation of a site.
5. **Targeted research** will assist both government and industry in making better and more informed decisions.

RELINQUISHMENT

Objective

To reach a point where the company has met agreed completion criteria to the satisfaction of the Responsible Authority.

Principles

1 A **Responsible Authority** should be identified and held accountable to make the final decision on accepting closure

2. Once the completion criteria have been met, the company may **relinquish** their interest.
3. **Records** of the history of a closed site should be preserved to facilitate future land use planning.

MINE CLOSURE

1 Stakeholder Involvement

It is generally agreed that, in principle, public involvement in mining-related decision-making and management processes is an important factor in enhancing the legitimacy of the industry, in developing public trust in the ability and desire of mining companies to conduct their business in an environmentally responsible manner, and in improving the quality of the decisions being made regarding environmental management (WMI, 1994).

In response to public concern, governments are encouraging, and in some cases requiring, companies to discuss their plans and the environmental results of their activities (from exploration, through development and operation, to closure) in an open and forthright manner (WMI, 1994). More effective approaches to environmental management can be developed, and the public trust in mining enhanced, when the community and other stakeholders are fully informed and participate in the closure process.

The benefits of a successful stakeholder consultation process include:

- improved planning decisions;
- better motivated staff;
- improved relations with government;
- better acceptance of closure decisions;
- enhanced public image and reputation; and
- improved community receptiveness to future mining proposals.

Objective: to enable all stakeholders to have their interests considered during the mine closure process.

1.1 Stakeholder Identification

Identification of stakeholders and interested parties is an important part of the closure process.

Stakeholders are those parties with the potential to be affected by the mine closure process. They are distinct from Interested Parties, who have an interest in the process or outcomes of mine closure. Identifying key stakeholders and interested parties, and developing a good relationship with them, is fundamental to a successful closure process [s*ee* ***Box 1*** – ***Stakeholder Groups***].

Box 1 Stakeholder Groups

Stakeholders fall into three broad categories, the company, the community and the State. Outlined below are some of the key sub-groups within these broad stakeholder categories, however, the list is not exhaustive and will vary with individual circumstances.

The Company

Key company stakeholders include:

- *Employees:* employees facing job loss have an obvious and immediate stake in mine closure.
- *Management:* in order to promote continuity of corporate knowledge and consistency of approach to the post-mine rehabilitation and closure process, it is important that selected managers and company environmental personnel be encouraged to continue their involvement beyond the cessation of production.
- *Shareholders:* shareholders need to be fully informed of their company's obligations for closure.

The Community

The impacts of closure on the community will vary with the degree of community dependence on, or interest in, the mining project and its environmental issues. In some cases, the community will not survive the loss of the mine. At a community level, consultation is also important to avoid building up false expectations about the outcomes of closure. Significant community stakeholders include:

- *Local business and service providers:* the economic effects of mine closure on local business and service providers may be severe, and consultation is important to assist them in their own planning for the transition.
- *Landholders, neighbours and nearby residents:* this group may be physically affected by the closure and may have particular needs and desires that can be incorporated into rehabilitation planning.
- *Local government:* in addition to their direct involvement with the mining operation, local government provide a vital link with the community. Early consultation and planning is essential to minimise disruption to community services.
- *NGOs and Community Groups:* these groups often represent different points of view to those elements in the community which are physically and/or financially affected by mine closure.

The State

The requirements of government agencies must be satisfied if relinquishment is to be achieved. Consultation with these agencies is essential to ensure that rehabilitation and closure plans satisfy regulatory requirements. Important government stakeholders include:

- *The Responsible Authority (and other regulators):* a key role of the Responsible Authority is to coordinate the functions and needs of other government agencies with accountabilities in the area.
- *The land management agency:* where the land management agency (current or future) differs from the Responsible Authority, there is a need to ensure that their requirements are an integral component of the closure process.
- *Other government agencies:* the potential effects of closure on the community and individuals may necessitate consultation with government agencies, such as community welfare and employment, that have not previously impacted on the mine management.

1.2 Effective Consultation

Effective consultation is an inclusive process which encompasses all parties and should occur throughout the life of the mine.

The process of consultation should begin early in the mine life, preferably during the planning phase, and continue into the closure and relinquishment phase. Consultation should not be on a selective basis, but should involve all parties with a stake in the project and the post-mining land use. Other parties, such as conservation organisations and other non-government organisations, may have an interest in the project and should be included in the consultation process. To be effective, communication must involve listening and feedback, as well as informing. Consultation is about both perception and reality (EPA,1995), and perceptions can only be gauged by listening to the affected stakeholders and interested parties.

1.3 Targeted Communication Strategy

A targeted communication strategy should reflect the needs of the stakeholder groups and interested parties.

Closure information distributed to stakeholders should be provided in a timely and coordinated manner, and when a response is requested, adequate time should be provided (WMI, 1994). This is particularly important when infrastructure is being retained for community use, where post-mining land use involves community input, or where the post-mining land use is different from the pre-existing land use. Effective community relations demands that the corporation, its personnel and sub-contractors, have the capacity and desire to bridge the cultural and capacity gaps that often separate them from local communities (Dunn, 2000).

1.4 Adequate Resources

Adequate resources should be allocated to ensure the effectiveness of the consultation process.

To be effective, consultation presupposes corporate commitment and should be taken seriously by all company representatives involved. Proper mine closure is the result of a combination of innovative concepts, long-term commitments, and multi-party cooperation (Mudder & Harvey, 1998). The objective should be to ensure that all stakeholders have the necessary information and resources to participate meaningfully in the closure process.

1.5 Working with Communities

Wherever practical, work with communities to manage the potential impacts of mine closure.

Mine closure often causes significant social concern, particularly in local communities where a mine may be the major commercial activity (WMI, 1994). To minimise the impact on these local communities it is essential that companies work with them to manage such impacts. During the life of the mine it may be possible to encourage and assist the development of community cooperative industries which can persist after closure. Local industries that have a broader focus than the mine could also be supported. Working with communities through community consultative committees will assist in the development of programmes to offset the inevitable changes that will occur at closure.

2 Planning

Proper planning for closure should come during the feasibility study, design and permitting phase of a mine, and be upgraded during operational life. The lack of an up-to-date mine closure plan can result in severe environmental and economic consequences (Mudder & Harvey, 1998).

The broad aims of closure planning are to:

- to protect the environment and public health and safety by using safe and responsible closure practices;
- to reduce or eliminate adverse environmental effects once the mine ceases operations;
- to establish conditions which are consistent with the pre-determined end land use objectives; and
- to reduce the need for long-term monitoring and maintenance by establishing effective physical and chemical stability of disturbed areas.

Objective: to ensure the process of closure occurs in an orderly, cost-effective and timely manner.

2.1 Integration

Closure should be integral to the whole of mine life plan.

Mine closure should not be an “end of mine life process” but should be integral to “whole of mine life” if it is to be successful. Planning for closure should commence at the feasibility phase of an operation. In this way, future constraints on, and costs of, mine closure can be minimised, post-mining land use options can be maximised and innovative strategies have the greatest chance of being realised.

2.2 Risk-based Approach

A risk-based approach to planning should reduce both cost and uncertainty.

Current trends in closure planning involve technical review and analysis of risk and cost benefit in both engineering and environmental terms. The advantages of a risk-based approach to closure planning lie in the quantification of subjective factors and the analysis of uncertainty related to both design performance and cost (Morrey, 1999). The objective of a risk-based approach is to reduce both cost and uncertainty.

2.3 Closure Plans

Closure plans should be developed to reflect the status of the project or operation.

At least two types of closure plan will be required through the life of a mine; a Conceptual Closure Plan (project phase) and the main Closure Plan (operations phase) [*see* ***Box 2 – Closure Plans***]:

- a Conceptual Closure Plan for use during feasibility, development and detailed design; and
- a Closure Plan for use during construction, operation and post-operation [*see* ***Box 3 – Typical Contents of a Closure Plan***].

2.4 Closure Feasibility

Closure planning is required to ensure that closure is technically, economically and socially feasible.

Being able to successfully close a mine is critical to project approval. It is necessary to ensure that closure is technically, economically and socially feasible without incurring long-term liabilities. These issues are initially addressed in the Conceptual Closure Plan, which should include preliminary land use objectives to ensure that closure concepts are factored into final project design.

2.5 Regular and Critical Review

The dynamic nature of closure planning requires regular and critical review to reflect changing circumstances.

The Closure Plan should be modified as a result of any operational change, new regulations or new technology, and should be comprehensively reviewed on a regular and pre-determined cycle (eg. every 3 to 5 years). It should always remain flexible enough to cope with unexpected events. The Plan should include the management of social as well as environmental issues.

Box 2 Closure Plans

Conceptual Closure Plan

A Conceptual Closure Plan identifies the key objectives for mine closure to guide project development and design. It should include broad land use objectives and indicative closure costs. (This does not preclude land use objectives being varied during the mine life to reflect changes in both knowledge and technology.)

Closure Plan

Closure planning includes a commitment to progressive rehabilitation and detailed plan development and implementation. A number of subsidiary plans need to be developed as the Closure Plan evolves. These typically include: a rehabilitation plan, a decommissioning plan and a maintenance and monitoring plan.

- *Rehabilitation plan:* A key component of the Closure Plan is a commitment to progressive rehabilitation. In conjunction with an active research and trials programme, this may assist in minimising ongoing contamination and reduce final costs by confirming or modifying completion criteria and demonstrating that they can be met. Progressive rehabilitation allows best use of available personnel and equipment and should assist in minimising required security deposits.
- *Decommissioning plan:* As a detailed component of the Closure Plan, a decommissioning plan should be developed towards the final stages of an operation. (As the exact date for ceasing production is rarely known, it is suggested that the decommissioning plan be developed 2 to 4 years prior to estimated cessation.) Once established it should be updated annually. The decommissioning plan include such things as: details of the demolition and removal or burial of all structures not required for other uses; removal, remediation or encapsulation of contaminated materials; and the procedures for making safe and sealing, openings to underground workings.
- *Maintenance and monitoring plan:* The last aspect of the Closure Plan is performance monitoring, which should be designed to demonstrate that the completion criteria have been met. This period should also plan for remedial action where monitoring demonstrates completion criteria are unlikely to be met. If progressive rehabilitation has been successful, with stabilisation and revegetation meeting completion criteria this last phase of closure may be shortened. It is, however, unlikely to be less than 5 years in duration.

Box 3 Typical Contents of a Closure Plan

The development of a Closure Plan needs to take into account both the legal requirements and the unique environmental, economic and social properties of the operation. Outlined below are the typical contents of a Closure Plan, which will vary depending on individual circumstances. In developing the Closure Plan, the following four key objectives should be kept in mind:

- to protect the environment and public health and safety by using safe and responsible closure practices;
- to reduce or eliminate environmental effects once the mine ceases operations;
- to establish conditions which are consistent with the pre-determined end land use objectives; and
- to reduce the need for long-term monitoring and maintenance by establishing effective physical and chemical stability of disturbed areas.

Closure Plan: typical contents of a Closure Plan (not a minimum requirement or template):

- Introduction & Project Description
  - Land tenure
- Objectives of Closure
- Baseline Environmental Data
- Legal & Other Obligations
  - Key statutes & regulations
  - Responsible Authority
  - Regulatory instruments
- Stakeholder Involvement
  - Stakeholder identification
  - Community consultation
- Risk Assessment
  - Existing legacies
  - Future risks
  - Cost/benefit analysis
- Closure Criteria
- Closure Costs
  - Provisions
  - Securities
- Closure Action Plan
  - Human resources/responsibilities
  - Progressive rehabilitation
  - Decommissioning
  - Remediation
  - Geotechnical assessment
  - Landform establishment
  - Revegetation
  - Aesthetics
  - Heritage
  - Health & safety
  - Post-closure maintenance & monitoring
  - Survey (remaining structures & areas of contamination)
  - Documentation/reporting/records
- Tenement Relinquishment

3 Financial Provision

It is in the best interest of an active mining operation to develop and periodically review and update the closure plan and to modify its internal accrual process so that unexpected costs do not occur at the beginning of decommissioning. More emphasis is being placed not only on the internal accrual process but also on the external bonding requirements. In order to reduce further public intervention into the accrual and bonding aspects of a mining operation, there needs to be a commitment to conduct these periodic assessments in a realistic manner (Mudder & Harvey, 1998).

It is essential that the cost of closure be estimated as early as possible. Without a realistic closure cost the feasibility study cost estimate will be inadequate, and project viability will not be adequately tested. Closure costs will, of necessity, be indicative only, but can be based on broad industry experience.

Securities should not be offset against provisions. Securities are quite separate from any internal accounting provision.

Objective: to ensure the cost of closure is adequately represented in company accounts and that the community is not left with a liability.

3.1 Cost Estimate

A cost estimate for closure should be developed from the closure plan.

Closure plans provide cost estimates for progressive rehabilitation and final closure activities, as well as for environmental monitoring and long-term site management. The closure cost estimate provides a technical basis for the value of closure funds required, and can be estimated reasonably accurately provided there is sufficient site-specific information and data (Anderson *et al*. 1999).

3.2 Regular Review

Closure cost estimates should be reviewed regularly to reflect changing circumstances.

Costs should be reviewed regularly (eg. annually) to adjust for inflation and closure work requirements, and undergo thorough re-assessment on a regular and predetermined cycle to account for changing community standards and expectations. Return on sale of assets or salvage value are difficult to predict, particularly at remote locations, and should not be used to offset the cost of closure.

3.3 Financial Provision

The financial provision for closure should reflect the real cost.

Mine closure takes place when there is typically no return from the operation and there may be little value in the remaining assets. The objective of providing a financial provision is to ensure that adequate funds are available at the time of closure.

A schedule for financial provision should be part of all closure plans. The amount provided for rehabilitation should be consistent with the degree of disturbance at any given time. The provision is typically accrued over the life of the operation, and may be varied to reflect changes in mine planning and operations.

3.4 Accepted Accounting Standards

Accepted accounting standards should be the basis for the financial provision.

The relevance of closure costs for financial stewardship reporting purposes is recognised by the accounting profession [*see* ***Box 4 – Accounting for Provisions***]. Generally accepted accounting principles and practice require companies to use the accrual basis of accounting to match revenues with associated expenses (WMI, 1994). The objective should be to ensure that at the end of mine life, when income has ceased, there is sufficient accounting provision to cover the often significant mine closure expenditure.

3.5 Adequate Securities

Adequate securities should protect the community from closure liabilities.

Most modern approvals require some form of security to protect the State and/or community from liability [s*ee* ***Box 5 – Types of Securities***]. The most important variables are the form and amount of the surety, and the requirements for obtaining partial and full release of the surety (Williams, 1993). During mining, assurance levels should be subject to periodic reviews, in order to allow regulators to adjust operators' assurance amounts upward or downward as clean-up needs, environmental risks, or economic factors dictate (Da Rosa, 1999).

Box 4 Accounting for Provisions

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International accounting practices for restoration and rehabilitation costs vary from no recognition of a liability to full recognition. There is no specific International Accounting Standard dealing with the costs of closing a mine, but this issue, and the recognition of provisions in general, is being addressed by International Exposure Draft E59 - Provisions, Contingent Liabilities and Contingent Assets and a number of very similar national exposure drafts.

The three most commonly used methods are:

- expense as incurred
- incremental method
- full liability method.

Expense as incurred

Using this method you expense all costs as they are incurred. You can justify this because at the end of the mine's life, you can sell any fully written-down assets, and re-work waste piles, slag heaps and tailings dams to provide cash surpluses. In many cases this surplus offsets the cost of restoration.

Alternatively, costs that were known to be incurred after the cessation of production are provided for in the concluding periods (say the last 5 years) of productive operations when the costs can be determined with more certainty.

We do not recommend this method because it is not in accordance with the principles of the international framework. We also note that this method has not been commonly used in recent years.

Incremental method

Using the incremental method you can accrue closure costs by gradually increasing the provision over the life of the mine. The practice of estimating the future cost of restoration and then building up to that cost over the life of a mine by making periodic provisions (the 'incremental' or 'rateable recognition') is adopted by many mining entities and grew out of conservative provisioning practices based on the matching concept.

The main objective of this approach is to ensure that the full liability is accrued at the end of the life of mine and closure costs are allocated equitably to the periods of operation. The liability is often small, in particular in the early stages of mining, so only limited disclosures are generally provided.

Full liability method

Using the full liability method, you provide for the total present value of the future cost of repairing past damage and other related shut down costs as soon as the commitment is incurred, and the amount capitalised under this method is amortised over the life of the mine. This method is not in common use.

A slightly different method is used in strip-mining, where restoration is required shortly after mining is completed in particular areas. In these cases you can make an accrual during production for the cost of restoration of mined-out areas. If restoration costs are incurred at a similar rate to production (and not significantly in arrears), you can treat these restoration costs as part of production costs when incurred.

Box 5 Types of Securities

In a survey conducted for the International Council on Metals and the Environment (ICME), Miller (1998) identified many types of surety.

"Performance guarantees have been used in the mining industry for several years. In recent years, however, governments have extended the concept of financial security much to include cradle-to-grave environmental performance. They have also experimented with different forms of financial assurance.

Financial surety instruments are guarantees issued by a bonding company, an insurance company, a bank, or another financial institution which agrees to hold itself liable for the acts or failures of a third party. Fidelity bonds, surety bonds, performance bonds and letters of credit are examples of this class of instrument. Today, the most common use of environmental surety instruments is to guarantee environmental performance after closure (through the funding of mine site reclamation or rehabilitation)."

4 Implementation

Well planned closure programmes consist of two distinct sequential phases; planning and implementation. Coordinating these stages will result in a well-designed, systematic, safe and cost-effective mine closure (Hordley, 1998).

The following considerations need to be taken into account in the management and implementation of Closure Plans:

- accountability for plan implementation;
- the resources needed to assure conformance with the plan; and
- on-going management and monitoring requirements after closure of the operation.

Objective: to ensure there is clear accountability, and adequate resources, for the implementation of the closure plan.

4.1 Accountability for Closure

The accountability for resourcing and implementing the closure plan should be clearly identified.

In theory, closure is the converse of commissioning, requiring similar skill levels, operational experience, motivation and commitment (Hordley, 1998). The closure process will be enhanced if there is a dedicated team structure, reporting to a project manager. Roles and responsibilities need to be clearly established.

4.2 Adequate Resources

Adequate resources must be provided to assure conformance with the closure plan.

Provisioning is designed to ensure that adequate funds are available to meet closure commitments. If the estimated provisions are inadequate to meet commitments, funds will need to be provided from other sources.

4.3 On-going Management

The on-going management and monitoring requirements after closure should be assessed and adequately provided for.

It should be the objective of all mine closure programmes to achieve a final land use which is maintenance free. However, under some closure scenarios (such as treatment of acid mine drainage) there may be a need to provide long-term, active management and/or monitoring of the closed site. The post-mining management and monitoring requirements need to be assessed and adequately provided for.

4.4 Closure Business Plan

A closure business plan provides the basis for implementing the Closure Plan.

A closure project should be managed as a self-funding operation, complete with comprehensive business plan, including costs, revenues, profit/loss and cash flows (Hordley, 1998). The development of a business plan provides the basis for measuring progress and highlighting any changes needed to the closure process, and should also include a schedule of actions, responsibilities, resources and timeframes.

4.5 Closure Implementation

The implementation of the Closure Plan should reflect the status of the operation.

Closure may be initiated in a number of different scenarios [*see* ***Box 6 – Closure Scenarios***], including: planned closure, sudden closure, temporary closure and maintenance and monitoring.

Box 6 Closure Scenarios

Planned Closure

Planned closure involves the preparation of a Conceptual Closure Plan, and the timely evolution from it of the Closure Plan. When developed, the Closure Plan is based on the current level of bio-physical and socio-economic information, and mine planning and development detail. As the Project advances, the Closure Plan should be regularly updated and refined to reflect changes in mine development and operational planning, and environmental conditions. Planned closure requires the preparation of a decommissioning plan some years prior to closure, and the systematic implementation of this plan.

Sudden (Unplanned) Closure

In the event of sudden or unplanned closure, an accelerated closure process will need to be implemented. This involves the immediate preparation and implementation of a decommissioning plan (based on the pre-existing Closure Plan), taking into account the site's non-operational status. Where provision accounts are inadequate to fund the full closure requirements, funds will need to be provided from other company sources.

Temporary Closure (Care & Maintenance)

As a result of economic or operational circumstances, it is possible that mining and/or milling activity may cease and the operation will shut down on a temporary basis. A temporary shutdown of this nature is normally planned and assumes that the operation will recommence. The care and maintenance process involves the immediate preparation and implementation of a decommissioning plan, taking into account the potential for future operations at the site. It is recommended that where possible, and economically sensible, rehabilitation should be undertaken on all disturbed areas, even if it is likely that some of these areas will be disturbed in the future. Site remediation, and works to prevent potential off-site contamination, should be implemented as if for a final closure scenario. A temporary closure should always trigger a review of the final Closure Plan, which will be required to be implemented if circumstances remain adverse to the reopening of the operation.

Management & Monitoring

Provision should be made in closure planning for an adequate period of maintenance and monitoring. Monitoring should be designed to demonstrate that completion criteria have been met and that the site is safe, stable and has achieved the land use objectives set during the planning process. It is unlikely that such conditions can be demonstrated in less than 5 years following cessation of mining. Of particular importance is the development of support mechanisms for the maintenance and monitoring phase, when operational support (accounting, maintenance, etc.) is no longer readily available.

The need for maintenance recognises that not all closure strategies will be initially successful. All closure situations are unique, and although past experience and good planning can minimise the risks of failure, some remedial activity will usually be necessary. Where the opportunity exists to relinquish tenement progressively this should be taken.

5 Standards

Current site rehabilitation standards focus on effective covers and long-term stability of dams, dumps and other structures. Insufficient attention is being directed to the establishment of sustainable ecosystems as a long-term goal (WMI, 1994). The issue of developing guidelines or standards for closure purposes needs to be addressed. Where possible appropriate standards should be developed that provide benchmarks against which to measure performance.

Completion criteria are an agreed set of environmental indicators which, upon being met, will demonstrate successful rehabilitation of a site. Completion criteria are specific to the mine being closed, and reflect the unique set of environmental, social and economic circumstances of the site. They should be developed and agreed with stakeholders and, where possible should be quantitative and capable of objective verification.

Criteria need to be established to enable closed-out sites to be returned to the State on an equitable and cost-efficient basis to both government and industry while ensuring long-term protection of the environment (WMI, 1994).

Objective: to establish a set of indicators which will demonstrate the successful completion of the closure process.

5.1 Legislation

Legislation should provide a broad regulatory framework for the closure process.

Closure related legislation should be non-prescriptive and objectives based, and should ensure that all reasonable and practicable measures are taken to protect and restore the quality of the environment. It should be clearly understood and accepted that the legislative requirements are the minimum standard required, which best practice should exceed wherever possible.

Statutes are often proclaimed in response to bad practice, public outrage or some catastrophic failure. It is in the interest of all parties to avoid the introduction of reactionary and prescriptive legislation that so often follows such events.

Future State and Federal legislation should be framed with the following objectives:

- to provide a clear and transparent process;
- to be accessible to, and to protect the interests of, stakeholders through effective consultation;
- to be non-prescriptive and specify objectives to be attained; and
- to have enforceable powers.

5.2 Standards

It is in the interest of all stakeholders to develop standards that are both acceptable and achievable.

There are a number of means to achieve this, including the establishment of Codes of Practice and the setting of industry standards.

Codes of Practice are extremely powerful tools that can be developed for a range of issues or aspects of environmental management (eg. the Australian Minerals Industry's *Code for Environmental Management)*. They can be voluntary or compulsory depending on the desired purpose and should be the basis on which industry sets its own standards. Industry standards can be established at a national or regional level as a basis for the development of more detailed company or site-specific standards. They provide a opportunity for validation through broad exposure and input from a wide range of operations. They should form the basis on which industry is judged, both by their peers, stakeholders and interested parties.

5.3 Completion Criteria

Completion criteria are specific to the mine being closed, and should reflect its unique set of environmental, social and economic circumstances

Completion criteria are the basis on which successful rehabilitation is determined, and should be developed in consultation with stakeholders. This ensures that there is broad agreement on both the end land use objectives and the basis for measuring the achievement of that objective. Ideally, completion criteria should reflect the specific environmental and socio-economic circumstances of the site.

Completion criteria should be flexible enough to adapt to changing circumstances without compromising the agreed end objective. This provides certainty of process and outcome (relinquishment of tenement when the conditions have been met). There should be an agreed process for the periodic review and modification of completion criteria in light of improved knowledge or changed circumstance.

5.4 Environmental Indicators

An agreed set of indicators should be developed to demonstrate successful rehabilitation of a site.

As the agreed end land use may take years or even decades to achieve, a set of specific performance indicators should be developed to measure progress in meeting the completion criteria. Correctly chosen, the environmental indicators will show whether the ecological processes which will lead to successful rehabilitation are trending in the right direction. This will enable early intervention where trends are not positive.

5.5 Targeted Research

Targeted research will assist both government and industry in making better and more informed decisions.

One of the challenges facing all stakeholders is making rational decisions with limited information or knowledge on which to base these decisions. It is in the interest of all parties to be involved in this process to ensure there is a balanced outcome and that the relevant issues are addressed.

For sound environmental decisions to be made in relation to mine closure:

- all stakeholders need access to high quality, relevant, and unbiased information grounded in sound science; but
- complete scientific certainty is not a prerequisite to appropriate action to protect the environment where there is a risk of serious adverse impact.

It is imperative that all the stakeholders look beyond the short-term gains and commit to the longer-term industry wide strategic research. This should be designed to provide knowledge and information on which future decisions are made, and should be supported at all levels in industry and government. In many cases there will be an altruistic expectation that the larger better resourced sectors will provide the lead in these matters. Where decisions are made with limited knowledge and assumptions this should be acknowledged and commitments freely and openly made to verify the assumptions and to research the appropriate answers.

6 Relinquishment

Despite the magnitude and complexity of mine closure, over time most operators will be able to satisfy their obligations under Federal and/or State regulations. The expectation is that the Responsible Authority will accept the operator's performance and release the surety, and accountability will revert to the State or a subsequent land owner. However, while it is one thing to expect to be released from mine closure obligations, it is quite another to expect to be discharged from further liabilities under broad environmental and civil laws (Williams, 1993).

Objective: to reach a point where the company has met agreed completion criteria to the satisfaction of the Responsible Authority.

6.1 Responsible Authority

A responsible authority should be identified and held accountable to make the final decision on accepting closure.

The Responsible Authority (usually State Department of Mineral Resources or equivalent) will make a judgement on the achievement of the agreed completion criteria after consultation with other involved regulatory agencies, including the future land controller. All release criteria are predicated on the prescribed or agreed post-mining land use.

A sufficient period of time should have elapsed to demonstrate the stability of the site. For revegetated areas, this may require verification that the vegetation is, or is trending towards, a self sustaining status. Potential impacts on groundwater may also take several years of monitoring to establish or refute.

The site should not endanger public health and safety, should alleviate or eliminate environmental damage, and allow a productive use of the land similar to its original use or an acceptable alternative. A site requiring active maintenance is unlikely to be acceptable to government agencies. Release of securities and bonds may be progressive, and reflect the progress of rehabilitation. To facilitate this process, Governments may wish to consider additional incentives for timely completion of closure commitments.

6.2 Relinquishment

Once the completion criteria has been met, the company may relinquish their interest.

When the Responsible Authority has agreed to relinquishment of the site, the management and maintenance of the site would rest with subsequent owners or the State.

Successful closure may preclude certain post-mining land uses. Where land uses are recognised as incompatible with any fragility in the rehabilitated site, these must be recognised and prohibited by either covenants on the title or by local government land zonings. Failure of rehabilitation due to faulty land management practices by the post-mining land user will not impose any retrospective liability on the mining company.

6.3 Record Retention

Records of the history of a closed site should be preserved to facilitate future land use planning.

In the past, when mines have closed and the tenure has been relinquished or surrendered, many of the records of activities that occurred on the sites have been lost, destroyed or inadvertently disposed of. These records, while potentially of no further use to the company that once operated the site, are valuable to governments and potential future land users (and stakeholders).

The retention of mine records is important because they provide:

- a history of past developments;
- information for incorporation into state and national natural resource data bases; and
- the potential to improve future land use planning and/or site redevelopment.

Box 7 Types of Records

Prior to relinquishment or surrender of tenure, records of the site development should be submitted to the Responsible Authority. The types of records required by the Responsible Authority will vary, however, it should include the following:

- geological records, including cores or core logs;
- plans and surveys of surface and underground developments and facilities;
- mining, milling and production records;
- locations, quantities and qualities of stored waste products (eg. tailings dams, waste dumps, etc.);
- site specific surveys or studies (eg. contaminated site survey); and
- design and specifications of final landform construction and rehabilitation.

These records are invaluable to any potential redevelopment of the site, particularly in assessing the suitability of proposed future land uses that are not consistent with the agreed future land use at the time of mine closure.

Supporting Documentation

Standards and Guidelines

ANZMEC (1995) *Security Deposit Systems for Minesite Rehabilitation.* ANZMEC Report No: 95.01.

Australian Minerals Industry (2000) *Code for Environmental Management.*

Environment Protection Agency (1995) *Community Consultation and Involvement.* Best Practice Environmental Management in Mining, Commonwealth of Australia.

Environment Protection Agency (1995) *Mine Planning for Environmental Protection.* Best Practice Environmental Management in Mining, Commonwealth of Australia.

Environment Protection Agency (1995) *Rehabilitation and Revegetation.* Best Practice Environmental Management in Mining, Commonwealth of Australia.

ISO (International Standards Organisation) (1996) *Environmental management systems - Specification with guidance for use.* ISO 14001.

Minerals Council of Australia (1999) *Mine Closure Policy.*

Minerals Council of Australia (1998) *Mine Rehabilitation Handbook.*

Queensland Department of Minerals & Energy (1995) *Technical Guidelines for the Environmental Management of Exploration and Mining in Queensland* - Part D - *Rehabilitation Guidelines.*

Northern Territory Department of Mines and Energy (1997) *Mine Close Out Criteria: Life of Mine Planning Objectives.*

The Chamber of Minerals and Energy of Western Australia (1999) *Mine Closure Guideline for Minerals Operations in Western Australia.*

References

Anderson, D., Orava, D., Garisto, N. & Donahue, M. (1999) Liability transfer agreements. *Mining Environmental Management.* March, 1999.

Da Rosa, C. (1999) Financial assurances. *Mining Environmental Management.* March, 1999.

Dunn, W.J. (2000) Beyond "*Beads 'n Trinkets*": A systematic approach to community relations for the next millennium. *CIM Bulletin.* **93:**41-45.

EPA (Environment Protection Agency) (1995) *Community Consultation and Involvement*. Best Practice Environmental Management in Mining. Environment Australia, Canberra.

Hordley, S. (1998) Gold plant decommissioning. *Mining Environmental Management.* November, 1998.

Miller, C.G. (1998) Use of financial surety for environmental purposes. *International Council on Metals and the Environment.*

Morrey, D.R. (1999) Principles of economic mine closure, reclamation and cost management. In: *Remediation and Management of Degraded Lands.* M.H. Wong *et al.* (eds). Lewis, New York.

Mudder, T. & Harvey, K. (1998) Closure concepts. *Mining Environmental Management.* November, 1998.

PricewaterhouseCoopers (1999) *Financial Reporting in the Mining Industry for the 21st Century.*

Sassoon, M (1996) *Closure or Abandonment.* Mining Magazine, August, 1996.

Williams, G.P. (1993) Closing a hardrock mine – can you ever walk away? Proceedings of the Rock Mountain Mineral Law Thirty-Ninth Annual Institute. Denver, Colorado, July 1993.

WMI (Whitehorse Mining Initiative) (1994) *Environment Issues Group.* Final Report. October, 1994.

Definitions

Abandoned Site: an area formerly used for mining or mineral processing, where closure is incomplete and for which the title holder still exists.

Agreed: a standard or level of performance which must be to the satisfaction of the relevant Responsible Authority

Closure: a whole of mine life process which typically culminates in tenement relinquishment. It includes decommissioning and rehabilitation.

Completion Criteria: an agreed standard or level of performance which demonstrates successful closure of a site.

Consultation: a process of interactive and responsive communication.

Contaminated: refers to a condition or state, which represents an actual or potential adverse health or environmental impact because of the presence of any potentially hazardous substance.

Decommissioning: the process that begins near, or at, the cessation of mineral production and ends with removal of all unwanted infrastructure and services.

Environmental Indicator: a parameter (or a value derived from a parameter) which provides information about an environmental phenomenon

Exploration: the search for mineral deposits up to discovery and includes the delineation of the deposit by means of drilling and sampling.

Inactive Site: a mining or mineral processing area which is currently not being operated but which is still held under some form of title. Frequently such sites are referred to as being under "care and maintenance".

Interested Party: a person, group or organisation with an interest in the process of, or outcome of, mine closure.

Landholder: the owner of freehold land, the holder of leasehold land, or any person or body who occupies or has accrued rights in freehold or leasehold land.

Mine: an area of land subject to some form of activity associated with the extraction and processing of minerals.

Mining Activity: activity whose purpose is the extraction, concentration and/or smelting of economic minerals from a mineral deposit. It includes exploration, development of mineral deposits, construction of the mine and mining (i.e. extracting and processing the ore) and closure.

Orphan Site: an abandoned mine for which a responsible party no longer exists or can be located.

Post-mining Land Use: term used to describe a land use which occurs after the cessation of mining operations.

Provision: a financial accrual based on a cost estimate of the closure activities.

Reclamation: as for rehabilitation, but specifically refers to the restoration of residual landforms following cessation of mining.

Rehabilitation (Reclamation): the return of disturbed land to a stable, productive and self-sustaining condition, after taking into account beneficial uses of the site and surrounding land.

Relinquishment: formal approval by the relevant regulating authority indicating that the completion criteria for the mine have been met to the satisfaction of the authority.

Remediation: to clean-up or mitigate contaminated soil or water.

Responsible Authority: any Government body empowered to approve activities associated with the closure process.

Safe: a condition where the risk of adverse effects to people, livestock, other fauna and the environment in general has been reduced to a level acceptable to all stakeholders.

Security: a financial instrument lodged with the responsible authority which is adequate to cover the estimated cost of closure.

Stable: a condition where the rates of change of specified parameters meet agreed criteria.

Stakeholder: a person, group or organisation with the potential to be affected by the process of, or outcome of, mine closure.

Standard: a document that prescribes the requirements with which the product, service or function has to conform.

Temporary Closure (Care and Maintenance): phase following temporary cessation of operations when infrastructure remains intact and the site continues to be managed.

Tenement: some form of legal instrument providing access to land for the purposes of mining.

MOUNT GIBSON MINING LIMITED

CONCEPTUAL CLOSURE PLAN MT GIBSON IRON ORE MINE AND INFRASTRUCTURE PROJECT

VERSION 2

MARCH 2006

REPORT NO: 2005/238

ATA Environmental
environmental scientists

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TABLE OF CONTENTS

1. INTRODUCTION

Mount Gibson Mining Limited (MGM) is seeking to obtain environmental approval from the Environmental Protection Authority for the Mt Gibson Iron Ore Project.

This Conceptual Closure Plan is intended to be used as a planning tool for the closure, decommissioning and rehabilitation of all elements of the mining operations including mine pits, waste dumps, plant sites, borefield, slurry, gas and water supply pipelines and associated infrastructure. The plan also establishes a framework for decommissioning for scrutiny by regulatory authorities in the event of unforseen closure.

The mine is expected to have a minimum life of 20 years. Mine closure will include the safe dismantling and removal of infrastructure, the appropriate disposal of waste materials and site rehabilitation to return the environment to a safe environment compatible with the surrounding environment and capable of supporting a self sustaining ecosystem comprising local plants and animals.

As the Mt Gibson Iron Ore Project has not yet commenced, the Conceptual Closure Plan has not anticipated all the issues that may arise throughout the course of the project. The plan has been issued with the Public Environmental Review for the Mt Gibson Iron Ore Project to facilitate public involvement in the closure process from the early stages. Key elements of closure planning for which preliminary requirements have been identified are:

- Legal and Other Requirements;
- Development of Strategies for Final Closure; and
- Financial Provisioning.

This Conceptual Closure Plan will form the basis for developing a comprehensive Closure Plan prior to the commencement of mining. The Closure Plan will be reviewed every 2 years during operations. A Final Closure Plan will be prepared at least 2 years prior to planned closure.

Specific completion criteria will be developed through the life of the mine as an agreed set of environmental indicators which, on being met, will demonstrate successful rehabilitation of the site. These will be developed and refined as the operational aspects and characteristics become better understood through operating experience, focussed research and stakeholder consultation.

The Closure plan will include:

- Closure objectives;
- Stakeholder consultation program;
- Closure aspects risk register;

- Closure design criteria;
- Closure standards and preliminary completion criteria;
- Brief description of progressive closure methodology;
- Closure research and monitoring plan;
- Basis for financial provision; and
- Closure schedule.

2. POST MINING LANDFORM AND OBJECTIVES FOR CLOSURE

The first step in developing the overall mine closure strategy is to identify potential post-mining land use options and establish key objectives for closure to be incorporated in the project design.

At this stage no formal process of identifying and assessing options for closure of the Mt Gibson Iron Ore Project have been undertaken. This will be addressed in future as part of the closure planning and will include stakeholder consultation. No specific statutory requirement or obligation for post closure land use has been defined. As yet there has been no formal assessment of the post closure land use alternatives, land capability or stakeholder expectations to determine a specific land use objective.

The Mt Gibson Iron Ore project is located on land currently utilised for pastoralism and vacant crown land. It is abutted by land which is managed for conservation purposes. Pending the outcome of the formal assessments detailed above, the post closure objective for the Mt Gibson Iron Ore Project is that all land disturbed by the Mt Gibson Iron Ore Project will be managed for conservation following the completion of mining activities.

The existing landforms and proposed post closure landform when viewed from Mt Singleton and White Wells Homestead is shown in Figures 1 and 2.

The primary objectives for the closure of the Mt Gibson Iron Ore Project have been based on the Strategic Framework for Mine Closure (ANZMEC/MCA, 2000) and are to:

- Establish a safe and stable post-mining land surface which supports vegetation growth and is erosion resistant over the long term;
- Re-establish a self generating ecosystem comprising local native vegetation which resembles the surrounding environment as closely as practical;
- Leave the site in a safe, stable, non-polluting and tidy condition with no remaining plant or infrastructure that is not required for post operational use;
- Minimise downstream impacts on vegetation due to interruption of drainage;
- Identify any potential long term soil, surface water or groundwater pollution associated with the project and develop an action plan to manage this;
- Develop a stakeholder consultation group prior to the onset of closure to facilitate discussion of closure planning;
- Continue to monitor environmental performance during the decommissioning, rehabilitation and post closure stages of the project and take appropriate action until the approved completion criteria are met.

3. LEGAL REQUIREMENTS

In Western Australia the main legislative obligations and potential liabilities are created under the following legislation, which is administered by the Department of Industry and Resources (DOIR):-

- *Mines Act 1978;* and
- The *Mines Safety and Inspection Regulations 1995.*

All mining operations in Western Australia are subject to the *Environmental Protection Act 1986*, which is administered by the Environmental Protection Authority and the Department of Environment. The *Environmental Protection Act* overrides all other Acts, including the *Mines Act*.

The regulation of mine closure in Western Australia is generally carried out as a condition of a mining lease imposed at the time approval to mine is granted.

MGM has made commitments relating to mine closure in the PER of the Mt Gibson Iron Ore Project. It is expected that these commitments will form part of the Ministerial approval for the project as part of the environmental assessment of the project under Part IV of the *Environmental Protection Act*.

4. EXISTING INFORMATION

Mt Gibson experiences a semi-desert Mediterranean climate characterised by hot, dry summers with 9-11 months of dry weather and mild, wet winters (Payne *et al*., 1998). Average rainfall at Paynes Find is 283mm pa and for Ninghan Station is 293mm pa (Bureau of Meteorology, 2005). Rainfall is both irregular and variable. The average annual temperature for Paynes Find is 27^{o}C, which ranges from 18^{o}C in July to 37^{o}C in January. Annual evaporation rate greatly exceeds the mean annual rainfall.

The mine site and associated infrastructure is located within the Ancient Drainage subregion of the Avon Wheatbelt Interim Bioregion but near the junction withteh Yalgoo and Coolgardie Interim Bioregions (Thackaway and Cresswell,1995).As a consequence the floristic composition of the area is considered to be representative of all three Bioregions. The Ancient Drainage Subregion is an ancient peneplain with low relief and a gently undulating landscape. Lateritic uplands are surrounded by a yellow dominated sandplain.

The mine lies within the Avon Botanical District in the Southwest Botanical Province but near the boundary of the Austin Botanical District of the Eremaean and the Avon Botanical District of the Southwest Botanical Provinces (Beard, 1990). The division between these two Botanical Provinces is the 'Eucalyptus-Acacia' line between the *Acaci*a low woodland and the *Eucalyptus* medium height woodland on the lower slope soils.

A total of 285 plant taxa were recorded from the area by Bennett (2000), with the dominant families being the Asteraceae (41 native taxa, 6 introduced), Myrtaceae (28 native taxa), Mimosaceae (22 native taxa), Chenopodiaceae (21 native taxa), Poaeae (11 native taxa, 5 introduced taxa) and Proteaceae (13 native taxa) representing 52% of the total number of taxa (Bennett, 2000). A supplementary survey of areas to the west of Great Northern Highway and to the east of Extension Hill recorded a total of 193 plant species, including 192 native species (ATA Environmental, 2005e).

The Declared Rare flora *Darwinia masonii* occurs on the upper slopes, crests and ridges in the Mt Gibson ranges. *Acacia cerastes* (P1) occurs through the Mt Gibson area. *Lepidosperma* sp Mt Gibson, has been recorded from the Mt Gibson hills. The species' conservation status has not yet been determined. Other significant flora recorded in the vicinity include Eucalyptus synandra (DRF), *Chamelaucium* sp Yalgoo (P1), *Persoonia pentisticha* (P2) and *Acacia acanthoclada* subsp *glaucescens* (P3).

Previous fauna surveys conducted in the vicinity of the project area recorded 112 vertebrate species including 64 species of birds, 38 species of reptiles and 10 species of mammals, 5 of which were introduced. A survey for Short Range Endemic Invertebrates recorded 4 species of land snails, 5 species of millipedes and 12 species of trapdoor spiders. The Malleefowl (*Leipoa ocellata*) (Schedule 1) occurs in the Mt Gibson hills and surrounding plains.

The Mt Gibson hills are a prominent folded ridge of Banded Ironstone Formation, which reaches an elevation of 451mAHD. Away from the ridge, the land has low topography at elevations of 320 to 360m AHD. Southerly drainage of runoff water

from the Mt Gibson ridge is to a claypan about 2km sq. located approximately 2km south of Mt Gibson. Northerly drainage is to a broad north trending channel with no defined water, leading to the Lake Monger paleo-drainage system.

The water table at the minesite lies at 320ADH, which is 50 to 100m below natural ground surface. Rock permeability is higher in the weathered material that extends below the water table, compared with fresh rock. Groundwater levels slope downwards away from the ridge by about 3m per km to the east (that is a hydraulic gradient of 0.003), reflecting the topography and overall low permeability of the bedrock (Rockwater, 2005a). Recharge to the aquifer is considered to be minimal (Rockwater, 2005a).

A saline paleochannel aquifer is located to the north and east of the mine area. The paleochannel aquifer is 4km east of the mine at its closest point. The aquifer is likely to extend to a further 20km towards Lake Monger. Groundwater salinities in the paleochannel are in the approximate range of 10,000 to 30,000mg/L TDS. The flanking alluvial deposits, between the channel and bedrock outcrop/subcrop contain small groundwater supplies. The hydraulic conductivity of the alluvial channel is about 0.0009 (Rockwater, 2005a).

MGM plans to rehabilitate all land disturbed by their operations to a self sustaining ecosystem resembling as close as practicable, the pre-mining environment. The Mt Gibson Iron Ore project is located on land currently utilised for pastoralism and vacant crown land. It is abutted by land which is managed for conservation purposes. Pending the outcome of the formal assessments, the post closure objective for the Mt Gibson Iron Ore Project is that all land disturbed by the Mt Gibson Iron Ore Project will be managed for conservation following the completion of mining activities. MGM will aim to re-establish vegetative cover using local native species.

5 STAKEHOLDER INVOLVEMENT

MGM recognises that stakeholder involvement is critical in developing and implementing mine closure strategy.

As this is a Conceptual Closure Plan, stakeholders have not yet been identified or consulted. MGM will ensure that communication with stakeholders occurs well before, and continues during, the closure planning, decommissioning and closure phases of the project.

Consultation will be undertaken with Local, State and Commonwealth decision making authorities and all non government organisations who may be affected and/or involved with the Project as part of the closure planning phase to ensure stakeholder concerns are built into the closure strategy.

Stakeholders are likely to include:

- Regulators including Department of Industry and Resources, Department of Environment; EPA Services Unit and CALM
- Community and non government organisations including land holders, Australian Wildlife Conservancy, Australian Bush Heritage Trust, Pindiddy Aboriginal Corporation, Ninghan Regional Conservation Association, Aboriginal communities; and
- Company management and employees.

6. RISK ASSESSMENT

An initial qualitative risk assessment will be undertaken as part of the development of the Closure Plan. The risk assessment will identify environmental risks associated with the operational, closure and post closure phases of the project.

7. FINANCIAL PROVISIONS

MGM will make financial provisions during the life of the operation to cover the costs of closure and decommissioning. This will ensure sufficient funds are set aside to cover these costs when revenue is no longer being generated.

The closure provision will be reviewed annually to ensure provisions are correct. MGM will develop an assets register which will be reviewed on an annual basis. On commencement of the closure process, an audit of the site and an update of the assets register will be conducted to ensure all closure requirements are recognised.

Performance bonds accumulated by DOIR are separate from the Company closure provisions and therefore do not contribute to the total closure provision.

8. REHABILITATION AND REVEGETATION MANAGEMENT PLAN

MGM recognises that mining is a temporary land use which should be integrated with or followed by, other forms of land use. Rehabilitation of the Extension Hill mine will be aimed towards a clearly defined future land use for the area. The future land use for the project area will be determined in consultation with relevant stakeholders including government agencies, local government authorities, traditional owners and private land owners. Different components of the project may have different post-mining landuses.

Rehabilitation and revegetation will be addressed as part of the Construction and Operational Environmental Management Plan (EMP) for the Project.

Applicable standards and guidelines for rehabilitation include:

- *Strategic Framework for Mine Closure* (ANZMEC & Minerals Council of Australia, 2000);
- *Mine Void Water Resource Issues in Western Australia* (Water & Rivers Commission, 2003)

The Extension Hill pit will remain as a permanent void upon the cessation of mining, and will be partially filled with water. The pit will act as a groundwater sink, with water levels in the pit expected to remain close to the pit floor. The salinity in the void is likely to increase over time. Saline waters will not move into the surrounding aquifers and the final mine void will have no impact on the surrounding regional groundwater table (Rockwater 2005a, 2005b). Due to the project schedule and pit depth, the 'in-pit' storage of waste rock is not feasible.

The project will disturb approximately 872ha of land at the minesite. Rehabilitation of the combined waste dump and dry tailings facility will be undertaken progressively throughout the life of the mine and will be based on industry best practice. Rehabilitation activities will include:

- ripping of compacted areas;
- re-establishment of a stable landform with erosion protection where necessary for long-term stability;
- construction of a post mining landform that resembles the pre mining landscape as closely as practicable;
- replacement of topsoil;
- spreading of vegetation debris to return organic matter to the area, and provide an additional seed source; and
- additional seeding and planting of seedlings if regeneration from topsoil is insufficient.

The rehabilitation program will include the development of rehabilitation and revegetation criteria in consultation with stakeholders. Rehabilitated areas will require ongoing monitoring to assess the effectiveness of the rehabilitation works. Monitoring will commence prior to the disturbance for mining activities and continue at control sites throughout the life of the project. Monitoring results will be used to assess the effectiveness of progressive rehabilitation and where remedial works may be required.

9. CONCEPTUAL CLOSURE DESIGN CRITERIA

The following table provides the conceptual design criteria and associated closure activities for achieving the closure objectives for the different aspects of the project. It is likely the actions required for closure will change with time due to likely changes in mining/processing technology and closure standards. More detailed closure plans will be prepared progressively as appropriate, during the life of the operation.

Conceptual Closure Objectives, Design Criteria and Activities for Various Aspects of the Project

Project Aspect	Closure Objective	Closure Design Criteria	Conceptual Closure Activities
Mine void	• Establish a safe and stable post-mining land surface which supports vegetated growth • Maximise infiltration of water • Minimise downstream impacts on vegetation due to interruption of drainage • Continue to monitor environmental performance during decommissioning, rehabilitation and post closure stages of the project and take appropriate action until the approved completion criteria have been met.	• Pit perimeters resembling topography of the surrounding environment • Abandonment bunding surrounding open pits in accordance with DOIR guidelines • Passive drainage diversion and downstream re-distribution	• Clear vegetation and topsoil from all disturbed areas for use in rehabilitation • Maintain/establish surface water diversion works • Monitor land/ecosystem function and downstream impacts on vegetation
Colocated (dry) tailings and waste dump	• Establish a safe and stable post mining landform which supports vegetation growth and is erosion resistant over the long term • Re-establish self generating ecosystem comprising local native vegetation which resembles the surrounding environment as closely as practical • Minimise downstream impacts on vegetation due to interruption of drainage • Continue to monitor environmental performance during decommissioning, rehabilitation and post closure stages of the project and	• Batters <20 degrees • 5m back sloping berms at 10m vertical intervals • Optimal topsoil cover with cleared vegetation material • Passive drainage diversion and downstream re-distribution • Self generating ecosystem function comprising appropriate pre-mining vegetation communities.	• Clear vegetation from all disturbed areas for use in rehabilitation • Progressively batter final waste dump slopes and contour to blend with topography • Direct replacement of topsoil where practical or respread stockpiled topsoil and vegetation where practical • Deep rip on the contour • Seed with local native species if required • Maintain/establish surface water diversion works • Monitor land/ecosystem function and downstream impacts on

Project Aspect	Closure Objective	Closure Design Criteria	Conceptual Closure Activities
	take appropriate action until the approved completion criteria have been met.		vegetation
Crushers, Screening and Processing plant	• Leave site in a safe, stable, non-polluting and tidy condition with no remaining plant or infrastructure that is not required for post operational use.	• No remaining plant or infrastructure that is not required for post-operational use	• Dismantle and remove crushing facilities • Excavate and remove and/or bury concrete footings • Bury remaining inert scrap materials not suitable for sale or recycling • Remediate any hydrocarbon contaminated soils • Rip surface to alleviate compaction and encourage regrowth of native vegetation
Work shop	• Leave site in a safe, stable, non-polluting and tidy condition with no remaining plant or infrastructure that is not required for post operational use.	• No remaining plant or infrastructure that is not required for post-operational use	• Dismantle and remove crushing facilities • Remove scrap metal from site for recycling • Excavate and remove and/or bury concrete footings • Bury remaining inert scrap materials not suitable for sale or recycling • Remediate any hydrocarbon contaminated soils • Contour to restore natural drainage • Rip surface to alleviate compaction and encourage regrowth of native vegetation
Power station	• Leave site in a safe, stable, non-polluting and tidy condition with no remaining plant or infrastructure that	• No remaining plant or infrastructure that is not required for post-operational	• Dismantle and remove all power generation equipment, associated infrastructure and transmission lines

Project Aspect	Closure Objective	Closure Design Criteria	Conceptual Closure Activities
	is not required for post operational use.	use	form site for sale • Remove scrap metal for recycling • Bury remaining inert scrap materials not suitable for sale or recycling • Remediate any hydrocarbon contaminated soils • Rip surface to alleviate compaction and encourage regrowth of native vegetation
Bulk hydrocarbon storage	• Leave site in a safe, stable, non-polluting and tidy condition with no remaining plant or infrastructure that is not required for post operational use. • Identify any potential long term soil, surface water or groundwater pollution associated with the operations and formulate an action plan to address this	• No remaining plant or infrastructure that is not required for post-operational use • All sites contaminated with hydrocarbons or chemicals to be completely remediated with levels of contaminants in soil, ground or surface water in compliance with values in the DoE guideline 2003 "Assessment levels for Soil, sediment and water' and the ANZECC 2000 guidelines for fresh and marine water quality	• Remove any residual hydrocarbon materials from the bulk storage tanks and transfer to a licenced facility for disposal • Remove empty bulk storage vessels from site or fill with sand and leave in situ • Sample the storage site for the presence for any hydrocarbon contamination • If any contamination is identified develop an action plan for further sampling and remediation • Remove scrap metal for recycling • Bury remaining inert scrap materials not suitable for sale or recycling • Excavate and remove and/or bury concrete footings • Rip surface to alleviate compaction and encourage regrowth of native vegetation

Project Aspect	Closure Objective	Closure Design Criteria	Conceptual Closure Activities
Explosive and detonator, ammonia nitrate storage and magazine	• Leave site in a safe, stable, non-polluting and tidy condition with no remaining plant or infrastructure that is not required for post operational use. • Identify any potential long term soil, surface water or groundwater pollution associated with the operations and formulate an action plan to address this •	• No remaining plant or infrastructure that is not required for post-operational use • All sites contaminated with hydrocarbons or chemicals to be completely remediated with levels of contaminants in soil, ground or surface water in compliance with values in the DoE guideline 2003 "Assessment levels for Soil, sediment and water' and the ANZECC 2000 guidelines for fresh and marine water quality	• Remove all explosives and associated equipment • Dismantle the magazine and remove from site if transportable or demolish is permanent • Sample the site for the presence for any contamination • If any contamination is identified develop an action plan for further sampling and remediation • Remove scrap metal for recycling • Bury remaining inert scrap materials not suitable for sale or recycling • Excavate and remove and/or bury concrete footings • Rip surface to alleviate compaction and encourage regrowth of native vegetation
Haul roads and access tracks	• Establish a safe and stable post mining landform which supports vegetation growth and is erosion resistant over the long term • Re-establish self generating ecosystem comprising local native vegetation which resembles the surrounding environment as closely as practical • Minimise downstream impacts on vegetation due to interruption of drainage • Continue to monitor environmental performance during	• No remaining plant or infrastructure that is not required for post operational use. • Self generating ecosystem function comprising appropriate pre-mining vegetation communities	• Stakeholder consultation to determine post operational use for haul roads and access tracks • Haul roads an access tracks not required by stakeholders will be rehabilitated • Remove culverts and other associated infrastructure • Remediate any soil contaminated with hydrocarbons • Respread stockpiled topsoil and vegetation material where available • Deep rip to alleviate compaction and encourage regrowth of native

Project Aspect	Closure Objective	Closure Design Criteria	Conceptual Closure Activities
	decommissioning, rehabilitation and post closure stages of the project and take appropriate action until the approved completion criteria have been met. •		vegetation • Seed with local native vegetation if necessary • Monitor land/ecosystem function and downstream impacts on vegetation
Administration and ancillary support facilities and accommodation village	• Leave site in a safe, stable, non-polluting and tidy condition with no remaining plant or infrastructure that is not required for post operational use.	• No remaining plant or infrastructure that is not required for post operational use.	• • Power, water and drainage systems to be shut off and the buildings removed from site for sale • Remove scrap metal for recycling • Bury remaining inert scrap materials not suitable for sale or recycling • Excavate and remove and/or bury concrete footings • Remediate any soil contaminated with hydrocarbons • Contour to restore natural drainage • Rip surface to alleviate compaction and encourage regrowth of native vegetation
Airstrip	• Leave site in a safe, stable, non-polluting and tidy condition with no remaining plant or infrastructure that is not required for post operational use.	• No remaining plant or infrastructure that is not required for post operational use.	• Consultation with stakeholders to determine post operational use for the airstrip by other parties • Remove any structures assembled by MGM and rehabilitate areas not required by the new manager

Project Aspect	Closure Objective	Closure Design Criteria	Conceptual Closure Activities
Sewage treatment facilities	• Leave site in a safe, stable, non-polluting and tidy condition with no remaining plant or infrastructure that is not required for post operational use.	• No remaining plant or infrastructure that is not required for post operational use.	• Empty sewage from the treatment facilities and transfer to an approved facility for disposal by a licensed operator • Dismantle and remove the sewage treatment facilities from site for sale • Remove scrap metal for recycling • Bury remaining inert scrap materials not suitable for sale or recycling • Excavate and remove and/or bury concrete footings • Remediate any soil contaminated with hydrocarbons • Contour to restore natural drainage • Rip surface to alleviate compaction and encourage regrowth of native vegetation
Ground water quality monitoring bores	• Leave site in a safe, stable, non-polluting and tidy condition with no remaining plant or infrastructure that is not required for post operational use.	• No remaining plant or infrastructure that is not required for post operational use.	• Groundwater quality monitoring bores will be retained for the post decommissioning monitoring • Groundwater quality monitoring bores that are not required for ongoing monitoring will be shut down, bore casings cut off below ground level and holes plugged.
Water supply bores and pipes	• Leave site in a safe, stable, non-polluting and tidy condition with no remaining plant or infrastructure that is not required for post operational use.	• No remaining plant or infrastructure that is not required for post operational use.	• Selected water supply bores will be retained for post decommissioning monitoring • Water supply bores that are not required for ongoing monitoring will be shut down, bore casings cut off

Project Aspect	Closure Objective	Closure Design Criteria	Conceptual Closure Activities
			below ground surface and holes plugged • Above ground pipes and pumps to be flushed and removed form site • Below ground pipes will be cut off below ground surface and remain buried • Disturbed areas contoured, ripped and seeded with local native species if required.
Drains	• Leave site in a safe, stable, non-polluting and tidy condition with no remaining plant or infrastructure that is not required for post operational use.	• No remaining plant or infrastructure that is not required for post operational use.	• Drains along roads and tracks that will be left open will remain intact • Drains no longer required will be filled in and the surface contoured to restore natural drainage • Eroded areas surrounding the drains will be repaired before being rehabilitated
Steel structures, pipes and other fabrications	• Leave site in a safe, stable, non-polluting and tidy condition with no remaining plant or infrastructure that is not required for post operational use.	• No remaining plant or infrastructure that is not required for post operational use.	• Steel structures, pipes and other metal fabrications will be removed from site for sale or recycling • Bury remaining inert material which are not suitable for sale or recycling
Machinery and pumps	• Leave site in a safe, stable, non-polluting and tidy condition with no remaining plant or infrastructure that is not required for post operational use.	• No remaining plant or infrastructure that is not required for post operational use.	• All machinery and pumps will be removed from site and sold
Electrical equipment	• Leave site in a safe, stable, non-polluting and tidy condition with no remaining plant or infrastructure that is not required for post operational use.	• No remaining plant or infrastructure that is not required for post operational use.	• All electrical equipment will be removed from site and sold

Project Aspect	Closure Objective	Closure Design Criteria	Conceptual Closure Activities
Remaining materials	• Leave site in a safe, stable, non-polluting and tidy condition with no remaining plant or infrastructure that is not required for post operational use.	• No remaining plant or infrastructure that is not required for post operational use.	• All other materials, which is anticipated to small quantities on non-recyclable and non-saleable items and rubbish, will be disposed of in accordance in accordance with DoE and Shire requirements.

10. COMPLETION CRITERIA

MGM will develop completion criteria, which will be used as a basis for assessing the closure of mine operations.

Preliminary completion criteria have been developed as follows. However, it is expected the completion criteria will be reviewed throughout the life of the project based on the results of monitoring and rehabilitation activities, and changing government and community expectations.

Objective	Potential Completion Criteria
Establish a safe and stable post mining land surface which supports vegetation growth and is erosion resistant over the long term	Combined dry tailing and waste dump areas have been contoured to be water shedding, spread with top soil, ripped and are geotechnically stable. Pit perimeter resembles topography of surrounding environment. Abandonment bunding surrounding open pit in accordance with doir guidelines. All processing and supporting infrastructure has been dismantled and removed from site and disposed of appropriately. All buildings and ancillary infrastructure has been removed from site and the surface ripped on the contour to relieve compaction. All bores (except monitoring bores) have been shut down, bore casings removed and holes plugged or capped. All pipelines and pumps have been flushed and removed from site (above ground) or left buried (below ground). All bulk hydrocarbon storage tanks have been emptied and removed. All haul roads and tracks have been rehabilitated with natural drainage lines re-established. The final rehabilitated landform: • has been ripped if compacted, and contoured to resemble the surrounding landscape • has been contoured to allow natural drainage patterns to be re-established • is stable and non-erosive • has a soil profile that is similar to the pre-mining profile and that will support plant growth.

Objective	**Potential Completion Cri**teria
Re-establish a self generating ecosystem comprising local native vegetation that resembles the surrounding vegetation as closely as practical	Revegetated areas are stable, well established and represent a self sustaining ecosystem similar to the surrounding environment in terms of flora and fauna species composition and fauna habitat.
Leave site is a safe, stable, non polluting and tidy condition with no remaining plant or infrastructure that is not required for post-operational use.	All plant and infrastructure post mining is identified, appropriately removed and disposed off site in an environmentally responsible manner. The project is not considered contaminated as per the DoE Guideline 2003 'Assessment Levels for Soil, Sediment and Water'
Minimise downstream impacts on vegetation due to disruption of drainage	Drainage re-established to areas dependent on overland flow
Identify any long term soil, surface water or ground water pollution associated with the operations and formulate an action plan to address this.	All sites contaminated with hydrocarbons or chemicals have been completely remediated with levels of contaminants in soil, ground or surface waters in compliance with the values in the DoE 2003 Guideline 'Assessment Levels for Soil, Sediment and Water' and the ANZEC 2000 Guideline for Fresh and Marine Water Quality. Any future sources of contamination identified and assessed for risk and treated by removal of the source and/or development of a management plan.
Develop a stakeholder consultation group prior to the onset of closure to facilitate discussion of closure planning	A consultation program has been implemented and a closure stakeholder reference group has been formed prior to the closure process commencing. The stakeholder reference group has been well informed of all closure activities and any concerns raised by the group have been formally addressed.
Continue to monitor environmental performance during decommissioning, rehabilitation an post closure stages of the project and take appropriate action until the approved completion criteria have been met.	Monitoring of soil, surface and groundwater, flora, fauna and any contaminated areas has continued according to the agreed schedule during the post closure period and the results have been included in the annual closure report provided to regulators. Monitor ecosystem function and downstream impact from mine pit and tailing and waste dump area on vegetation. Progressively apply results of revegetation trials. Any areas of concern identified during the post closure period have been addressed with an action plan and included in the annual closure report.

11 CLOSURE SCHEDULE

The Mt Gibson Iron Ore Project has a projected minimum mine life of 20 years.

MGM will prepare a Closure Plan for the project prior to the commencement of mining.

The Closure Plan will be reviewed at least every two years during the operational life of the mine.

A Final Closure Plan will be prepared at least two years prior to planned closure.

12. REFERENCES

ANZEC/MCA (2000) *Strategic Framework for Mine Closure*. Australian and New Zealand Minerals and Energy Council and Mineral Council of Australia.

ATA Environmental (2005e) *Mt Gibson Magnetite Project Supplementary Vegetation and Flora Surveys* Version 2. Unpublished Report prepared for Mt Gibson Mining Limited. Report No 2005/149. November 2005.

Beard (1990) Plant Life of Western Australia. Kangaroo Press.

Bennett Environmental Consulting (2000) *Flora and Vegetation of Mt Gibson*. Unpublished report prepared for Mount Gibson Iron Ltd. Dec 2000.

Payne A.L., Van Vreeswyk, A.M.E, Pringle, H.J.R, Leighton K.A and Henning P. (1998) *An Inventory and vegetation Condition Survey of the Sandstone-Yalgoo-Paynes Find Area. Western Australia*. Technical Bulletin No 90 Agriculture Western Australia, South Perth.

Rockwater (2005a) *Extension Hill. Study of Pit Hydrogeology and Dewatering*. Unpublished report for Mt Gibson Mining. July 2005.

Rockwater (2005b) *Revised Dewatering Assessment for 50metres/year Pit Excavation Rate*. Unpublished Report for Mt Gibson Mining. September 2005.

Thackway R.and Cresswell I.D. (1995) *An Interim Biogeographic Regionalisation for Australia*. Australian Nature Conservation Agency, Canberra.

FIGURES

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ATA Environmental
environmental scientists

CONCEPTUAL CLOSURE PLAN - MT GIBSON IRON ORE PROJECT

VISUAL IMPACT ASSESSMENT - MT SINGLETON

FIGURE 1

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CONCEPTUAL CLOSURE PLAN - MT GIBSON IRON ORE PROJECT

VISUAL IMPACT ASSESSMENT - WHITE WELLS HOMESTEAD

FIGURE 2