MOUNT GIBSON MINING LIMITED

MT GIBSON IRON ORE MINE AND INFRASTRUCTURE PROJECT PUBLIC ENVIRONMENTAL REVIEW

April 2006
ATA Environmental Report No. 2004/246

INVITATION TO MAKE A SUBMISSION

The Environmental Protection Authority (EPA) invites people to make a submission on this proposal. If you are able to, electronic submissions emailed to the EPA Service Unit project officer would be most welcome.

Mount Gibson Mining Ltd proposes to develop an iron ore mine and magnetite processing plant at Mt Gibson, approximately 350km north east of Perth. The magnetite concentrate will be transported 280km to Geraldton as a slurry in a buried pipeline within a services corridor. In accordance with the Environmental Protection Act, a Public Environmental Review (PER) has been prepared which describes this proposal and its likely effects on the environment. The PER is available for a public review period of 6 weeks **from 18 April 2006 closing on 30 May 2006**.

Comments from government agencies and from the public will help the EPA to prepare an assessment report in which it will make recommendations to government.

Where to get copies of this document

Printed copies may be obtained from Mount Gibson Mining, Level 1, 7 Havelock St West Perth tel 9485 2355 at a cost of $10 for a hard copy or $8 for a CD.

Why write a submission?

A submission is a way to provide information, express your opinion and put forward your suggested course of action - including any alternative approach. It is useful if you indicate any suggestions you have to improve the proposal.

All submissions received by the EPA will be acknowledged. Submissions will be treated as public documents unless provided and received in confidence subject to the requirements of the Freedom of Information Act, and may be quoted in full or in part in the EPA's report.

Why not join a group?

If you prefer not to write your own comments, it may be worthwhile joining with a group interested in making a submission on similar issues. Joint submissions may help to reduce the workload for an individual or group, as well as increase the pool of ideas and information. If you form a small group (up to 10 people) please indicate all the names of the participants. If your group is larger, please indicate how many people your submission represents.

Developing a submission

You may agree or disagree with, or comment on, the general issues discussed in the PER or the specific proposals. It helps if you give reasons for your conclusions, supported by relevant data. You may make an important contribution by suggesting ways to make the proposal more environmentally acceptable.

When making comments on specific elements of the PER:

- clearly state your point of view;
- indicate the source of your information or argument if this is applicable; and
- suggest recommendations, safeguards or alternatives.

Points to keep in mind

By keeping the following points in mind, you will make it easier for your submission to be analysed:

- attempt to list points so that issues raised are clear. A summary of your submission is helpful;
- refer each point to the appropriate section, chapter or recommendation in the PER;
- if you discuss different sections of the PER, keep them distinct and separate, so there is no confusion as to which section you are considering; and
- attach any factual information you may wish to provide and give details of the source. Make sure your information is accurate.

Remember to include:

- your name;
- address;
- date; and
- whether and the reason why you want your submission to be confidential.

Information in submissions will be deemed public information unless a request for confidentiality of the submission is made in writing and accepted by the EPA. As a result, a copy of each submission will be provided to the proponent but the identity of private individuals will remain confidential to the EPA.

The closing date for submissions is: 30th May 2006

The EPA prefers submissions to be sent in electronically. You can either email the submission to the project officer at the following address

ruwani.ehelepola@environment.wa.gov.au

OR

Use the submission form on the EPA's website:
www.epa.gov.au/submissions.asp and click on the EIA Assessment Submission option.

OR

If you do not have access to e-mail then please post your submission to:

The Chairman
Environmental Protection Authority
PO Box K822
PERTH WA 6842

Attention: Ruwani Ehelepola.

DISCLAIMER

This document is published in accordance with and subject to an agreement between ATA Environmental **("ATA")** and the client for whom it has been prepared Mount Gibson Mining Ltd **("Client")** and is restricted to those issues that have been raised by the client in its engagement of ATA and prepared using the standard of skill and care ordinarily exercised by Environmental Scientists in the preparation of such Documents.

Any person or organisation that relies on or uses the document for purposes or reasons other than those agreed by ATA and the Client without first obtaining the prior written consent of ATA, does so entirely at their own risk and ATA denies all liability in tort, contract or otherwise for any loss, damage or injury of any kind whatsoever (whether in negligence or otherwise) that may be suffered as a consequence of relying on this Document for any purpose other than that agreed with the Client.

QUALITY ASSURANCE

ATA Environmental has implemented a comprehensive range of quality control measures on all aspects of the company's operation and has Quality Assurance certification to ISO 9001.

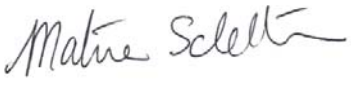
An internal quality review process has been applied to each project task undertaken by us. Each document is carefully reviewed by core members of the consultancy team and signed off at Director level prior to issue to the client. Draft documents are submitted to the client for comment and acceptance prior to final production.

Document No: MGM2005-004-mgmt_010_ms_V3

Report No: 2004/246

Checked by: Signed: 

Name: Shaun Grein Date: 11 April 2006

Approved by: Signed: 

Name: Martine Scheltema Date: 11 April 2006

TABLE OF CONTENTS

EXECUTIVE SUMMARY 1

1. INTRODUCTION 28

1.1 The Proposal 28
1.1.1 Background 28
1.1.2 Project Overview 29
1.1.3 Location 29
1.1.4 Project Timing 30
1.2 The Proponent 30
1.2.1 Proponent Contact Details 30
1.2.2 Corporate Overview 31
1.3 This Public Environmental Review Document 32
1.3.1 Purpose of this Document 32
1.3.2 Structure of Document 33
1.4 Stakeholder Consultation 33

2. PROJECT JUSTIFICATION AND EVALUATION OF ALTERNATIVES 34

2.1 Project Justification 34
2.2 Evaluation of Alternatives 35
2.2.1 Transportation of Mine Product 35
2.2.2 Reduction in Number of Mine Pits 43
2.2.3 Siting of Tailings Storage Facility (TSF) 44
2.2.4 Waste Rock Storage 45
2.2.5 Location of Facilities within Geraldton Port 46
2.2.6 No Development Option 46

3. LEGISLATIVE FRAMEWORK 49

3.1 Relevant Legislation and Policies 49
3.2 Key Decision Making Authorities 50
3.3 Approvals Process 50

4. DESCRIPTION OF PROJECT 52

4.1 Overview 52
4.2 Mining of Hematite and Magnetite 54
4.2.1 Mining Methodology 54
4.2.2 Overburden Management 55
4.2.3 Dewatering 55
4.3 Processing of Ore 56
4.3.1 Hematite 56
4.3.2 Magnetite 56
4.3.3 Tailings 57
4.4 Mine Infrastructure 57
4.4.1 Ancillary Services 57

4.4.2 Power Supply 58
4.4.3 Accommodation Village 58
4.4.4 Realignment of Great Northern Highway and Airstrip 58
4.5 Transportation of Product / Services Corridor 58
4.5.1 Services Corridor 58
4.5.2 Slurry Pipeline 61
4.5.3 Return Water Pipeline 61
4.5.4 Gas Pipeline 61
4.5.5 Bore Water Pipeline 62
4.5.6 Construction 62
4.6 Water Supply 63
4.6.1 Processing and Transportation Water 64
4.6.2 Water for Dust Suppression, Washdown, Domestic and Potable Uses 64
4.6.3 Construction Water Supply 65
4.7 Operations at Geraldton Port 65

5. EXISTING ENVIRONMENT 67

5.1 Climate 67
5.2 Land Systems 67
5.3 Geology, Topography and Soils 68
5.3.1 Regional Geology, Topography and Soils 68
5.3.2 Project Geology 69
5.4 Surface Drainage 70
5.4.1 Minesite 70
5.4.2 Service Corridor 70
5.5 Groundwater at the Minesite 71
5.6 Tathra Sub Area Groundwater Investigations 71
5.7 Biological Context of Study Area 73
5.8 Conservation Estate 74
5.9 Vegetation and Flora 74
5.9.1 Vegetation Surveys 74
5.9.2 Vegetation Communities 75
5.10 Fauna 87
5.10.1 Fauna Habitats 87
5.10.2 Vertebrate Fauna 87
5.10.3 Invertebrate Fauna 89
5.10.4 Stygofauna 91
5.10.5 Threatened Fauna 92
5.10.6 Other Vertebrate Species of Interest 96
5.11 Social and Economic Setting 97
5.11.1 Regional Setting 97
5.11.2 Demographics 97
5.11.3 Surrounding Land Use 98
5.12 Aboriginal and European Heritage 98
5.12.1 Aboriginal Heritage 98
5.12.2 European Heritage 99

6. CONSULTATION 101

6.1 Consultation Program 101
6.2 Issues Raised 104
6.3 Peer review 105

7. ENVIRONMENTAL PRINCIPLES, SUSTAINABILITY & MANAGEMENT 106

7.1 Sustainability 106
7.2 Environmental Management 112
7.2.1 Environmental Management System 112
7.2.2 Environmental Training 112
7.2.3 Environmental Management Plan 113
7.3 Environmental Offset 114

8. ENVIRONMENTAL IMPACTS AND MANAGEMENT 118

8.1 Environmental Factors 118
8.2 Vegetation and Flora 118
8.2.1 Management Objectives and Applicable Standards and Guidelines .. 118
8.2.2 Potential Impacts 119
8.2.3 Management Strategies 120
8.2.4 Predicted Outcome 122
8.3 Rare and Priority Flora 122
8.3.1 Management Objectives and Applicable Standards and Guidelines .. 122
8.3.2 Potential Impacts 122
8.3.3 Management Strategies 124
8.3.4 Predicted Outcome 125
8.4 Fauna 125
8.4.1 Management Objectives and Applicable Standards and Guidelines .. 125
8.4.2 Potential Impacts 126
8.4.3 Management Strategies 130
8.4.4 Predicted Outcome 132
8.5 Surface Hydrology 132
8.5.1 Management Objectives and Applicable Standards and Guidelines .. 132
8.5.2 Potential Impacts 133
8.5.3 Management Strategies 134
8.5.4 Predicted Outcome 136
8.6 Groundwater 136
8.6.1 Management Objectives and Applicable Standards and Guidelines .. 136
8.6.2 Potential Impacts 136
8.6.3 Management Strategies 138
8.6.4 Predicted Outcome 140
8.7 Landform/Landscape Values (Geoheritage) 140
8.7.1 Management Objectives and Applicable Standards and Guidelines .. 140
8.7.2 Potential Impacts 141
8.7.3 Management Strategies 141
8.7.4 Predicted Outcome 142
8.8 Mine Planning, Decommissioning and Rehabilitation 142
8.8.1 Management Objective and Applicable Standards and Guidelines ... 142

8.8.2 Potential Impacts 142
8.8.3 Management Strategies 142
8.8.4 Predicted Outcome 144
8.9 Air Quality - Dust 144
8.9.1 Management Objective and Applicable Standards and Guidelines ... 144
8.9.2 Potential Impacts 144
8.9.3 Management Strategies 145
8.9.4 Predicted Outcome 146
8.10 Greenhouse Gas Emissions 146
8.10.1 Management Objective 146
8.10.2 Potential Impacts 147
8.10.3 Management Strategies 151
8.10.4 Predicted Outcome 152
8.11 Air Emissions – non Greenhouse Gases 152
8.11.1 Management Objective and Applicable Standards and Guidelines ... 152
8.11.2 Potential Impacts 155
8.11.2 Management Strategies 158
8.11.4 Predicted Outcome 159
8.12 Noise 159
8.12.1 Management Objective and Applicable Standards and Guidelines ... 159
8.12.2 Potential Impacts 159
8.12.3 Management Strategies 161
8.12.4 Predicted Outcome 162
8.13 Solid & Liquid Waste 162
8.13.1 Management Objective and Applicable Standards and Guidelines ... 162
8.13.2 Potential Impacts 162
8.13.3 Management Strategies 165
8.13.4 Predicted Outcome 167
8.14 Aboriginal Heritage and Culture 167
8.14.1 Management Objective and Applicable Standards and Guidelines ... 167
8.14.2 Potential Impacts 167
8.14.3 Management Strategies 168
8.14.4 Predicted Outcome 168
8.15 European Heritage 169
8.15.1 Management Objective and Applicable Standards and Guidelines ... 169
8.15.2 Potential Impacts 169
8.15.3 Management Strategies 169
8.15.4 Predicted Outcome 169
8.16 Public Health & Safety 169
8.16.1 Management Objective and Applicable Standards and Guidelines ... 169
8.16.2 Potential Impacts 170
8.16.3 Management Strategies 170
8.16.4 Predicted Outcome 171
8.17 Visual Amenity 171
8.17.1 Management Objective and Applicable Standards and Guidelines ... 171
8.17.2 Potential Impacts 172
8.17.3 Management Strategies 172
8.17.4 Predicted Outcome 172
8.18 Light Overspill 173

8.18.1 Management Objectives and Applicable Standards and Guidelines..173
8.18.2 Potential Impacts.....173
8.18.3 Management Strategies.....173
8.18.4 Predicted Outcome.....173

9. ENVIRONMENTAL MANAGEMENT COMMITMENTS.....174

10. CONCLUSIONS.....179

11. REFERENCES.....182

12. GLOSSARY.....189

TABLES

FIGURES

APPENDICES

LIST OF TABLES

1. Key Characteristics Table

2. Tenement Holdings

3. Comparison of Alternatives for Transportation of Mine Product

4. Comparison of Alternative Locations for the Tailings Storage Facility

5. Groundwater Quality at Tathra

6. Land System Units in the Mt Gibson Area

6a Area of Floristic Community Types (Group 40 Groups) at Mt Gibson

7. CALM List of Declared Rare and Priority Flora Previously Recorded from the Vicinity of Mt Gibson

8. Priority Flora Located along the Mt Gibson to Geraldton Port Services Corridor Alignment

9. Classification of Fauna Species of Conservation Significance under the *Wildlife Conservation Act 1950*

10. Significant Vertebrate Species Recorded or Listed as Potentially Occurring in the Mt Gibson Area

11. Population Trends in Geraldton and Perenjori 1991-2003

12. Projected Population Growth Geraldton and Perenjori 2001-2008/9

13. Stakeholder Consultation for the Mt Gibson Iron Ore Mine and Infrastructure Project

14. Key Issues Raised during Consultation

15. Application of the Principles of Sustainability to the Mt Gibson Iron Ore Mine and Infrastructure Project

16. Application of the Sustainability Checklist to the Mt Gibson Iron Ore Mine and Infrastructure Project

17. Hierarchy of Management of Environmental Impacts Resulting from the Mt Gibson Iron Ore Project

18. Area of Vegetation Impacted by Proposed Mine and Associated Infrastructure at Mt Gibson

19. Summary of Greenhouse Gas Estimate

20. Comparison of Greenhouse Emissions Intensities of Recent Iron Ore Developments

21. NSW Criteria for Stack Emissions from Various Sources Including Reciprocating Engines

22. National Environmental Protection Measures Ambient Air Quality Standards and Goals

23. Air Quality Guidelines for Protection of Vegetation in Europe

24. Air Emissions from Proposed Wartsila 20V34s6 Reciprocating Engine

25. Predicted Concentrations of Air Emissions Outside the Mine Area

26. Proponent Environmental Management Commitments

LIST OF FIGURES

1. Regional Location

2. Corporate Structure

3. Layout of Project at Mt Gibson
   a. Layout of Project at Mt Gibson
   b. Tenements at Mount Gibson

4. Process Flow – Hematite

5. Process Flow – Magnetite

6. Route of Services Corridor

7. Layout of Pipelines within the Services Corridor
   a. Cross Section of Services - Pastoral Section
   b. Cross Section of Services - Agricultural Section

8. Pipeline Construction

9. Shiploading Facilities at Geraldton Port

10. Regional Geology

11. Surface and Groundwater at the mine site
   a. Surface Hydrology at Mine Site
   b Groundwater Bores in the Vicinity of Mt Gibson
   c. Calculated Drawdown of Groundwater in Upper Bedrock from Dewatering

12. Bioregions

13. Land Use Surrounding the Proposed Mine

14. Floristic Community Groupings
   a. Floristic Community Groupings on Banded Ironstone Formation (BIF) at Mt Gibson
   b. Floristic Community Groupings on Regional Banded Ironstone Formation (BIF)

15. Vegetation at the Minesite
   a. Vegetation at Mt Gibson Minesite
   b. Vegetation Legend

16. Location of Significant Flora
   a. Location of Siginificant Flora
   b. Location of *Acacia ceratses*
   c. Location of *Lepidosperma* sp Mt Gibson

17. Location of Malleefowl Mounds at Mt Gibson

18. Observations of Malleefowl and/or Malleefowl Mounds in the Region

19. Visual Impact Assessment – Great Northern Highway

20. Visual Impact Assessment – Mt Singleton
21. Visual Impact Assessment – White Wells Homestead

22. Visual Amenity at Geraldton Port
    a. location of Viewscapes
    b. view from Geraldton Yacht Club
    c. view from Marina
    d. view from Sydney Memorial

LIST OF APPENDICES

1. Hydrogeological Investigations at the Minesite
Rockwater 2005a Dewatering Report 1
Rockwater 2005b Dewatering Report 2
Rockwater 2005c Surface Water Report
Rockwater 2005d Paleochannel Report

2. Hydrological Investigations at Tathra Borefield
Aquaterra 2005

3. Approval in Principle to Extract Water
Correspondence from DoE

4. Vegetation and Flora at Minesite
Muir Environmental 1995 Rare Flora
Bennett Environmental Consulting 2000 Flora and Vegetation
Paul Armstrong & Associates 2004 Vegetation and Rare Flora
ATA Environmental 2004 *Darwinia masonii*
ATA Environmental 2005e Supplementary Vegetation and Flora Report
ATA Environmental 2006 *Lepidosperma* sp. Mt Gibson report
Griffin 2005 PATN Analysis
Botanic Gardens and Parks Authority (2005) Research Benchmarks *D. masonii*

5. Biological Studies on Services Corridor
Paul Armstrong & Associates 2004Vegetation and Flora
ATA Environmental 2005f Vegetation and Flora
ATA Environmental 2005d Fauna Assessment
Stygofauna at Tathra

6. Fauna at the Minesite
Hart Simpson & Associates 2000 Fauna at Mt Gibson
ATA Environmental 20005b Fauna at Mt Gibson
ATA Environmental 20005c Malleefowl Assessment
Harvey 2005 Millipedes
Main 2005 Trapdoor spiders
Slack-Smith 2005 Land snails
Stygofauna report

7. Draft Objectives for the Proposed Regional Conservation Association

8. Access Protocols for Landholders on the Service Corridor

9. Conceptual Closure Plan

10. Air Emission Screening Report
Air Emissions (2006)

Acoustical Assessments

Herring Storer Acoustics 2006a Mining
Herring Storer Acoustics 2006b Geraldton Port
Herring Storer Acoustics 2006c Construction of Services Corridor
Herring Storer Acoustics 2005d Blasting

EXECUTIVE SUMMARY

Introduction

Mount Gibson Mining Limited (MGM) proposes to develop the Mt Gibson Iron Ore Mine and Infrastructure Project in response to the increased world demand for iron ore.

This Public Environmental Review (PER) document addresses environmental factors associated with the Mt Gibson Iron Ore Mine and Infrastructure Project, the potential impacts and management measures proposed by MGM. The Mt Gibson Iron Ore Project is considered to be a controlled action under the *Environmental Protection and Biodiversity Conservation Act* 1999 (referral number 2005/2381). This PER therefore also addresses matters relevant to the Commonwealth.

The Project

The Mt Gibson Iron Ore Mine and Infrastructure Project is a combined hematite/magnetite open cut mining operation that will produce both direct shipping grade hematite ore and magnetite concentrate. The hematite will be mined, crushed and screened then stockpiled on site for future transportation by road and rail. Magnetite bearing Banded Iron Formation (BIF) will be mined and processed by crushing, grinding and magnetically separating to produce 5Mtpa of magnetite concentrate. The magnetite concentrate will be transported to Geraldton as a slurry by buried pipeline within a services corridor for filtration, storage and loading onto ships at Geraldton Port. New material handling and storage facilities will be constructed at Berth 5 at Geraldton Port for the magnetite concentrate. No dredging will be required for the construction of the ship loading facilities.

Process water will be obtained from the Arrowsmith Groundwater Area at Tathra, 20 km south west of Three Springs and piped 168km to the minesite. Water from the slurry pipeline will be returned to the mine and reused in a closed circuit. Gas will be sourced from the Dampier Bunbury Gas Pipeline. The pipelines for the magnetite concentrate slurry, water, return water from Geraldton Port and gas will be contained in a services corridor (Figure 1).

The Mt Gibson Iron Ore Mine and Infrastructure Project has projected minimum mine life of 20 years and an operational workforce of approximately 300 personnel.

Location

The Mt Gibson hills are located approximately 350km north east of Perth, immediately adjacent to Great Northern Highway, approximately 70km south of Paynes Find and 80km north of Wubin. Geraldton Port is located approximately 300km to the north west of the Mt Gibson hills.

Evaluation of Alternatives

A number of alternative routes and transportation methods (road, rail, as a slurry in a buried pipe) were evaluated for the transportation of hematite and magnetite concentrate from Mt Gibson to Geraldton Port. The option selected, the transportation of magnetite concentrate by buried pipeline, although expensive, will result in less vegetation being impacted than the options of trucking/railing to Perenjori, no truck impacts, no noise impacts and rehabilitation of disturbed areas immediately following construction.

Several possible locations were considered for the Tailings Storage Facility. The company's preferred alternative is to co-locate the filtered tailings with the waste dump, which will result in less disturbance than the other options considered and will significantly reduce water usage.

MGM's initial preference was to locate the material handling and shiploading facilities within Geraldton Port at Berth 7. Following community consultation, discussions with Geraldton Port Authority and government support for the development of Berth 5 as a multi-user iron ore product, MGM's preference is to locate its material handling and shiploading facilities on Berth 5, which will have less impact on the visual amenity than Berth 7.

Consultation

MGM has undertaken an extensive consultation program with stakeholders as part of the development of the Mt Gibson Iron Ore Mine and Infrastructure Project. Key agencies have been actively consulted during the preparation of the PER including the EPA Services Unit, CALM Perth and Geraldton Regional Office, Botanic Gardens and Parks Authority, Department of Environment Midwest Office and the WA Museum.

Non government organisations considered key stakeholders and consulted in the development of the project included:

- Australian Bush Heritage Fund (White Wells Station)
- Australian Wildlife Conservancy (Mt Gibson Station)
- Pindiddy Aboriginal Corporation (Ninghan Station)
- Wildflower Society
- Conservation Council
- Northern Malleefowl Conservation Group
- Widi Mob
- Badimia People
- Widi Binyardi People
- Mullewa Wadjari People
- Taylor People
- Amangu people and
- Naaaguja People

A series of community meetings were held in each of the local government authority areas traversed by the services corridor (Mingenew, Three Springs, Perenjori, Irwin, and Greenough). All 82 landholders, five local government authorities, 6 public utilities (including the DBNGP Corridor, MRWA, Water & Rivers, Telstra, Public Transport Authority and Western Power) and 3 pastoral lease holders impacted by the services corridor have been consulted. The company had a stand at the 2005 Mingenew Expo and a public meeting at the City of Geraldton.

Existing Environment

The services corridor crosses through three IBRA regions. The majority of the proposed route is located in the Avon Wheatbelt and Geraldton Sandplains Bioregions with a small portion crossing into the Yalgoo Bioregions. The minesite and associated infrastructure is located in the Ancient Drainage Subregion of the Avon Wheatbelt Bioregion, and is near the junction of the Avon Wheatbelt, Yalgoo and Coolgardie Interim Bioregions. As a consequence, the floristic composition of the area is considered to be representative of all three Bioregions.

The existing environment is summarised in Table ES-1.

Environmental Impact Assessment and Management

The potential impacts of the Mt Gibson Iron Ore Mine and Infrastructure Project have been assessed in the PER, and the proposed management measures to be adopted are described. Table ES-1 summarises the potential environmental impacts, MGM's proposed management of these potential impacts and the predicted outcome.

The key environmental issues associated with the development of the mine and related infrastructure, the services corridor from the minesite to Geraldton Port, the borefield at Tathra and the magnetite concentrate storage and ship loading facilities at Geraldton Port have been identified as impacts on Threatened and Priority flora and on selected floristic communities and on the Malleefowl population in the Mt Gibson hills.

MGM is committed to avoiding environmental impacts where practicable and to minimising, mitigating and offsetting potential impacts. MGM will ensure all impacts are minimised and managed using the Construction and Operational Environmental Management Plans for the project. MGM has committed to developing an Environmental Management System (EMS) for the Mt Gibson Iron Ore Mine and Infrastructure Project, consistent with the objectives of ISO14001. The key elements of ISO14001 include assessing environmental risk and legal requirements, developing objectives and targets for improvement, training, operational control, communication, emergency response, corrective actions, audits and reviews.

The proposed Mt Gibson Iron Ore Mine and Infrastructure Project will impact on 14% of the known population of the DRF *Darwinia masonii*. The Botanic Gardens and Parks Authority (BGPA), in research supported by MGM, has already made significant advances in the knowledge of the DRF *Darwinia masonii*. The ongoing

research by BGPA and the development and implementation of a Recovery Plan for the species will assist in the long term protection and sustainability of the species.

An undescribed species of *Lepidosperma*, *Lepidosperma sp Mt Gibson*, is known only from Mt Gibson where it prefers gullies that provide increased water availability. The conservation status of the species is as yet undetermined. The Mt Gibson Iron Ore Mine and Infrastructure Project will impact on 55% of the known population of 14,939 plants. MGM will undertake surveys of areas of potential habitat in areas of Banded Ironstone Formation throughout the Midwest. Depending on the results of the surveys, MGM will hold discussions with CALM and BPGA with a view to supporting a research program leading to the preparation and implementation of a Recovery Plan and the long term sustainability of the species.

The floristic communities on the Banded Ironstone Formation at Mt Gibson appear to be distinct from the floristic composition of vegetation on other areas of BIF. There is also geographic-related variation in the floristic communities within the Mt Gibson area. The ridges of Extension Hill and Extension Hill South largely contain communities that are different to the other areas. There are some similarities with the communities on Iron Hill and Iron Hill East. Six of the twenty floristic communities (Group 40 group) mapped for the Mt Gibson area were assessed as occurring only within the proposed project area.

Malleefowl are known to occur at Mt Gibson. The preparation and implementation of a Malleefowl Conservation Plan, and support for a regional on-ground feral animal control program (especially for foxes which predate on malleefowl at Mt Gibson) will ensure the project has minimal long term impact on the species at a regional level and at the same time, will complement the work being undertaken as part of the Co-operative Research Centre for Invasive Animal Control on Mt Gibson Station.

MGM recognises that, while not part of the conservation estate, the properties adjoining the mine site are managed by private organisations for conservation purposes. MGM's Offset Package has been designed in accordance with the EPA's Position Paper No 9 to result in **a net benefit to environmental values in the area**. It recognises the significant contributions being made to the conservation values in the region by the private organisations Australian Wildlife Conservancy (AWC), Australian Bush Heritage Fund (ABHF) and the Pindiddy Aboriginal Corporation (Pindiddy), and has been developed in association with stakeholders and CALM.

The Offsets Package includes:

(i) Support for the ABHF, AWC and Pindiddy for suitable projects on White Wells, Mt Gibson and Ninghan Stations that are aimed at enhancing the protection and conservation of biodiversity and regional sustainability values. Each organisation will receive up to $50,000 pa (a total of $3 million over the life of the mine based on a contribution per tonne), with an emphasis placed on on-ground works.

(ii) Establishment of and funding for a Regional Conservation Association (RCA) aimed at enhancing regional sustainability, biodiversity, visitor and cultural

values in the northern Avon Wheatbelt and Southern Yalgoo IBRA bioregions generally focussing on an 2,600,000 ha area between Morawa and Beacon (200km west - east) and Wubin to Paynes Find (approximately 130km north - south). Funding for the RCA would be $100,000pa or $2 million over the life of the mine (based on a contribution per tonne). Activities to be funded would have an emphasis an on-ground works aimed at enhancing the protection and conservation of biodiversity and regional sustainability values and may also include research, educational and cultural activities, the purchase of land or any other activities as seen fit by the RCA.

The Mt Gibson Iron Ore Project will also provide a number of significant benefits to the social and economic sustainability of the area including:

- significant regional infrastructure investment in the Midwest of Western Australia;
- significant direct employment opportunities in the Midwest region;
- significant indirect employment opportunities in the Midwest region and Western Australia; and
- major foreign investment into project development.

MGM believes the construction and operation of the Mt Gibson Iron Ore Project will result in net environmental, economic and social benefits to the Midwest region and to the State as a whole.

TABLE ES-1
ENVIRONMENTAL FACTORS, EXISTING ENVIRONMENT, POTENTIAL IMPACT AND PROPOSED MANAGEMENT FOR THE MT GIBSON IRON ORE PROJECT

Environmental Factor	EPA/Project Environmental Objective	Existing Environment	Potential Impacts	Environmental Management	Predicted Outcome
INTEGRATION					
REGIONAL BIODIVERSITY VALUES	To maintain the abundance, diversity, geographic distribution and productivity of flora and fauna at species and ecosystem levels through avoidance or management of adverse impacts and improvement in knowledge.	The minesite and associated infrastructure is located in the Ancient Drainage Subregion of the Avon Wheatbelt Bioregion, and is near the junction of the Avon Wheatbelt, Yalgoo and Coolgardie Interim Bioregions. As a consequence the floristic composition of the area is considered to be representative of all three Bioregions. The services corridor crosses through three IBRA regions. The majority of the proposed route is located in the Avon Wheatbelt and Geraldton Sandplains Bioregions with a small portion crossing into the Yalgoo Bioregions.	Potential to impact on conservation values in the area though loss/impact on poorly represented species or ecosystems or through introduction or spread of introduced species. The vegetation associations are not regarded as regionally significant. However based on the PATN analysis of the floristic data collected from the area, the project area contains floristic communities that are distinct from other areas of BIF within a 20km radius of Mt Gibson. 872ha of vegetation will be cleared for the minesite and associated infrastructure, however these areas will be progressively rehabilitated throughout the life of the project. 90ha of vegetation will be cleared for the services corridor (67ha in the pastoral area and 23ha in the agricultural area).	Implement a Construction and Operational EMP which will include specific plans for management of flora and vegetation, weeds, fauna, surface water, groundwater, waste, dust, and fire management. Support for projects aimed at protection of biodiversity and regional sustainability by ABHF, AWC and Pindiddy on White Wells, Mt Gibson and Ninghan Stations. ($50,000pa each, equating to $3mill over the life of the project). Establishment and support for a Regional Conservation Association aimed at protection of biodiversity and regional sustainability in the Northern Avon Wheatbelt and South Yalgoo Bioregions generally focussing on an 2,600,000 ha area between Morawa and Beacon (200km west - east) and Wubin to Paynes Find (approximately 130km north - south). ($100,000pa, equating to $2mil over the life of the project).	No unacceptable impacts on the biological diversity of the project area.

Environmental Factor	EPA/Project Environmental Objective	Existing Environment	Potential Impacts	Environmental Management	Predicted Outcome
			These areas will be rehabilitated immediately following the completion of construction. Other potential impacts on biodiversity may include off road vehicle impacts, erosion, impact on vegetation, dust disruption to surface hydrology, drawdown, increased risk from fire and introduction of weeds.		
SUSTAINABILITY	To ensure, as far as is practicable, the proposal meets the sustainability principles outlined in the State Sustainability Strategy	The project area is currently used for mining exploration activities. The surrounding pastoral properties are managed for conservation. The services corridor passes through land used for pastoral/farming activities. The Midwest region is experiencing population decline.	Poor design could result in unacceptable economic, environmental or social impacts. Potential impacts are: • Environmental – land clearing, dust, noise, impact on surface and groundwater hydrology etc • Social – employment opportunities, regional development • Economic – royalties, procurement	Implementation of an Environmental Management System (EMS) for the management of environmental and social issues. MGM will: • establish sustainability principles in purchasing and contracting; • ensure efficient energy and water use; • minimise waste; • encourage recycling; and • provide for industry and community partnerships.	The project will assist the sustainable development of the Midwest Region. The Project will be developed in a manner that meets the needs of the present without comprising the ability of future generations to meet their own needs.
BIOPHYSICAL					
VEGETATION -Vegetation Communities	To maintain the abundance, diversity, geographic distribution and productivity of flora at species and ecosystem levels through avoidance or management of adverse impacts and improvement in knowledge. To minimise significant adverse impact on the survival of any	***Minesite*** 24 vegetation associations were described in the Mt Gibson project area including five woodland associations, four Mallee associations, 12 thicket associations and 2 health associations.	*Minesite* The proposal will result in the clearing of approximately 872ha of vegetation The regional significance of the differences in the floristic communities differences occurring at Mt Gibson cannot	The management and monitoring of vegetation impacts will be addressed in the construction and Operational EMP. MGM will prepare and implement a Fire Management Plan as part of the Project EMP to minimise the risk of unplanned fires. A regional approach (ie broader than the project area) will be adopted to	Given the proposed management strategies and the environmental offsets, it is considered the EPA's objective for the conservation of vegetation will be met.

Environmental Factor	EPA/Project Environmental Objective	Existing Environment	Potential Impacts	Environmental Management	Predicted Outcome
	Threatened Ecological Communities or regionally significant vegetation.	Supplementary vegetation and flora survey of two additional areas to the west of great Northern Highway and one area to the East of Extension Hill identified a total of 35 vegetation associations. None of the vegetation associations described from the Mt Gibson area are classified as TEC's, are listed as TECs under the *EPBC Act* (1999) or are regarded as regionally significant. PATN analysis (i.e. clustering analysis) of permanent quadrants surveyed in Spring 2005 was used to identify potentially restricted floristic communities on BIF both in and within a 20km radius of the Mt Gibson project area. The analysis indicated that at a sub-regional scale the Mt Gibson area contains communities that appear to be distinct from those in the other areas sampled. There is also variation in the floristic composition of vegetation within the Mt Gibson	be definitively determined as the results from the recent Yilgarn regional surveys conducted by CALM are yet to be published. At a subregional level, six of the 20 floristic communities (Group 40 group) occurring at Mt Gibson will be impacted by the project. *Services Corridor* The route of the services corridor has been selected to avoid remnant vegetation wherever possible. However it has not been possible to avoid all vegetation such as in the case of pastoral section of the route, north-south road reserves, vegetated watercourses or topographical features. *General* Other potential impacts include off road vehicle impacts, erosion and dust and the introduction/spread of weeds	fire management and suppression at the mine site. Weed control measures will be developed and implemented to prevent the introduction or spread of weeds. Weed hygiene will be included in the Construction and Operational Environmental Management Plan Water sprays will be used during construction and operation to minimise the impact of dust on vegetation. Vegetation health will be monitored in dusty areas MGM will progressively rehabilitate areas not required for operations. MGM will rehabilitate areas of vegetation disturbed for the construction of the services corridor immediately following completion of construction.	

Environmental Factor	EPA/Project Environmental Objective	Existing Environment	Potential Impacts	Environmental Management	Predicted Outcome
		area. ***Service corridor*** A total of 82 vegetation communities were recorded along the alignment of the services corridor. None of the vegetation communities along the route of the services corridor are listed as Threatened Ecological Communities (TEC) on CALM's TEC database, nor listed as a TEC under the EPBC Act (1999).			
RARE AND PRIORITY FLORA	To protect Declared Rare and Priority Flora consistent with the provisions of the Wildlife Conservation Act, 1950.	***Minesite*** *Darwinia masonii* (DRF) has a restricted distribution, generally being located on the upper slopes (350m+ ADH), crests and ridges over the 6km length of the Mt Gibson Ranges. Nine discrete populations of *Darwinia masonii* were recorded from the Mt Gibson ranges, with a total population of 14,307 adult plants and 1,725 seedlings The most significant populations were recorded from the T3, T6 and HS1 vegetation communities	Two thousand one hundred mature plants or 14% of the known population of *D. masonii* will be impacted by the proposal to mine Extension Hill Loss of approximately 118 plants of *Acacia cerestes* (P1). from an estimated population of 1700 plants located throughout the Mt Gibson ranges. *A. cerastes* is also known from Mt Singleton, Mt Gibson station and west of Great Northern Highway. Loss of approximately 8,200 plants of *Lepidosperma* sp Mt Gibsn from an estimated population of 14,939 throughout the Mt Gibson	***Minesite*** MGM will provide support for a three plus year research program undertaken by the BGPA leading to the preparation and implementation of a Recovery Plan for the DRF *D. masonii*. This research has already commenced. A Threatened Flora Management and Conservation Plan will be prepared as part of the Environmental Management Plan for the project, which will address the management of threatened flora impacted by the project. Fire is considered to one of the threatening processes to the species. Fire management will be addressed in the Construction and Operational EMP. Procedures for the management of	The project will impact on 14% of the total known adult population of *Darwinia masonii*. The research by BGPA and the development and implementation of a Recovery Plan for the species will assist in the long term protection and sustainability of the species. Given the proposed management strategies, it is considered the conservation of Declared Rare and Priority flora will not be adversely impacted by the project.

Environmental Factor	EPA/Project Environmental Objective	Existing Environment	Potential Impacts	Environmental Management	Predicted Outcome
		occurring on the crest and east-facing slopes of Mt Gibson. The genetic diversity of the known population of *Darwinia masonii* is being investigated by the Botanic Gardens and Parks Authority as part of the development of a recovery plan for the species. Standard population genetics statistics suggest that the whole population can be treated as a single provenance unit for *Darwinia masonii*. *Acacia cerastes (P1)* The species is known from Mt Gibson ranges, Mt Singleton, Mt Gibson station and west of Great Northern Highway. CALM records indicate there are 11 populations of A. cerastes, of these 5 are in the general area of the project. Armstrong and ATA Environmental have recorded additional populations throughout the Mt Gibson ranges. The estimated population of A. cerastes within the MGM lease areas at Mt	ranges. The conservation status of *Lepidosperma* sp Mt Gibson is as yet undertermined however initial discussions in dicate the species is likely to be classified as P1. ***Services Corridor*** The route of the services corridor has avoided significant flora wherever possible. However Four Priority species will be impacted: up to seven of the 23 *Chamelaucium* ?sp. Yalgoo (P1), 83 of the 332 *Cryptandra imbricata* (P3), 1001 of the >8000 *Podotheca uniseta* (P3) and 650 of the 4500 *Psammomoya implexa* (P3) within the services corridor will be impacted by the construction of the corridor	vegetation will be applied, including marking clearing limits to limit the extent of clearing. ***Services Corridor*** A Threatened Flora Management and Conservation Plan, which will address the management of threatened flora impacted by the project. Several of the management strategies for the protection of vegetation will also apply to the management of priority flora. Populations of priority flora adjoining the services corridor will be strategically fenced off during construction to prevent direct physical impact. the environmental induction program will include information about Declared Rare and Priority flora.	

Environmental Factor	EPA/Project Environmental Objective	Existing Environment	Potential Impacts	Environmental Management	Predicted Outcome
		Gibson is 1700 plants. *Lepidosperma sp. Mt Gibson* Lepidosperma sp Mt Gibson is known only from gullies associated with the slopes throughout the Mt Gibson ranges. A total of 14,939 plants were recorded from the Mt Gibson area. The conservation status of *Lepidosperma* sp Mt Gibson is as yet undetermined however initial discussions indicate the species is likely to be classified as P1. The Proposal will not impact on other significant flora present at Mt Gibson ranges including *Eucalyptus synandra* (DRF), *Chamelaucium* sp Yalgoo (P1), *Persoonia pentisticha* (P2) and *Acacia acanthoclada* subsp *glaucescens* (P3) ***Services Corridor*** The alignment of the services corridor has been modified to minimise impacts on priority flora.			

Environmental Factor	EPA/Project Environmental Objective	Existing Environment	Potential Impacts	Environmental Management	Predicted Outcome
		Seven Priority species occur within the vicinity of the proposed pipeline route, four of which will potentially be affected by the proposed route. No Declared Rare Flora were recorded or will be impacted upon by the proposed pipeline alignment.			
FAUNA - Terrestrial Fauna - Special Protected (Threatened) fauna	To maintain the abundance, diversity, geographic distribution and productivity of fauna at species and ecosystem levels through avoidance or management of adverse impacts and improvement in knowledge. To protect Specially Protected (Threatened) Fauna and Priority Fauna consistent with the provisions of the *Wildlife Conservation Act*, 1950	The minesite and associated infrastructure contains 4 primary habitats: flat sandplains, flat woodlands, hillside slopes and the ironstone ridges. None of the habitat types are considered unique or significant at a bioregion scale. Fauna surveys 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 of Short Range Endemics recorded 4 species of land snails, 5 species of millipedes and 17 species of trapdoor spiders	The Proposal will result in the loss of approximately 870ha of fauna habitat at the minesite. Three active and 25 inactive Malleefowl mounds will be directly impacted by the project. The project is unlikely to impact adversely on any species of Short Range Endemics (SREs). The services corridor will have a marginal impact on fauna as it represents a traverse and is not a broadscale or permanent disturbance. 90ha (67ha in the pastoral sector and 23ha in the agricultural sector) will be cleared for the construction of the services corridor.	The management of fauna will be addressed in the Construction and Operation EMP MGM will prepare and implement a Malleefowl Conservation Plan, which will involve working closely with other stakeholders including the Malleefowl Conservation Group. MGM will contribute to a regional on-ground feral animal control program, in particular foxes which are known to predate on malleefowl in the Mt Gibson area. MGM will prepare and implement a Stygofauna Monitoring Plan for the mine dewatering waters. In the unlikely event it is necessary to develop a borefield in the paleochannel or to extract water from the fractured rock reserves, MGM will develop a Stygofauna Sampling & Management Plan will be developed	There will be limited loss of fauna habitats and associated direct impacts to individual fauna and fauna populations. Some loss of larger fauna is expected from road fauna deaths, but these impacts will be minimised through appropriate management. The regional impact on fauna is expected to be negligible as representation of fauna habitats and their associated fauna communities will be maintained in the project area and surrounds. Preparation and implementation of the Malleefowl Conservation Plan will ensure the project will not impact on an ecologically significantly proportion of the population.

Environmental Factor	EPA/Project Environmental Objective	Existing Environment	Potential Impacts	Environmental Management	Predicted Outcome
		No stygofauna were found in the borefield at Tathra nor in bores adjacent to the pit at Extension Hill. Malleefowl (*Leipoa ocellata*) occur on the site. 96 mounds are present within the project area, of which 15 are active. The services corridor route has been selected to avoid remnant habitat. No large areas of uncleared land is traversed.		A Fauna Management Plan will be prepared prior to the commencement of construction. No open trench construction will be undertaken in vegetated areas in January or February to minimise fauna mortality without prior approval from CALM. The open trench will be limited to 10km at any one time (ie two parallel trenches each 10km long) through vegetated areas or less, depending on the habitat values of the area, and 25km in cleared areas. No part of the trench will remain open for longer than 7 days without prior approval from CALM. A minimum of two fauna clearing personnel will be employed for the duration of the construction per 10km of open trench.	
SURFACE HYDROLOGY	To maintain the quantity of water so that existing and potential environmental values, including ecosystem maintenance are protected.	***Minesite*** Surface drainage in the Mt Gibson 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	The salt lake and ephemeral drainage lines within the mining lease will not be impacted by the proposal ***Services Corridor*** The construction of the services corridor may potentially impact on watercourses by altering natural flows, increasing erosion and destabilising banks. Increased sediment load in flow waters can decrease water quality. Poorly placed construction material may impede flows. The service corridor is unlikely to have any	***Minesite*** Hydraulic modelling based on 1 in a 50 year annual rainfall event (ARI) was used to assess the surface hydrology of the mine site area and develop appropriate management of surface runoff. Site specific surface drainage controls will be implemented where required Surface water management will be implemented for the waste dump and dry tailings facility to ensure that the natural flow paths do not alter or deviate to other locations. A set of perimeter drains designed according to hydraulic computations will be implemented.	The natural functions and environmental values of watercourses within and downstream of the project will not be adversely affected by the project. There will be no unacceptable impacts on surface water quality.

Environmental Factor	EPA/Project Environmental Objective	Existing Environment	Potential Impacts	Environmental Management	Predicted Outcome
		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 the Lockier, Irwin and Greenough Rivers. There are several crossings of salt lakes systems and numerous crossings of small water courses and drainage lines. A number of artificial drainage lines in the form of contour banks to redirect surface flows are also crossed by the services corridor.	impacts on surface hydrology once construction and rehabilitation is completed.	All hydrocarbons and chemicals will be stored according to Australian Standards to minimise contamination ***Service Corridor*** Specific construction measures will be required and implemented for the crossing of watercourses. Major crossings will be assessed and specific construction and restoration measures implemented. Vegetation will be cleared and stockpiled for respreading. Topsoil will be stripped from the banks and stockpiled separately to trench excavation material. Material will not be stockpiled in the beds of watercourses to prevent the impoundment and loss of materials. Surface flow will be diverted to suitable drainage areas by the construction of erosion control banks. Drainage lines and watercourses that are crossed by the service corridor will be reconstructed and re-profiled following construction of the corridor. Rehabilitation of major watercourses will comprise replacement and compaction of bank material and later topsoil. Specific bank stability measures may be required including placement of cement stabilised sandbags, stone mattresses and reseeding. The crossings of the two salt lake systems (the tributary of the Yarra Yarra Lakes and Mongers Lake) will require specific attention. Temporary elevated works may be required. The final restored profile of	

Environmental Factor	EPA/Project Environmental Objective	Existing Environment	Potential Impacts	Environmental Management	Predicted Outcome
				the services corridor will be such that sheet flow in these drainage systems will not be affected. The management of surface water will be addressed in the Construction and Operational Environmental Management Plan.	
GROUNDWATER	To maintain the quality and quantity of water so that existing and potential environmental values, including ecosystem maintenance are protected.	***Minesite*** The water table at the minesite lies at 320ADH, which is 50 to 100m below natural ground surface. 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. ***Tathra Sub Area*** Groundwater conditions in the Tathra Sub Area were extensively investigated by Aquaterra (2005). Hydrological modelling undertaken by Water and Rivers Commission has shown the sustainable yield from the groundwater area to be 26GLpa. The aquifer occurs at depth (140m below groumd level)	***Minesite*** Mine dewatering may result in short or long term changes to water table level and the hydraulics of the aquifer. Groundwater quality may be impacted through pollution from chemical and hydrocarbon materials and wastewater streams and increases in salinity caused by the concentration of salts by evaporation of water in the pit void. Dewatering is not expected to have significant effect on local groundwater resources and usage. Once mining and groundwater abstraction ceases, water levels in the pit will stabilise, with the pit persisting as a groundwater sink, with water levels below the present static levels. The final pit void will have no impact on the regional groundwater table. Saline waters from the final mine void will not move ito the surrounding aquifers.	***Minesite*** Pollution of groundwater will be avoided by appropriate management of solid and liquid wastes. Comprehensive monitoring will be undertaken to ensure the hydrogeological modelling is correct. Where required, the groundwater model will be updated with the results of the operational monitoring data to confirm the predictions remain valid. ***Tathra Borefield*** A groundwater monitoring program will be developed to ensure the sustainable use of groundwater for the life of the project. Monitoring will address water levels, water quality and production history. The results of the monitoring program will be reported in accordance with the conditions of the Groundwater Abstraction Licence.	Water abstraction will be managed in a sustainable manner. Groundwater drawdown and water quality will be monitored. No unacceptable impacts are expected.

Environmental Factor	EPA/Project Environmental Objective	Existing Environment	Potential Impacts	Environmental Management	Predicted Outcome
			Tathra Borefield Hydrological modelling undertaken by Water and Rivers Commission has shown the sustainable yield from the groundwater area to be 26GLpa. The abstraction of up to 5.5GLpa through a borefield consisting of 8 bores located 500m apart is therefore sustainable. In principle agreement to this abstraction has been obtained from the DoE		
LANDFORM /LANDSCAPE VALUES (GEOHERITAGE)	Apply every available measure to minimise impacts on geoheritage and landscape values	The landscape of the proposed mine area is not considered to be unique, with similarly elevated areas of BIF occurring in the Midwest and at Mt Gibson. The area proposed to be mined is one of up to 9 hills, with the remaining hills including Iron Hill, Iron Hill East, Mt Gibson and Mt Gibson South, being more elevated than Extension Hill. Mt Singleton is located approximately 20km to the north is recognised for its geological values on the Register of the National Estate as an Indicative Place.	The project area is not included on the Register of the National Estate, the Commonwealth Heritage List, National Heritage list and World Heritage List for natural values. No significant geoheritage values have been identified	Rehabilitation of disturbed areas at the mine site will be undertaken progressively and in accordance with legislative requirements. Surfaces will be contoured to create a post mining landform that resembles as closely as possible the pre mining landform.	There will be no significant impact on the landscape and geoheritage values in the area as a result of the project**.**

Environmental Factor	EPA/Project Environmental Objective	Existing Environment	Potential Impacts	Environmental Management	Predicted Outcome
MINE PLANNING, DECOMMISSIONING AND REHABILITATION	To ensure that rehabilitation achieves a stable and functioning landform which is consistent with the surrounding landscape and other environmental values according to best practice at the time of decommissioning	The minesite and associated infrastructure is located in the Mt Gibson Hills	The project will disturb approximately 872ha of land at the minesite. If these areas are not decommissioned and rehabilitated appropriately, it could result in unstable landforms, contamination of groundwater and surface water, impacts on flora and fauna and health and safety issues. In addition, poor closure planning may result in insufficient allocation of funds/resources for closure, particularly in the event of unforseen closure. The Extension Hill pit will remain as a permanent void upon the cessation of mining, and will be partially filled with water. Due to the project schedule and pit depth, the 'in-pit' storage of waste rock is not feasible.	The Preliminary Closure Plan will be reviewed and updated every 2 years throughout the life of the operation, with a final Rehabilitation and Closure Management Plan submitted at least 2 years prior to mine closure. Accounting methods will be used for managing financial closure provisions. Rehabilitation of the combined waste dump and dry tailings facility will be undertaken progressively throughout the life of the mine.	Rehabilitation will minimise the impact of land disturbance, resulting in safe, stable and functioning landforms consistent with the surrounding landscape.
POLLUTION MANAGEMENT					
DUST/ PARTICULATES	To ensure that dust/particulates meet appropriate criteria and do not cause an environmental or human health impact	The project is located in the Midwest, which has high ambient dust levels due to climatic conditions.	***Minesite*** Dust is likely to be generated during construction and mining operations. Stripping and stockpiling of topsoil, waste rock and/or overburden will also generate dust. There is potential for vegetation to be adversely affected through	The Construction and Operational Environmental Management Plan will address dust management and will identify specific management measures to minimise the generation of dust during construction and operation. ***Geraldton Port*** At approximately 10%, the moisture within the magnetite concentrate will be	Dust emissions will not adversely affect environmental values or human health.

Environmental Factor	EPA/Project Environmental Objective	Existing Environment	Potential Impacts	Environmental Management	Predicted Outcome
			the repeated deposition of dust on foliage. High levels of dust may also impact on visibility on Great Northern Highway. Dust emissions are not expected to impact on residences due to the isolated nature of the mine. ***Services Corridor*** Magnetite concentrate will be transported in a buried pipeline as a slurry and will not generate dust. *Geraldton Port* Loading operations at Geraldton Port are unlikely to result in dust due to the high levels of moisture in the magnetite concentrate (approximately 10%), the storage of the magnetite in an enclosed shed, and transportation of the concentrate using covered conveyors.	well above the level where dust is generated from the in loading or out loading operations. Despite this, the magnetite shed will be equipped with water sprays as part of the dust management system. There will be a fume extraction and scrubbing system to manage exhaust fumes during the out load operation. All transfer points on the conveying system will be covered and fitted with water sprays that can be initiated should dust be generated as a result of unforseen circumstances causing loss of moisture content. All conveyors will be covered.	
GREENHOUSE GAS EMISSIONS	Minimise greenhouse gas emissions for the project and reduce emissions per unit product to as low as practicable, and mitigate greenhouse gas emissions in accordance with established State policies	The mine site area is currently used for exploration activities and is well vegetated. The majority of the services corridor has been cleared and is used for farming.	It is conservatively estimated that 6.7kg CO_{2e} will be emitted per tonne of Hematite and 57.6kg CO_{2e} –per tonne of magnetite shipped.	MGM will report on its greenhouse emissions in accordance with WAGGI requirements. Reporting will be based upon approved emission estimation techniques and Australian Greenhouse Office (AGO) approved emission factors as appropriate. Land clearing will be minimised and progressive rehabilitation will be undertaken.	Emissions of greenhouse gasses will be kept as low as possible.
AIR EMISSIONS	Ensure that emissions do not	Closest residence to	A 53MW Power Station will	The proposed technology for the power	No unacceptable impacts to the

Environmental Factor	EPA/Project Environmental Objective	Existing Environment	Potential Impacts	Environmental Management	Predicted Outcome
OTHER THAN GREENHOUSE GASSES	adversely affect environmental values or the health, welfare and amenity of people and land uses by meeting statutory requirements and acceptable standards	minesite is approx 15km from minesite	located adjacent to the mine site. The power station will be gas fired and will use large (4 – 9MW) reciprocating gas engines. A screening assessment and preliminary modelling of impacts on air quality resulting from the power station predicted that the concentrations of NOx, NO2, CO VOCs and PM10 will be below the adopted standards and criteria.	station is regarded as the Best Practicable Measures (BPM) possible for an isolated and heat affected area given the nature of the process load with associated energy efficiency, small quantity of discharge, and minor potential for impacts on the environment. MGM will conduct the emission dispersion modelling studies prior to installation and power station design emission rates will be confirmed by measurement as part of the hot commissioning process to ensure the plant meets prescribed specifications and the NEPM 1998 standards and relevant occupational, health and safety requirements.	environment or human health.
NOISE	To protect the amenity of nearby residents from noise impacts resulting from activities associated with the proposal by ensuring noise levels meet statutory requirements and acceptable standards Ensure that noise and vibration levels meet acceptable standards and that an adequate level of service, safety and amenity is maintained.	White Wells Homestead is located approximately 15km to the west of the proposed mine. The Mt Gibson Homestead is located approximately 20km to the east of the mine while Ninghan Homestead is approximately 20km to the north.	***Minesite*** Construction and operation will cause periodic increases in noise levels. The nearest noise sensitive premise to the minesite is White Wells homestead, located approximately 15km to the west of the minesite while Mt Gibson and Ninghan homesteads are located approximately 20km to the east and north respectively. An acoustical screening assessment concluded that the sound power levels of the mining operations will comply with the Environmental Protection (Noise) Regulations	MGM will employ all reasonable and practicable measures to minimise noise emissions. Noise management will be addressed in the Environmental Management Plan. Noise management measures that may be considered include:- • Modification of blasting practices to reduce noise emissions; • Incorporation of a buffer in the length of Great Northern Highway closed during blasting operations; • Monitoring of blast noise on Great Northern Highway, to determine allowable blasting mass in accordance with Regulation 11 of the Environmental Protection (Noise)	No unacceptable impacts generated during the construction or operation of the project.

Environmental Factor	EPA/Project Environmental Objective	Existing Environment	Potential Impacts	Environmental Management	Predicted Outcome
			at all times and the homesteads are expected to receive minimal acoustical impact from the project Blasting will be undertaken during daylight hours as part of mining operations and will comply with the requirements of the Environmental Protection (Noise) Regulations. ***Aircraft Overflights*** Aircraft overflights have the potential to impact on rural properties or towns in the vicinity of the airstrip. Mining operations will be a fly in fly out operation, with on average, one flight (2 plane movements) a day. ***Services Corridor*** The route of the services corridor was selected and diverted to achieve significant setback distances from rural and urban residences. Pumping stations will be located at a sufficient distance from residences or sensitive premises to not constitute a noise nuisance. The construction of the trench for the services corridor has the potential to impact on residences at Mt Tarcola and Mahomet's Flat.	Regulations; • Consideration of meteorological data during general operations and blasting; and • Purchase of heavy equipment with reduced sound power levels. Prior to realignment, Great Northern Highway will be closed to traffic (for up to 20 minutes at a time) during blasting operations in the northern end of the pit where deemed necessary under the Mining Regulations. The length of road that will be closed will be based on the results of measurements to ensure compliance with the *Environmental Protection (Noise) Regulations*. ***Aircraft Overflights*** The flight plan for aircraft flying to and from the minesite will be designed to minimise noise impacts on the homesteads and rural towns in the general area. ***Services Corridor*** The management of noise will be addressed in the EMP. Noise will comply with the requirements of the *Environmental Protection (Noise) Regulations.* ***Geraldton Port*** Operations at Geraldton Port will comply with the *Environmental Protection (Noise) Regulations* 1997 due to the design of the facilities and the nature of	

Environmental Factor	EPA/Project Environmental Objective	Existing Environment	Potential Impacts	Environmental Management	Predicted Outcome
			The operation of the services corridor is not expected to result in any discernable noise impact. ***Geraldton Port*** An acoustical assessment of Operations at the Port determined that noise level received at the nearest residences located to the west and south of the facilities on Berth 5 comply with the *Environmental Protection (Noise) Regulations 1997*.	the product. Noise management will be addressed in the EMP	
LIQUID & SOLID WASTE	To ensure that solid and liquid wastes do not affect groundwater or surface water quality, nor lead to soil contamination	The project area is currently used for exploration and farming activities.	Incorrect disposal of wastes may result in contamination of soils, surface and ground water and/or air, as well as increased risks to human health.	***General Wastes*** A Waste Management Plan will be prepared prior to construction, which will be based on the principles of Reduce, Reuse, Recycle. ***Hydrocarbons and Hazardous Wastes*** The transport of hazardous materials will be undertaken in accordance with the *Dangerous Goods (Transport) (Road and Rail) Regulations 1999* and the Australian Code for the Transportation of Dangerous Goods by Road and Rail. Hydrocarbons and other potentially polluting substances will be stored according to Australian Standards. ***Sewage and Grey Water*** Sewage and greywater from the mine operations buildings, plant and	Waste that has the potential to contaminate soil, surface water and groundwater will be managed appropriately. No adverse impacts to soil, surface water or groundwater quality are expected. Overburden and waste dumps will be safe, stable and non polluting. Material that is potentially acid generating will be managed to minimise the potential for acidic materials to leaching from waste rock into the groundwater or surface water bodies.

Environmental Factor	EPA/Project Environmental Objective	Existing Environment	Potential Impacts	Environmental Management	Predicted Outcome
				accommodation camp will be treated on site using sewage waste water treatment system in accordance with Health Department and local government requirements. ***Overburden and Waste Rock*** The overburden and waste rock material from the hematite/magnetite pit will be stockpiled in a large, purpose designed dump to the east of the Extension Hill pit. Some overburden may be used in construction activities. Backfilling the pit with overburden and waste rock is not technically viable as backfilling the pit would prevent further mining at depth. Design and construction of the waste rock dump will incorporate features to control surface runoff, facilitate progressive rehabilitation and minimise visual impacts after mine closure. The waste dump area will be progressively rehabilitated, capped with topsoil and revegetated as part of MGM's standard procedures. ***Tailings*** The filtered (dry) tailings from the processing of the magnetite will disposed of concurrent with the waste rock in a combined waste dump located to the east of the Extension Hill pit. The dewatered (dry) tailings will not require a supernatant pond.	

Environmental Factor	EPA/Project Environmental Objective	Existing Environment	Potential Impacts	Environmental Management	Predicted Outcome
				Acid Mine Drainage Potential Potentially acid forming material will be encapsulated in designated and appropriately designed waste dumps to minimise the potential for acidic materials leaching from the waste rock into the groundwater or surface water bodies. ***Hydrotest Water*** A Hydrotest Management Plan will be developed which will detail the sourcing, management and disposal of test water. The volume of hydrotest water to be disposed of is small and is not expected to result in any adverse impacts. Disposal will be at an approved site and will not impact on groundwater, sensitive water bodies or remnant vegetation.	
SOCIAL SURROUNDS					
ABORIGINAL HERITAGE & CULTURE	To ensure that changes to the biophysical environment do not adversely affect historical and cultural associations and comply with relevant heritage legislation.	MGM has project agreements with the Badimia People and the Widi Mob, whose Native Title claims cover the area of the mine site. MGM is in the process of negotiating pipeline-only Native Title agreements with the Mullewa Wadjari, Amangu and Naaguja Peoples whose registered Native Title claim areas cover parts of the pipeline corridor. A number of heritage sites	The Mt Gibson Hills including the site of proposed open pit mine and the playa are of significance the Widi Mob. The Widi Mob supported an application under Section 18 of the Aboriginal Heritage Act to allow mining of the Extension Hill deposit. The application has been approved. A site of significance to the Badimia People was identified just outside the proposed northern boundary of the waste dump. In consultation with the Badimia people, MGM has	The project was designed to avoid any impact on the playa, which is of significance to the Widi Mob A 300m wide exclusion zone will be established to protect the archaeological site just outside the proposed northern boundary of the waste dump, which is of significance to the Badimia People. The conditions of all approvals obtained under Section 18 of the Aboriginal Heritage Act will be adhered to. If any additional aboriginal site is required to be disturbed for the project, an application will be made to disturb the site under Section 18 of the Aboriginal Heritage	Some Aboriginal Sites will be disturbed in accordance with Section 18 of the Aboriginal Heritage Act 1972 and following consultation with the appropriate groups. All requirements of the Aboriginal Heritage Group will be complied with.

Environmental Factor	EPA/Project Environmental Objective	Existing Environment	Potential Impacts	Environmental Management	Predicted Outcome
		were identified during heritage surveys of the project area.	agreed to a 300m wide exclusion zone to protect the site.	Act. The Dept of Indigenous Affairs will be notified of any sites identified during construction or operation. Workforce induction will include Aboriginal heritage issues. Management procedures will be detailed in the Project EMP. Representatives of relevant Aboriginal groups will be employed to carry out heritage monitoring during pipeline construction.	
NON INDIGENOUS HERITAGE	To ensure the proposal complies with statutory requirements in relation to areas of cultural or historical significance	The project area is not included on the Register of the National Estate, the Commonwealth Heritage List, National Heritage List or World Heritage list. Mt Singleton, 200km to the north is listed on the Register of the National Estate. Lake Moore, 30km to the east, has several entries on the Register of the National Estate. An area to the south of White Wells Station is also listed on the Register of the National Estate.	The project will not affect or impact on the value of the places listed on the Register of the National Estate. No impacts to the Goulds Cottage precinct in the Southern Transport Corridor are expected	MGM will comply with all statutory requirements relating to European heritage and historical significance during the construction and operation of the Mt Gibson Iron Ore Project.	The will be no impact on sites of European heritage value.

Environmental Factor	EPA/Project Environmental Objective	Existing Environment	Potential Impacts	Environmental Management	Predicted Outcome
		Goulds Cottage, a significant heritage site is located within the Geraldton Southern Transport Corridor. The western section of the services corridor route is within the Geraldton Southern Transport corridor but is located south of the cottage in accordance with corridor planning.			
PUBLIC HEALTH & SAFETY	Ensure that roads are maintained or improved and road traffic managed to meet an adequate standard of level of service and safety and MRWA requirements	The northern end of the proposed pit is located approximately 200 m from Great Northern Highway. The alignment of the services corridor has been selected to locate the pipeline in areas to achieve low risk. Setbacks in excess of the nominated distances from residences and sensitive structures have been adopted	Mining operations (drilling, excavation, ore and waste removal) will be carried out on a 24 hour per day basis and have the potential to adversely affect the travelling public through the proximity to mining operations.	Blasting will only occur during daylight hours. Prior to its realignment, Great Northern Highway will be closed to traffic for the duration of the blast (approx 20 minutes). Great Northern Highway will be permanently realigned to increase the separation distance between the northern end of the pit and the Highway. Public access to the mine will be controlled. MRWA requirements will be adhered to ensure public safety. Traffic will be controlled at the Great Northern Highway by intersection modifications to increase line of sight for oncoming traffic and will be MRWA approved. Hematite will be conveyed under Great Northern Highway to remove the requirement for road trains crossing the highway.	The safety of the travelling public will not be adversely impacted by the project as traffic on Great Northern Highway will be managed in accordance with MRWA requirements. Mining (including blasting) operations will be managed in accordance with DOIR requirements. The hazard and risk associated with the services corridor will be maintained at acceptably low levels through the adoption of recognised pipeline industry practices and compliance with legislative requirements.

Environmental Factor	EPA/Project Environmental Objective	Existing Environment	Potential Impacts	Environmental Management	Predicted Outcome
				The gas pipeline will be designed, constructed and operated in accordance with AS2885. The return water and slurry pipelines will be designed, constructed and operated in accordance with AS2885 where appropriate and other relevant Australian standards. The American standard for slurry pipelines ASME –B31.11-2002 will also be used where appropriate.	
LIGHT SPILL	To avoid or manage potential impacts from light spill and manage in accordance with applicable standards	CALM is considering the development of an observatory at Mt Singleton, approximately 20km to the north of the proposed mine site.	There is potential for the project to impact on the proposed observatory through dust and lighting from the project. However prior to and at the completion of mining Extension Hill will provide a buffer between the plant site and the line of sight to the proposed Observatory.	Lighting at the mine site will be managed in accordance with Standard AS 4282-1997 *Control of the Obtrusive Effects of Outdoor Lighting.* Dust will be managed in accordance with the Construction and Operational EMP.	Light spill and dust from the Mt Gibson Iron Ore Project will not adversely affect the operations of the proposed Observatory.
VISUAL AMENITY	To ensure that aesthetic values are considered and measures are adopted to reduce visual impacts on the landscape as low as reasonably practicable	The existing viewscape of the mine site is of vegetated Banded Iron Formation (BIF), elevated above the surrounding plain. The existing viewscape of Geraldton Port incorporates a number of storage sheds and ship loading facilities.	The pit and waste dump at Extension Hill will be visible from Great Northern Highway. The mine and associated infrastructure will not be easily visible from Mt Singleton. The waste dump will be visible from Mt Singleton until rehabilitation has been completed. Mining operations will not be easily visible from White Wells homestead. Neither the processing plant nor the waste dump will be visible from	The design of waste dump will incorporate principles of visual aesthetics while still complying with safety requirements. Progressive rehabilitation will be undertaken during the life of the project. The post mining landform will replicate the premining landscape as closely as practical. The visual impact of the magnetite shed and associated ship loading facilities at Berth 5 will be minimised through the appropriate choice of colours.	On completion of rehabilitation, the mining areas are not expected to create an unacceptable visual impact on the landscape at Mt Gibson. The impact of the proposed magnetite storage shed and associated ship loading facilities at Berth 5 are expected to complement the viewscape of existing infrastructure at the Port and therefore it is considered it will have an acceptable visual impact.

Environmental Factor	EPA/Project Environmental Objective	Existing Environment	Potential Impacts	Environmental Management	Predicted Outcome
			White Wells homestead. ***Geraldton Port*** The magnetite storage shed on Berth 5 will be visible from various locations in Geraldton City. The storage shed and associated ship loading facilities are expected to complement the viewscape of existing infrastructure at the Port.		

1. INTRODUCTION

1.1 The Proposal

1.1.1 Background

The Mount Gibson hills located 350km north east of Perth contain significant deposits of iron ore. The deposits were evaluated in the period 1962 - 1967 by a consortium of Kokan Mining Co Ltd and T Kaikiuchi & Co Ltd, and again between 1975 – 1977 when Griffin Coal Mining Company joined the consortium. From 1995 - 1997 Extension Hill Pty Ltd ('EHPL') (formerly Asia Iron Pty Ltd), a subsidiary of Mount Gibson Iron Limited, carried out extensive diamond core drilling into the magnetite deposit underlying the higher, weathered zones. Since then, EHPL envisaged a mining operation to exploit the significant iron deposits at Mt Gibson, with the ore to be beneficiated into concentrate and railed to a Direct Reduced Iron/Hot Briquetted Iron Plant at Oakajee, 23km north of Geraldton.

In 1999 EHPL and Mount Gibson Mining Limited scoped a project to produce iron ore pellets for export. The Mt Gibson Iron Pellet Project was referred to the EPA and Environment Australia in late 2000 and included a proposal to mine magnetite at Mt Gibson and produce iron ore pellets for export at a coastal site north of Dongara (Assessments 1371, 1372 and 1373). The Environmental Protection Authority (EPA) was informed in January 2002 that the Mt Gibson Iron Pellet Project was on hold due to difficult economic conditions. In October 2003, Mount Gibson Mining withdrew the Mt Gibson Iron Pellet Project referral.

The reduction in railway freight charges around 2000 resulted in the prospect of mining of hematite at Mt Gibson as a direct shipping grade ore becoming economically feasible. The company therefore decided to concentrate on the development of a discrete hematite mining operation at Mt Gibson independent of the development of the underlying magnetite resource. The Mt Gibson Hematite Project was referred to the EPA in December 2001. The EPA resolved to formally assess the Hematite Project and set the level of assessment as a Public Environmental Review (PER) (Assessment No. 1415).

With the current strong demand for iron ore in the form of both direct shipping grade ore (hematite) and concentrated magnetite, development of both the hematite and magnetite resources at Mt Gibson has become economically viable. The company has therefore decided, subject to the outcome of a Bankable Feasibility Study, to develop the Mt Gibson Iron Ore Mine and Infrastructure Project. The Mt Gibson Iron Ore Mine and Infrastructure Project supersedes the Mt Gibson Hematite Project.

The Mt Gibson Iron Ore Mine and Infrastructure Project was referred to the EPA under Section 38 of the *Environmental Protection Act 1986* on 18 August 2004. The EPA resolved to formally assess the project and set the level of assessment at Public Environmental Review (PER) (Assessment No. 1538).

The Mount Gibson Iron Ore Mine and Infrastructure Project is a controlled action under the *Environmental Protection and Biodiversity* (EPBC) Act 1999 (Referral

Number 2005/2381). As the Commonwealth has determined that the proposal requires assessment and approval and has accredited the Western Australian PER assessment process, the Western Australian PER process must include assessment of matters relevant to the Commonwealth approval.

1.1.2 Project Overview

The project described in this PER represents the Australian 'half' of a vertically integrated mine & processing operation spanning the Mt Gibson mine and pellet production in the Jiangsu Province, China.

The Mt Gibson Iron Ore Mine and Infrastructure Project is a combined hematite/magnetite open cut mining operation that will produce both direct shipping grade hematite ore and magnetite concentrate. The hematite will be mined, crushed and screened then stockpiled on site for future transportation by road and rail. Magnetite bearing Banded Iron Formation (BIF) will be mined and processed by crushing, grinding and magnetically separating to produce 5Mtpa of magnetite concentrate. The magnetite concentrate will be transported to Geraldton as a slurry by buried pipeline within a services corridor for filtration, storage and loading onto ships at Geraldton Port. New material handling and storage facilities will be constructed at Berth 5 at Geraldton Port for the magnetite concentrate. No dredging will be required for the construction of the ship loading facilities.

Process water will be obtained from the Arrowsmith Groundwater Area at Tathra, 20 km south west of Three Springs and piped 168km to the minesite. Water from the slurry pipeline will be returned to the mine and reused in a closed circuit. Gas will be sourced from the Dampier Bunbury Gas Pipeline. The pipelines for the magnetite concentrate slurry, water, return water from Geraldton Port and gas will be contained in a services corridor (Figure 1).

The Mt Gibson Iron Ore Mine and Infrastructure Project has projected minimum mine life of 20 years and an operational workforce of approximately 300 personnel.

The key characteristics of the project are summarised in Table 1.

1.1.3 Location

The Mt Gibson hills are located approximately 350km north east of Perth, immediately adjacent to the Great Northern Highway, approximately 70km south of Paynes Find and 80km north of Wubin (Figure 1). The proposed project abuts the Mt Gibson, White Wells and Ninghan pastoral leases. Mongers Lake and Lake Moore are located approximately 40km to the west and 30km to the east respectively. Geraldton Port is located approximately 300km to the north west.

The mining tenements held over the Mount Gibson area are shown in Table 2 and Figure 3a.

TABLE 2
TENEMENT HOLDINGS

Tenement Number	Registered Holders	Date Granted	Date Expiry	Application Date	Area	
					Hectares	Blocks
E59/1179	Mount Gibson Mining Ltd*			10/09/2004		6.0
G59/0030	Extension Hill Pty Ltd	19/04/2005	18/04/2026		755.00	
G59/0031	Extension Hill Pty Ltd			5/08/2004	400.00	
G59/0032	Extension Hill Pty Ltd			5/01/2005	845.00	
G59/0033	Extension Hill Pty Ltd			5/01/2005	46.00	
G59/0034	Extension Hill Pty Ltd			2/02/2005	561.00	
G59/0035	Extension Hill Pty Ltd			22/06/2005	315.00	
L59/0063	Mount Gibson Mining Ltd*	29/04/2005	28/04/2026		7.20	
L59/0066	Extension Hill Pty Ltd			02/10/2005	146.00	
L59/0067	Extension Hill Pty Ltd			02/10/2005	2.00	
L59/0068	Extension Hill Pty Ltd			02/10/2005	6.00	
L50/0069	Extension Hill Pty Ltd			3/10/2005	5.00	
M59/0338	Extension Hill Pty Ltd	1/09/1994	31/08/2015		918.45	
M59/0339	Extension Hill Pty Ltd	1/09/1994	31/08/2015		638.20	
M59/0454	Extension Hill Pty Ltd	15/01/2002	14/01/2023		103.20	
M59/0455	Extension Hill Pty Ltd	15/01/2002	14/01/2023		3.02	
M59/0526	Mount Gibson Mining Ltd*	27/12/2001	26/12/2022		54.00	
M59/0550	Extension Hill Pty Ltd			11/05/2001	125.00	
M59/0609	Extension Hill Pty Ltd			5/08/2004	379.00	

*Application lodged with DoIR to transfer MGM tenements to EHPL

1.1.4 Project Timing

Construction of mine infrastructure and associated infrastructure is scheduled to commence in October 2006 (pending receipt of approvals), with the production of magnetite commencing in April 2008. The first shipment of magnetite concentrate from Geraldton Port is scheduled for May 2008.

The construction of the services corridor is scheduled to commence in October 2006 (pending receipt of approvals), with construction scheduled for completion in March 2008

1.2 The Proponent

1.2.1 Proponent Contact Details

The proponent for the Mt Gibson Iron Ore Mine and Infrastructure Project is Mount Gibson Mining Limited (MGM). The office and point of contact for Mount Gibson Mining Limited is

Mount Gibson Mining Limited
Level 1, 7 Havelock Street (PO Box 55 West Perth 6872)
West Perth 6005
Tel 089 485 2355 Fax 089 485 2305
Point of Contact: Mr Brian Johnson
Director

1.2.2 Corporate Overview

Mount Gibson Mining Ltd ('MGM') is a wholly owned subsidiary of Mount Gibson Iron Ltd (MGI) and acts as Manager for the tenement holder EHPL (Figure 2).

MGI will jointly develop the magnetite resources at Mt Gibson with Shougang Holding (Hong Kong) Ltd ('Shougang'). Shougang is a wholly owned subsidiary of the Beijing based Shougang Group (also known as Capital Steel), which is China's fourth largest steelmaker. Shougang will purchase 2.5mtpa of magnetite concentrate for the life of the mine. Shougang is expected to use the concentrate for the production of blast furnace pellets at a major new steel mill being developed by its parent company on the central east coast of China. Asia Iron Holdings Ltd ('AIHL'), which is majority owned (76%) by MGI, will buy 2.5mtpa of magnetite concentrate through its subsidiary Asia Iron Nanjing Ltd ('AIN') for the life of the mine. AIN will construct a 2.5mtpa pellet plant at Longtan in the Jiangsu Province and use the magnetite concentrate as feed.

The MGI group of companies have been structured so that EHPL will own the mining components of the project while the water pipelines, slurry pipeline and return water pipeline will be owned by a subsidiary MGM Pipelines Pty Ltd. Shougang Group will own 50% of EHPL and therefore 50% of MGM Pipelines Pty Ltd. Infrastructure at Geraldton Port will be owned by Geraldton Bulk Handling Pty Ltd, a wholly owned subsidiary of MGI. The owner of the gas pipeline is likely to be Burns Roe Worley. The corporate structure is shown schematically in Figure 2.

AIN will construct a new pellet plant at Longan, at the centre of one of China's major steel making regions. Longtan is located on the Yangtze River near Hanjing in Jiangsu Province. Vessel draft along this stretch of river is limited to 50,000dwt vessels. The Mt Gibson Iron Ore Project will supply magnetite concentrate to the Longtan pellet plant directly from the Port of Geraldton in similar sized vessels.

The proposed project is unique in Australia in several respects:

- It is an 'end to end' supply chain. The logistical structure includes a dedicated shipping fleet transferring the raw material to the final point of processing in China.

- There will be no 'sale' of bulk iron ore to a customer at the despatch port as is usually the case. The consortium will take the mine output and processes it into saleable pellet product. The cost of pellet production will be an accumulation of all costs incurred from the mine pit onwards.

- The Chinese partners will invest considerable capital to obtain a 50% interest in the Australian component of the project. The capital will be contributed as equity in order to gain access to a reliable long term supply of pellet feed.

- MGI's subsidiary, (MGM), will manage the Australian operations for EHPL.

- The MGI Group will ship its 50% share of concentrate produced by EHPL to its wholly owned pellet plant for sale in the Nanjing region.

- Shougang will ship its 50% share of concentrate to a new steel mill in China where it will be used as feed for pellet production and its own consumption.

The project described in this document represents the Australian element of a vertically integrated mining & pellet making operation.

1.3 This Public Environmental Review Document

1.3.1 Purpose of this Document

The Mt Gibson Iron Ore Mine and Infrastructure Project was referred to the EPA under Section 38 of the *Environmental Protection Act 1986* on 18 August 2004. The EPA resolved to formally assess the project and set the level of assessment at Public Environmental Review (PER) (Assessment No. 1538), with a 6 week public review period. A Scoping Document outlining the proposed scope of works for the environmental impact assessment was prepared and submitted to the EPA on the 16 December 2004.

This PER has been prepared according to Part IV Division 1 of the *Environmental Protection Act 1986* for proposals of local or regional significance that raise a number of significant environmental factors, some of which are considered complex and require detailed assessment. The EPA considers that such proposals should be subject to a formal public review period, which in the case of this project was set at 6 weeks, during which time the public, stakeholders and other interested groups are invited to make submissions to the EPA, which in turn have to be responded to by the proponent. The EPA will then submit its report and recommendations to the Minister for the Environment on the environmental acceptability of the proposal along with any environmental conditions, which should apply if the proposal is to proceed.

The EPA's report will be published in the form of a Bulletin and the public may appeal to the Minister against the recommendations or content of the report. The Minister for the Environment will assess any appeals received and ultimately determine whether or not the project can proceed. If the Minister determines that the project can proceed, legally binding conditions, detailing the environmental requirements within which the proponent will have to comply, will be set pursuant to Section 45 of the *Environmental Protection Act 1986.*

The Mount Gibson Iron Ore Mine and Infrastructure Project is a controlled action under the *Environmental Protection and Biodiversity* (EPBC) Act 1999 (Referral

Number 2005/2381). As the Commonwealth has accredited the Western Australian PER assessment process, the Western Australian PER process must also include assessment of matters relevant to the Commonwealth approval.

1.3.2 Structure of Document

This document aims to:

- Place the proposal in the context of the local and regional environment;
- Describe all components of the proposal to allow the Minister for the Environment to review and consider a well-defined project;
- Provide the basis of the proponent's environmental management program; outlining how environmental impacts of the proposal are minimized and acceptably managed;
- Communicate clearly with stakeholders so that the EPA can obtain informed comment to assist in providing advice to government; and
- Outline the reasons why the proposal should be judged by the Minister and the EPA to be environmentally acceptable.

This document is structured as follows:

Section 1:	Introduction
Section 2:	Project justification and evaluation of alternatives.
Section 3:	Legislative framework.
Section 4:	Proposal description.
Section 5:	Existing environment.
Section 6:	Stakeholder consultation.
Section 7:	Environmental principles, sustainability and management
Section 8	Environmental impacts and management.
Section 9:	Environmental management commitments.
Section 10	Conclusions

1.4 Stakeholder Consultation

MGM conducted a consultation program with key stakeholders during the planning stages of the Mt Gibson Iron Ore Mine and Infrastructure Project. The program was aimed at ensuring effective communication with the regulators, local and wider community and other stakeholders, and to allow issues raised during the consultation process to be taken into consideration during the planning and design stages of the project. A summary of the consultation program and its outcomes is given in Section 6. Stakeholder consultation will continue throughout the life of the project.

2. PROJECT JUSTIFICATION AND EVALUATION OF ALTERNATIVES

2.1 Project Justification

The current strong demand for iron ore in global markets is driven by China's growing steel industry. Western Australia is one of the world's major iron ore producers, accounting for 16% of the world's iron ore production in 2002 (Department of Industry and Resources (DoIR), 2003). Due to the proximity of Western Australia to the high growth Asian economies, seaborne trade in iron ore is established and is forecast to grow.

The Mt Gibson Iron Ore Mine and Infrastructure project exploits the strong demand for magnetite concentrates.

Mining of hematite and magnetite ores from the Extension Hill deposit at Mt Gibson will deliver considerable benefits, including:

- development of a significant mineral resource in an attractive economic environment;
- exploits strong world demand, particularly from China for magnetite concentrates;
- regional development benefits in the Midwest region;
- major foreign investment into project development; and
- creation of a vertically integrated supply chain linking the mine with a downstream pellet plant facility at Nanjing, China.

Development of a single, major open pit to mine both hematite and magnetite resources over a projected minimum of 20 year mine life will result in significant regional infrastructure investment in the Midwest of Western Australia.

The Mt Gibson Iron Ore Mine and Infrastructure Project will make a significant contribution to regional development of the Midwest Region in both the construction and operational phases of the project. It is recognised that construction provides a short lived economic boost and that greater benefits result from the operational phase. During operation the project will employ around 300 people, with most mine site workers living in a village on site in a fly in fly out arrangement.

The Mt Gibson Iron Ore Mine and Infrastructure Project will have a multiplier effect on employment, with total employment resulting from the project expected to be approximately 828 (based on the earlier estimate of a workforce of 200) in Western Australia (McLeod, 2005). The Mt Gibson Iron Ore Mine and Infrastructure Project will also result in employment growth at Geraldton Port, with up to 40 additional jobs generated at the Port due to the constant non seasonal nature of the product (McLeod, 2005).

2.2 Evaluation of Alternatives

MGM has expended considerable resources evaluating a number of alternatives to minimise the environmental impacts of the project. The options assessed related to the transportation of ore, the location of the tailings storage facility, the number and size of pits and associated waste rock dumps and the location of the material handling and shiploading facilities within Geraldton Port.

MGM's preferred alternative of transporting the magnetite concentrate from Mt Gibson to Geraldton Port as a slurry in a buried pipeline has significantly higher capital cost than road/rail transportation. However this alternative will result in the least area of vegetation being impacted and less social impacts. Similarly co-locating the waste rock dump and the dry tailing storage facility will minimise the extent of disturbance compared with that resulting from separate locations for the waste rock dump and the tailing storage facility. Locating the material handling and ship loading facilities on Geraldton Port at Berth 5 will have less impact on the visual amenity of the Port compared to the alternative location of Berth 7.

2.2.1 Transportation of Mine Product

A number of routes and transportation methods have been considered for the transportation of ore including:

- Transportation of hematite ore and magnetite concentrate 70km by road to Wubin and rail 318km from Wubin to Geraldton.
- Transportation of hematite ore and magnetite concentrate 200km by road to Morawa via Blue Hills, and rail 194km from Morawa to Geraldton.
- Transportation of hematite ore and magnetite concentrate 85km by road to Perenjori and rail 236km from Perenjori to Geraldton.
- Transportation of hematite ore and magnetite concentrate by rail from Mt Gibson to Geraldton following the route of the private road option from Mt Gibson to Perenjori.
- Transportation of magnetite concentrate from Mt Gibson to Geraldton by slurry pipeline with hematite ore transported by road to Perenjori and then by rail from Perenjori to Geraldton.
- Transportation of magnetite concentrate from Mt Gibson to Geraldton by slurry pipeline with hematite ore stockpiled at the minesite. The transportation of the hematite ore will be a separate referral.

A summary of the various transportation options is provided in Table 3.

TABLE 3
COMPARISON OF ALTERNATIVES FOR TRANSPORTATION OF MINE PRODUCT

	Mt Gibson - Wubin - Geraldton	**Mt Gibson - Blue Hills – Morawa - Geraldton**	**Mt Gibson-Perenjori- Geraldton**					
			Private Road Mt Gibson-Perenjori , rail Perenjori - Geraldton	**Public Road Mt Gibson-Perenjori & rail Perenjori – Geraldton**	**Public & private road to Perenjori & rail Perenjori to Geraldton**	**Rail from Mt Gibson to Geraldton Port**	**Magnetite transported by slurry pipeline. Hematite transported by road/rail**	**Magnetite transported by slurry pipeline. Hematite stockpiled at minesite**
Total distance of route	388km	394km	321km	321km	321km	321km	321km for hematite 280 km for magnetite	280km
Description of route	By road via Great Northern Highway 80km south east to Wubin Rail 318km from Wubin to Geraldton.	By road 200km via Great Northern Highway, Ninghan-Yalgoo Road, Warriedar-Coppermine Road, Koolanooka Springs Road & Munckton Roads to Morawa. Rail 194km from Morawa to Geraldton.	Magnetite and hematite transported by 85km by **private** haul road to Perenjori then railed 236km to Geraldton. Route follows Wanarra Road & avoids vegetation in agricultural area. Six alternative routes were considered for the private haul	Magnetite and hematite transported by 85km on existing **public roads** to Perenjori then railed 236km to Geraldton.	Magnetite and hematite transported by upgraded public road in the pastoral sector and on a private haul road in the agricultural sector to Perenjori, then railed 236km to Geraldton.	Both magnetite and hematite transported by rail from Mt Gibson to Geraldton. This option will require construction of an 85km rail spur from Perenjori to Mt Gibson. The rail spur will follow the route of the private haul road from Perenjori to Mt Gibson	Hematite transported 85km by **public road** to Perenjori then by rail to Geraldton. Hematite will be transported for a minimum of 8 years. Magnetite transported by a buried slurry pipeline within the services corridor for the public road to Perenjori then to Geraldton.	Magnetite transported by a buried slurry pipeline within the services corridor for the public road to Perenjori then to Geraldton. Services corridor will include all services (slurry, water, gas) Hematite stockpiled on site. Transportation of hematite a

	Mt Gibson - Wubin - Geraldton	Mt Gibson - Blue Hills – Morawa - Geraldton	Mt Gibson-Perenjori- Geraldton					
			Private Road Mt Gibson-Perenjori , rail Perenjori - Geraldton	**Public Road Mt Gibson-Perenjori & rail Perenjori – Geraldton**	**Public & private road to Perenjori & rail Perenjori to Geraldton**	**Rail from Mt Gibson to Geraldton Port**	**Magnetite transported by slurry pipeline. Hematite transported by road/rail**	**Magnetite transported by slurry pipeline. Hematite stockpiled at minesite**
			road to minimise social and environmental constraints					separate referral
Width of easement	na	28m	28m (includes 8m service corridor)	*In agricultural sector*: 17m + separate 8m service corridor *in pastoral sector* :28m (includes service corridor).	28m (includes 8m service corridor)	28m (includes service corridor)	*In agricultural sector*: 17m + separate 8m service corridor *in pastoral sector* :28m (includes service corridor).	Approx 15m (max) abutting Wanarra Road, except for a minor deviation away from Wanarra Road to avoid priority flora, where the easement will be 21m to provide for a working service. The easement in the agricultural section will be 20m to allow for access
Number of truck/train movements	50,785 loaded truck movements per annum (= 1	50,785 loaded truck movements per annum = 1 truck	39,300 loaded truck trips per annum = 1 truck movement	50,785 loaded truck movements per annum = 1 truck	50,785 loaded truck movements per annum = 1 truck	6 train movements per day	Hematite trucks 17,520 loaded truck movements per	na

	Mt Gibson - Wubin - Geraldton	Mt Gibson - Blue Hills – Morawa - Geraldton	Mt Gibson-Perenjori- Geraldton					
			Private Road Mt Gibson-Perenjori , rail Perenjori - Geraldton	**Public Road Mt Gibson-Perenjori & rail Perenjori – Geraldton**	**Public & private road to Perenjori & rail Perenjori to Geraldton**	**Rail from Mt Gibson to Geraldton Port**	**Magnetite transported by slurry pipeline. Hematite transported by road/rail**	**Magnetite transported by slurry pipeline. Hematite stockpiled at minesite**
	truck movement every 5 minutes between Wubin and mine site). 6 train movements/ day (2 magnetite trains, 1 hematite train)	movement every 5 minutes between Perenjori and mine site. 6 train movements/ day (2 magnetite trains, 1 hematite train)	every 6.5 minutes between Perenjori and mine site. 6 train movements per day (2 magnetite trains, 1 hematite train) from Perenjori to Geraldton Port	movement every 5 minutes between Perenjori and mine site. 6 train movements per day (2 magnetite trains, 1 hematite train) from Perenjori to Geraldton Port	movement every 5 minutes between Perenjori and mine site. 6 train movements per day (2 magnetite trains, 1 hematite train) from Perenjori to Geraldton Port	(2 magnetite trains, 1 hematite train)	annum (= 1 truck movement every 15 minutes between Perenjori and Mt Gibson) 2 train movements/day (1 hematite train)	
Issues/Constraints	• requires 82km of rail track between Wubin and Perenjori to be upgraded and/or replaced at significant capital cost. • Requires rail	• Will require approx 200km of roads to be significantly upgraded & widened, • Will require clearing of approx 400ha of vegetation adjacent to	• This option minimises impact on vegetation in agricultural area but would result in a greater total area of vegetation (126ha versus 90ha) being	• This option is strongly preferred by the Shires of Perenjori and Yalgoo due to regional development benefits • Will result in the clearing of	• This option will result in the least clearing of vegetation (90ha in total) for all the road options except for the Wubin option • Has	• high capital cost but efficient method of transportation • will result in clearing of 126ha of vegetation in pastoral area, no clearing in	• Very high capital costs for construction of pipelines • Will result in clearing of 40ha of roadside veg in agricultural area and 90ha	• Very high capital cost to construct but lower operating costs than road/rail • Pipeline will be buried therefore no noise impact

	Mt Gibson - Wubin - Geraldton	Mt Gibson - Blue Hills – Morawa - Geraldton	Mt Gibson-Perenjori- Geraldton					
			Private Road Mt Gibson-Perenjori , rail Perenjori - Geraldton	**Public Road Mt Gibson-Perenjori & rail Perenjori – Geraldton**	**Public & private road to Perenjori & rail Perenjori to Geraldton**	**Rail from Mt Gibson to Geraldton Port**	**Magnetite transported by slurry pipeline. Hematite transported by road/rail**	**Magnetite transported by slurry pipeline. Hematite stockpiled at minesite**
	between Perenjori & Geraldton to be upgraded • Significant increase in total haulage distance resulting in significant increase in haulage costs	CALM managed stations for upgrade of road • Will require upgrade of rail from Morawa to Geraldton	cleared • lower noise levels than the public road option but would not comply with noise regulations • Within 700m of White Wells homestead • Could facilitate use of special performance vehicles with higher payloads, and therefore fewer truck movements.	40ha of roadside vegetation within the agricultural area and 90ha of vegetation in the pastoral area • Complies with noise regulations at White Wells Homestead but has a higher noise level than private road option. • ABHF do not support trucking along/adjacent to Wanarra Road	significant truck numbers from Mt Gibson to Perenjori compared with all rail and slurry pipeline/ road/rail Option • ABHF do not support trucking along/adjacent to Wanarra Road	agricultural area • Rail would have less impact on White Wells homestead than trucking	in pastoral area • May possibly require upgrade of rail Perenjori to Geraldton	on White Wells Homestead • Will result in clearing max of 67ha in pastoral area. Route deviated to minimise impact on priority flora. • Clearing in agricultural area minimised to 23ha through route selection, with Horizontal Directional drill under Greenough & Irwin Rivers. Crossing at Lake Monger

	Mt Gibson - Wubin - Geraldton	Mt Gibson - Blue Hills – Morawa - Geraldton	Mt Gibson-Perenjori- Geraldton					
			Private Road Mt Gibson-Perenjori , rail Perenjori - Geraldton	**Public Road Mt Gibson-Perenjori & rail Perenjori – Geraldton**	**Public & private road to Perenjori & rail Perenjori to Geraldton**	**Rail from Mt Gibson to Geraldton Port**	**Magnetite transported by slurry pipeline. Hematite transported by road/rail**	**Magnetite transported by slurry pipeline. Hematite stockpiled at minesite**
								and the tributary of Yarra Yarra lakes will be within the road causeways.
Approx capital cost	$100mil-$120mil ($30-$50mil to upgrade rail Wubin-Perenjori; $70mil to upgrade rail Perenjori to Geraldton	Not costed	$90mil-$103mil (road $20-33mil, $70mil to upgrade rail Perenjori to Geraldton)	$90mil-$103mil (road $20-33mil, $70mil to upgrade rail Perenjori to Geraldton)	$90mil-$103mil (road $20-33mil, $70mil to upgrade rail Perenjori to Geraldton)	$120mil-$135mil (Rail spur to Mt Gibson $50-65mil, $70mil to upgrade rail Perenjori to Geraldton)	$320mil-$333mil ($300mil for pipeline plus $20-33mil for road, possible upgrade of rail not costed)	$300mill
Rating	Discounted as an option due to high operating cost from increased haul distance	Discounted as an option due to excessive clearing (400ha) and high operating cost from increased haul distance	Discounted as an option due to impact of trucking on White Wells Stn and clearing of 126ha in pastoral area	Discounted as an option due to clearing of 40ha in the agricultural area & 90ha in pastoral area and impact of trucking on White Wells Stn	Not selected due to trucking impacts	Possible alternative but not selected due to extent of clearing (126ha)	Company's first & urgent priority is approval of magnetite operation. This option would require the issues	Preferred option Company's first & urgent priority is approval of magnetite operation. Issues associated with transportation of

	Mt Gibson - Wubin - Geraldton	Mt Gibson - Blue Hills – Morawa - Geraldton	Mt Gibson-Perenjori- Geraldton					
			Private Road Mt Gibson-Perenjori , rail Perenjori - Geraldton	**Public Road Mt Gibson-Perenjori & rail Perenjori – Geraldton**	**Public & private road to Perenjori & rail Perenjori to Geraldton**	**Rail from Mt Gibson to Geraldton Port**	**Magnetite transported by slurry pipeline. Hematite transported by road/rail**	**Magnetite transported by slurry pipeline. Hematite stockpiled at minesite**
							associated with transportation of hematite to be resolved and therefore was not the preferred option.	hematite to be resolved in the future (as separate referral)

(i) Mt Gibson –-Wubin - Geraldton

The transportation of product approximately 80km southeast to Wubin by road for transfer onto the rail system would require 82km of rail track between Wubin and Perenjori to be upgraded and/or replaced.

The Mt Gibson-Wubin-Geraldton Option is significantly longer that other options considered by the company (388km compared with 321km for the Perenjori-Geraldton option), with the associated increased haulage costs and capital costs for the upgrade/replacement of the rail between Wubin and Perenjori. This option was not favoured due to the costs associated with the upgrade/replacement of 82km of rail between Wubin and Perenjori, and the significant difference in haulage costs associated with the greater haulage distance.

(ii) Mt Gibson - Blue Hills – Morawa - Geraldton

Under this alternative, product would be transported approximately 200km by road (using Great Northern Highway, Ninghan-Yalgoo Road, Warriedar-Coppermine Road, Koolanooka Springs Road & Munckton Roads) to Morawa, where the product would be transferred to rail for transportation to Geraldton. The longest of the alternatives at 394km, this option was not favoured due to the significantly increased total distance to be travelled and the associated increased haulage costs, the costs associated with the upgrading and sealing 200kms of roads and the extent of vegetation clearing required for the upgrades of the roads.

(iii) Road/Rail Mt Gibson - Perenjori - Geraldton

MGM undertook extensive investigations into various options for the road transportation from Mt Gibson – Perenjori and rail from Perenjori – Geraldton.

MGM commissioned Halpern Glick Maunsell (HGM) to investigate options for a haul road between Mt Gibson and the rail loading facility to be located approximately 3km to the south of Perenjori (Halpern Glick Maunsell, 2002). The haul road is approximately 85km in length.

Options for the Perenjori-Mt Gibson haul road included:

- an upgrade of the **existing** Perenjori – Rothsay and Wanarra Roads to a high standard, sealed road for general public use, as well as for the cartage of product from Mt Gibson using road trains; and

- provision of a dedicated, fully sealed, **private** haul road, generally parallel to existing roads, utilising special performance vehicles with higher payloads.

Under this option, the haul road and associated drainage will be 17m in width, with an additional 8m corridor on cleared farmland on one side of the road for a services corridor for pipelines. In the agricultural sector of the route, the services corridor on cleared farm land rather than on the road reserve.

HGM evaluated six alternative routes for the haul road (upgrade of public road and five routes for the private haul route) using a number of criteria including the environmental, social, land use, engineering and geotechnical and financial impacts of each route. Environmental constraints were identified from database searches of the CALM Threatened (Declared Rare) Flora database, the Western Australian Herbarium database for priority species, the CALM Threatened Fauna database, Heritage Council of Western Australia's Register of Heritage Places and the Department of Indigenous Affairs Register System. A flora survey of the alignment options was subsequently undertake and input sought from affected landowners and the Shires of Perenjori and Yalgoo regarding the alignment of the private and public haul roads.

Use of the public road would require the existing road alignment between Wubin - Mullewa Road and Great Northern Highway (ie existing Perenjori - Rothsay Road and Wanarra Road) to be upgraded.

The preferred alternative for the private haul road (Option 5) utilised paddock boundaries wherever possible to minimise property impacts, minimises conflicts with Telstra installations and deviated at chainage 60000 to avoid remnant vegetation in good condition. The location of the rail loading facility in Option 5, although closer to the town of Perenjori, is actually further from all houses than Option 4 and therefore would result in fewer noise impacts.

MGM also evaluated transporting magnetite and hematite product from Mt Gibson to Perenjori by rail. The rail option would follow the route of the private haul road from Mt Gibson to Perenjori before joining the existing rail network. The rail would require a similar width to the private haul road, and a similar area of vegetation to be cleared to the private haul road option.

Following detailed assessment of the transportation alternatives and consultation with stakeholders, MGM concluded that the transportation by road/rail was not its preferred option due to the impact of 56,000 truck movements on White Wells Station, the clearing of 126ha or 90ha of vegetation in the pastoral area (private haul road and public haul road respectively) and 40ha of vegetation in the agricultural section (public haul road only) and concerns by stakeholders (Table 2).

MGM's preferred alternative, the transportation of magnetite concentrate by buried pipeline within a services corridor, although expensive, will result in less vegetation being impacted (67ha in the pastoral area and 23ha in the agricultural area), no truck impacts, no noise impacts and rehabilitation of disturbed areas immediately following construction compared with the road/rail options. A description of the services corridor is provided in Section 4.

2.2.2 Reduction in Number of Mine Pits

As part of its evaluation of the proposed project, MGM has deferred indefinitely its earlier plans to mine the Iron Hill deposit approximately 2 km south of Extension Hill. Rather, the company will focus entirely on the mineral deposits at Extension Hill which has an expected minimum life of 20 years. This decision was based, in part, on

the cumulative environmental impact of mining both the Extension Hill and Iron Hill deposits on the Declared Rare Flora, *Darwinia masonii*, and the company's objective that any impact must be minimised and responsibly managed. As of 2004, 712 adult plants and 811 seedlings (defined as plants generally less than 20cm in height with no flowering material) are known to occur at Iron Hill.

If, at some time in the future, the company decides to proceed with plans to mine the Iron Hill deposit or any other area in the Mt Gibson Range, the proposal will be referred to the EPA for assessment.

2.2.3 Siting of Tailings Storage Facility (TSF)

The Company considered several possible locations for construction of a Tailings Storage Facility. These are summarised below and in Table 4.

(i) Playa to south of Extension Hill

MGM initially identified the use of a natural depression in the topography some 5000m to the south of Extension Hill as a convenient site for tailings storage. This site is a small saline clay pan (playa) located on the Crown Common Reserve, which would minimise the project interference with neighbouring pastoral leases.

The use of the playa offered several technical and economic advantages due to the natural topography enabling construction of a 'valley type' dam including a natural down slope of 20m in the direction towards the TSF site giving lower operating costs, low capital cost of construction as embankment volumes are relatively low for the storage area achieved and water harvesting benefits due to the catchment being larger than the storage area. Negative impacts of this option included disruption of natural drainage paths, possibility of an effect on groundwater hydrology, ecological impacts on micro invertebrates which have possibly colonised the saline ecosystem and disturbance to evidence of aboriginal activity. This option has been discounted due to the potentially significant environmental impacts.

(ii) Deposition into Redundant Mine Voids

Use of the closed pits at the Mt Gibson Gold mine (20km south of Extension Hill) for storage of tailings was considered. While an attractive technical proposition as it obviates the need to build and maintain significant earth structures for tailings storage, the combined volume of the Mt Gibson Gold mine pits is significantly less than the volume of tailings to be generated through the Mt Gibson Iron Ore Project. Regardless, deposition of tailings in the Gold mine voids would permanently sterilise any future economic value of those pits which may be recoverable as a result of future exploration and under future economic circumstances. The Mt Gibson Gold Mine was sold in November 2005 to Legend Mining. The previous owners indicated gold resources in the vicinity of 800,000ozs in the mineralised structure below and between the pits. Use of the Gold mine pits have therefore been discounted as an option.

(iii) Pastoral Land West of Highway

The site west of Great Northern Highway and **north** of Wanarra Road, while slightly closer to the processing plant, is at a higher elevation than the plant site and will therefore impose increased operating cost, compared with the playa option. It is situated on a pastoral lease, Ninghan Station. Use of this site requires tailings discharge & return water lines to be installed under the Great Northern Highway formation and permission of the station holder to use the site for the specified purpose. A preliminary engineering assessment showed that the topography of the site is unsuitable for the purpose and the high external walls of the TSF will be visually prominent from Wanarra Rd.

The site west of Great Northern Highway and **south** of Wanarra Road is situated on the Mt Gibson Station pastoral lease held by the Australian Wildlife Conservancy (AWC). Use of this site requires tailings discharge & return water lines to be installed under the Great Northern Highway formation and permission of the station holder to use the site for the specified purpose. The TSF and associated infrastructure will have a reduced footprint at this site compared with the site north of Wanarra Road (450ha compared with 500ha) resulting in less clearing. The structure will be less prominent from Wanarra Road as it can be set into the lower topography of the site. However geotechnical investigations have shown the site to be pervious and at risk of seepage of the tailings into the groundwater.

Both alternatives to the west of Great Northern Highway have therefore been discounted as options for the location of the TSF.

(iv) Co-location with Mine Waste Rock

MGM's preferred alternative is to co-locate the TSF with the waste rock dump on the east flank of Extension Hill. Two options were considered for the combined waste dump and tailings facility. The first option consisted of a series of tailings cells constructed using the waste rock, with the tailings cells progressively filled with slurried tailings. Tailings would be deposited into each cell by a pipeline and supernatant water and rainwater would be recovered and reused in the processing plant. The second option, which is the company's preferred option, involves the transportation of dry (16% moisture) filtered tailings via a series of conveyors to the waste dump where it will be pushed with a dozer and buried. This option does not require a supernatant pond.

At 552ha, there is no difference in the footprint of either option for co-location with the waste rock. The co-location options will result in approximately 100ha less disturbance than if the TSF was located separately to the waste dump.

2.2.4 Waste Rock Storage

As is common practice in mine design, the Waste Rock Dump is located adjacent to the pit. Backfilling of the pit is not technically viable due to the staged development of the pit and would prevent further mining at increased depth.

2.2.5 Location of Facilities within Geraldton Port

MGM's initial preference was to locate the materials handling and shiploading facilities within Geraldton Port at Berth 7. Concerns were expressed at a community meeting held in Geraldton in November 2005 about the impact of the proposed facilities on Berth 7 on the visual amenity of the Port area. MGM redesigned the facilities at Berth 7 to locate the storage tanks and filtration plant to the eastern end of Berth 7 in response to community requests. Following discussions with the Geraldton Port Authority and Government support for the development of Berth 5 as a multi-user iron ore product, MGM has discounted Berth 7 as an option.

The company's preference is to locate the materials handling and shiploading facilities within Geraldton Port at Berth 5. Locating the material handling and ship loading facilities on Geraldton Port at Berth 5 will have less impact on the visual amenity of the Port compared to the alternative location of Berth 7.

2.2.6 No Development Option

The no development option would result in the loss of opportunity to add value to Australia's raw materials and the loss of employment opportunities and economic benefit, particularly within regional communities. The increasing global demand for iron ore would then be met through the development of other projects predominantly overseas, with the loss of the associated benefits to Western Australia.

TABLE 4
COMPARISON OF ALTERNATIVE LOCATIONS FOR TAILINGS FACILITY

	Deposition into Playa 5km south of Extension hill	Deposition into Redundant Mine Voids at Mt Gibson Gold mine	Pastoral Land West of Highway and north of Wanarra Road	Pastoral Land West of Highway and south of Wanarra Road	Co-location with Mine Waste Rock to east of Extension Hill	
					Conventional Tailings	**Dry (16%) Tailings**
Description	Small saline clay pan (playa) on the Crown common reserve approx 5km south of Extension Hill	Use of the closed pits at the Mt Gibson Gold mine (20km south of Extension Hill) for storage of tailings	West of Great Northern Highway and north of Wanarra Road on Ninghan Station. Would require approx 500ha and discharge and return water lines to be installed under Great Northern Highway	West of Great Northern Highway and south of Wanarra Road on Mt Gibson Station	A series of tailings cells incorporated into the waste dump, with the tailings cells progressively filled with slurried tailings	Dry (16% moisture) filtered tailings transported via a series of conveyors to the waste dump where it will be pushed with a dozer and buried. This option does not require a supernatant pond.. .
Advantages	• Minimises impact of project on adjoining pastoral leases • Technical and economic advantages due to natural topography allowing the construction of 'valley type' dam	Technically attractive as it obviates the need to build and maintain significant earth structures for tailings storage. However would still require a tailings dam somewhere as the pits would only hold a relatively small fraction of the overall tailings volume to be generated.	Closer to plant site than Oroya Gold Mine and playa	Footprint area reduced by approx 50ha compared with site north of Wanarra Road.	• Footprint area approx 100ha less than area of separate TSF and waste dump • Can undertake progressive rehabilitation • Less risk of dust lift off due to smaller area of exposed tailings	• Footprint area approx 100ha less than area of separate TSF and waste dump • Can undertake progressive rehabilitation • Less risk of dust lift off due to smaller area of exposed tailings • Significantly reduced water requirement

	Deposition into Playa 5km south of Extension hill	Deposition into Redundant Mine Voids at Mt Gibson Gold mine	Pastoral Land West of Highway and <u>north</u> of Wanarra Road	Pastoral Land West of Highway and <u>south</u> of Wanarra Road	Co-location with Mine Waste Rock to east of Extension Hill	
Disadvantages	• Possible disruption to natural drainage paths and groundwater hydrology • Potential for impact to aboriginal site • Unlikely to be environmentally acceptable	• Capital and operating costs associated with the extended pumping distances to and from the mine • Deposition of tailings in the Mt Gibson Gold mine voids would permanently sterilise any future economic value of those pits which may be recoverable as a result of future exploration and under future economic circumstances, which is not acceptable to current owners • existing voids are full of hypersaline water that would need to be disposed of as cannot be used in MGM process	• The ground slopes within the area require the external walls of the TSF to be high with impacts on visual amenity • Presence of granite on the site make it unsuitable for use as a tailings facility • Greater total footprint of disturbance of separate Tailings Facility and Waste dump than for co-disposal option. • Would need to bring construction material from the mine across Great Northern Highway.	• Located on Mt Gibson Station, owned by Australian Wildlife Conservancy. • Embankments will be highly visible from Great Northern Highway due to flat topography • High risk of seepage due to deep sandy soils, with consequent high potential for environmental impacts • Greater total footprint of disturbance of separate Tailings Facility and Waste dump than for co-disposal option. Would need to bring construction material from the mine across Great Northern Highway.	• Will require careful scheduling for placement of waste rock to be coordinated with tailings management	• na
Rating	Discounted as an option	Discounted as an option	Discounted as an option	Discounted as an option	Discounted as an option	Preferred Option for location of TSF

3. LEGISLATIVE FRAMEWORK

3.1 Relevant Legislation and Policies

Environmental legislation relevant to the Mt Gibson Iron Ore Mine and Infrastructure Project includes:

- Aboriginal Heritage Act, 1980
- Agricultural and Related Resources Protection Act 1995
- Bush Fires Act 1954
- Conservation and Land Management Act 1984
- Dangerous Goods (Transport) Act 1998
- Dangerous Goods Safety Act 2002
- Environmental Protection Act, 1986
- Explosives and Dangerous Goods Act 1961
- Health Act 1911
- Heritage of Western Australia Act 1990
- Land Administration Act 1997
- Local Government Act 1995
- Occupational Health and Safety Act 1984
- Mining Act 1978
- Mine Safety & Inspection Act 1995
- Rights in Water and Irrigation Act 1914
- Soil and Land Conservation Act, 1945
- Town Planning & Development Act 1928
- Water Supply , Sewerage and Drainage Act 1912
- Wildlife Conservation Act, 1950

In addition, the following Commonwealth legislation is relevant to the project:

- Environment Protection and Biodiversity Conservation Act, 1999.
- Native Title Act 1993

Under the EPBC Act 1999, an action requires approval from the Federal Minister for Environment and Heritage if the action has, will have or is likely to have, a significant impact on a matter of national significance such as:

- World Heritage properties
- National Heritage places
- Ramsar wetlands of international significance
- Listed threatened species and communities
- Migratory species protected under international agreements
- Nuclear actions; or
- The Commonwealth marine environment.

The Mount Gibson Iron Ore Mine and Infrastructure Project is considered by the Department of Environment and Heritage as a controlled action under the *Environmental Protection and Biodiversity* (EPBC) Act 1999 (Referral Number 2005/2381). The Commonwealth has accredited the Western Australian PER assessment process. The

Western Australian PER process must include assessment of matters relevant to the Commonwealth approval.

3.2 Key Decision Making Authorities

The key decision making authorities (DMAs) involved in the environmental assessment of the Mt Gibson Iron Ore Mine and Infrastructure Project are the EPA and the EPA Services Unit, which provides advice to the EPA.

MGM has had ongoing consultation with the Department of Conservation and Land Management on the assessment of the project's potential impacts on biodiversity. Consultation has also been undertaken with the Water and Rivers Commission section of the Department of the Environment regarding the assessment of the potential impacts on water resources.

Other DMAs involved in the project include the Department of Indigenous Affairs, Geraldton Port Authority, the Shires of Yalgoo, Perenjori, Mingenew, Three Springs, Irwin, Greenough, the City of Geraldton and the Department of Industry and Resources.

3.3 Approvals Process

The Mt Gibson Iron Ore Mine and Infrastructure Project was referred to the EPA under Section 38 of the *Environmental Protection Act 1986* on 18 August 2004. The EPA resolved to formally assess the project and set the level of assessment at Public Environmental Review (PER) (Assessment No. 1538), with a 6 week public review period. A Scoping Document outlining the proposed scope of works for the environmental impact assessment was prepared and submitted to the EPA on the 16 December 2004.

This PER has been prepared according to Part IV Division 1 of the *Environmental Protection Act 1986* for proposals of local or regional significance that raise a number of significant environmental factors, some of which are considered complex and require detailed assessment. The EPA considers that such proposals should be subject to a formal public review period, which in the case of this project was set at 6 weeks, during which time the public, stakeholders and other interested groups are invited to make submissions to the EPA, which in turn have to be responded to by the proponent.

Guidelines for making a submission are presented in the front of this document.

The EPA will then submit its report and recommendations to the Minister for the Environment on the environmental acceptability of the proposal along with any environmental conditions, which should apply if the proposal is to proceed.

The EPA's report will be published in the form of a Bulletin and the public may appeal to the Minister against the recommendations or content of the report. The Minister for the Environment will assess any appeals received and ultimately determine whether or not the project can proceed. If the Minister determines that the project can proceed, legally binding conditions, detailing the environmental requirements within which the proponent

will have to comply, will be set pursuant to Section 45 of the *Environmental Protection Act 1986.*

If approval for the project is obtained under Part IV of the *Environmental Protection Act 1986*, the construction and operations will be licensed under Part V of the Act. This requires a Works Approval Application to be submitted to the DoE prior to the commencement of construction and an Application for Licence to Operate submitted to the DoE for the mining components of the project, prior to the commencement of commissioning. Parts of the project will be constructed on tenure granted under the *Mining Act 197*8 and therefore a Notice of Intent will also be required to be submitted to DOIR for approval before construction can commence.

4. DESCRIPTION OF PROJECT

4.1 Overview

The Mt Gibson Iron Ore Mine and Infrastructure Project is a combined hematite/magnetite open cut mining operation that will produce both direct shipping grade hematite ore and magnetite concentrate. The Extension Hill deposit contains hematite resources of 13Mt and a further 230Mt of BIF resources underlying and extending beyond the hematite cap. The hematite will be crushed and screened and the magnetite will be concentrated at Mt Gibson before transportation to Geraldton Port. The magnetite concentrate will be exported to China at an annual shipping rate of 5Mtpa. The hematite will be stockpiled on site. The transportation of hematite will be a separate referral to the EPA for determination of a level of assessment once the transportation solution is decided. Hematite will be transported once environmental approval is obtained.

The project has several components

(i) mining of hematite and magnetite. This involves the development of a single open cut pit as the hematite ore overlies the magnetite ore, waste dump and associated infrastructure. The hematite will be crushed and screened on site.

(ii) processing of Banded Iron Formation to extract the magnetite mineral (called magnetite concentrate).

(iii) transportation of magnetite concentrate as a slurry to Geraldton Port. Water from the slurry is recovered at the Port. Approximately 10% of the water is exported with the magnetite concentrate. The remainder of the water is directed back into the return water line.

(iv) support infrastructure including gas fired power station, workshops, offices, accommodation village, water and gas pipelines, pumping stations for the water, gas and slurry pipelines, sheds and shiploading facilities at Geraldton Port.

The key characteristics of the project are summarised in Table 1.

TABLE 1
SUMMARY OF KEY CHARACTERISTICS OF THE MT GIBSON IRON ORE PROJECT

Component	Element	Characteristic
Project Life	Magnetite Hematite	Minimum of 20 years Minimum of 8 years
Mining Operations		
Estimated resource	Magnetite bearing BIF Hematite	230Mt 13Mt
Mining rate	Magnetite bearing BIF Hematite	13Mtpa 1.5-2Mtpa
Volume of Waste Rock	Waste rock Overburden Dry Tailings	65.2Mm^3 0.35Mm^3 56Mm^3
Size of final pit	Single pit for both hematite and magnetite	2400m long, 700m wide
Final pit depth		340m
Dewatering requirements		2,500m3/day
Stripping ratio (t:t)	(waste: ore) hematite magnetite	1.13:1.0 1.5:1.0
Proportion of waste to be backfilled		Nil
Estimated total area of disturbance		872ha
Processing Requirements		
	Hematite	None (crushing & screening only as direct shipped ore)
	Magnetite	Wet circuit to fine grind and magnetically separate magnetite from feed. Concentrate dewatered at Port before shipping. Filtrate water returned to minesite for reuse
Transportation		
	Distance of services corridor	280km
	Area of native vegetation disturbed (est.)	Pastoral section 67ha Agricultural section 23ha
General		
	Workforce (mine & transportation)	Construction 400 Operation 300
	Workforce Accommodation	Accommodation village for 300 Area of disturbance 19ha
	Infrastructure	53MW gas fired power station, warehouses, workshops, offices at mine site,
	Water supply requirements & sources	*Potable & domestic supplies* 0.03GLpa (80m^3/day) sourced from mine dewatering *Dust suppression* 0.75GLpa (2,055m^3/day) sourced from mine dewatering *Process and slurry transportation water* 2GLpa (5,424m^3/day) – sourced from Tathra borefield and drying of tailings

4.2 Mining of Hematite and Magnetite

4.2.1 Mining Methodology

The project will source both hematite ore and magnetite bearing Banded Iron Formation (BIF) ore from the Extension Hill deposit, which is the most northerly ridge of the Mt Gibson hills. The magnetite bearing BIF underlies and extends beyond the hematite ore.

The Extension Hill pit will ultimately achieve crest dimensions of approximately 2400m long, 700m wide and 340m deep, and will be developed in stages over the projected 20 year minimum mine life (Figure 3).

Vegetation and topsoil will be removed from above the overburden and stored for later use in rehabilitation activities and the overburden above the ore body removed. Mining will commence with the development of a small elongated 'starter' pit at the northern extremity of the deposit which facilitates access to a limited strike extent of the partly weathered magnetite deposit lying in a relatively thin 'transition zone'.

The starter pit will be extended, widened and deepened so that the annual output of 13Mt of BIF can be extracted. Simultaneously, some 1.5-2.0Mt of hematite ore will be mined each year and stockpiled for crushing and future transport. Hematite mining will continue until the limited volume of the hematite orebody has been fully depleted.

Hematite ore and magnetite bearing BIF and waste will be mined by conventional open cut methods of blasting and excavation with material loaded onto trucks and transported to stockpile areas. Blasting will be designed to minimise the occurrence of noise and vibration and to manage flyrock in the vicinity of Great Northern Highway. Backhoe excavators will load material into trucks for transportation to the stockpiles.

Hematite ore will be stockpiled on a Run Of Mine (ROM) pad from where it will be crushed into both a lump (-32mm, +6.3mm) product and a fines (-6.3mm) product via a primary jaw crusher, secondary cone crusher and transported by conveyor underneath the Great Northern Highway to a stockpile on the western side of the Highway (Figure 4). The conveyor will be located in a culvert underneath Great Northern Highway and will be fitted with wind guards and water sprays for dust management. The hematite stockpile will be located approximately 300m to the north of Wanarra Road and is not likely to be visible from Wanarra Road due to the height of the vegetation and distance from the road.

Ore quality magnetite bearing BIF will be stockpiled on a ROM pad adjacent to the hematite ROM, from where it will be fed by direct tipping and front end loaders into a primary gyratory crusher.

Mining operations (drilling, excavation, ore and waste removal) will be carried out on a 24 hour per day basis. Blast operations will only occur during daylight hours. Crushing and stockpiling operations will be carried out 24 hours per day.

4.2.2 Overburden Management

Overburden material which overlies the mineralisation will be removed prior to mining of the magnetite ore. The overburden at Extension Hill is generally around 40m thick and will take around 12 months to remove (Year 0). A life of mine strip ratio of waste:ore is approximately 1.5:1.0. The overburden and waste rock material from the hematite/magnetite pit will be stockpiled in a large, purpose designed dump to the east of the Extension Hill pit (Figure 3). Some overburden may be used in construction activities.

Tailings will be located within the waste dump (see Section 4.3.3).

The footprint of the co-located waste dump and tailings facility is 552ha. The maximum height of the waste dump will not exceed RL 400m, which is lower than the peak elevation of the adjacent Extension Hill. The dump edges will be battered down to intercept the natural plain levels as they extend east and north. Extension Hill ranges from the surrounding plain (RL 330m) to a peak of RL 440m at Extension Hill and RL 425m at Extension Hill South.

Backfilling the pit with overburden and waste rock is not technically viable due to the staged development of the pit, with space unlikely to be available until around Year 15. In addition, backfilling the pit would prevent further mining at depth.

Geochemical test work indicates there will be negligible potentially acid forming material. The waste rock consists primarily of weathered BIF, clay and chert and basalt, all of which is classified as non acid forming, with minor amounts of chert/chortitic tuff. The chert/chloritic tuff, which is less than 1% of the ore body, is classified as potentially acid forming. Potentially acid forming material will be encapsulated in designated sections of the waste dumps to minimise the potential for acid rock drainage. (See Section 8.13).

Design and construction of the waste rock dump will incorporate features to control surface runoff, facilitate progressive rehabilitation and minimise visual impacts after mine closure. The overburden storage area will be rehabilitated and revegetated as part of MGM's standard procedures (see Rehabilitation and Revegetation Management Plan Section 8.8).

4.2.3 Dewatering

The water table at the minesite lies at 320ADH, which is 50 to 100m below natural ground surface. The final depth of the pit is 220m below groundwater level. Dewatering will be required as a component of the mining operation to ensure dry mining conditions and pit wall stability. Dewatering will be achieved by pumping from bores located outside the pit, supplemented by in pit bores if required. Average pumping rates of up to 2,500m^3/day will be required (Rockwater 2005b). Mine dewatering will be an important component of the water supply for the project (See Section 4.6) and no excess groundwater discharge is anticipated. A copy of the hydrogeological investigations at the mine are provided as Appendix 1.

4.3 Processing of Ore

4.3.1 Hematite

The hematite ore is direct shipping grade ore (DSO) and therefore no processing of the ore is required other than the crushing and screening of the ore into fines (<6.3mm particle size) and lumps (6.3 – 32.0mm) particle size (Figure 4).

4.3.2 Magnetite

Production of magnetite requires size reduction of the BIF to a point where the mineral grains of magnetite are able to mechanically separate from the host siliceous material. At that point the magnetic properties of the magnetite are used to recover the magnetite. The concentration of magnetite does not involve the use of chemical additives other than flocculants and therefore will not result in the production of chemical pollutants.

The magnetite bearing BIF will be crushed to less than 32mm particle size using primary and secondary crushers. From the secondary crushing circuit the BIF will be further reduced using High Pressure Grinding Rolls (HPGR) (Figure 5).

The HPGR product will be wet screened at 3mm particle size to remove material larger than 3mm. The oversize material will be recycled to the HPGR for further crushing. The product less than 3mm will be passed to the first stage of the magnetic concentration, or rougher magnetic separators. The non magnetic material from the rougher stage passes directly to the tailings. The magnetic product from the rougher stage is then screened at 0.7mm, with oversize material returned to the HPGR for further size reduction. The screen undersize product passes to the ball mill for the first stage of fine grinding, to 80% <55micron. At this size the ground product passes to the next stage of magnetic separation, called intermediate magnetic separation. Non magnetic material of this size is passed to the tailings. The intermediate magnetic material is ground further in a tower mill with a product size of 80% <34micron and again passed through magnetic separation, termed the cleaner magnetic separation. In the cleaner stage large volumes of recycled water are used to wash the final magnetic concentrate as it is produced.

The tailings disposal has been optimised to minimise the overall water consumption and maximise the recycling of water within the plant. The tailings from the rougher magnetic separation and the coarse fraction of the intermediate fraction are dewatered on purpose designed dewatering screens. The dewatered tails are then transported by conveyor to the waste dump and tailings area. The fine tailings material from the intermediate magnetic separation and the tailings from the cleaner magnetic separation go to the tailings thickener, a stilling tank that allows solids to settle out and be mechanically raked to a central pumping point. The thickened solids are pumped to the filtration plant from where the filtered tails are transferred via conveyor to the waste dump. The clarified thickener overflow water returns to the plant process water tank for reuse in the process. Similarly the water reclaimed from the coarse and fine tails dewatering screens and filters returns to the plant process water tank.

The final concentrate from the cleaner magnetic separation stage is thickened and the clarified overflow water returned to the process water tank for reuse. The thickened

concentrate is stored in large agitated storage tanks in preparation for transportation to the Port of Geraldton.

4.3.3 Tailings

Dry tailings solids generated during the concentration of magnetite must be permanently stored as landfill. By Year 20 the volume of tails solids produced will total around 56M m^3. The tails will comprise mostly the fine silica with small amounts of magnetite, carbonates, pyrite, hematite and silicates. Tails will be deposited via a series of conveyors as a cake containing on average 16% moisture. The solids fraction will be finely ground particles at less than 60 micron size.

The tailings from the processing of the magnetite will be managed with the waste in a combined waste dump co-located to the east of the Extension Hill pit (Figure 3). The dewatered (dry) tailings will be disposed of concurrent with the waste rock and will not require a supernatant pond.

4.4 Mine Infrastructure

Support infrastructure for mining operations is outlined in Sections 4.4.1 to 4.4.4.

4.4.1 Ancillary Services

Ancillary services including a warehouse, maintenance workshop, administration building, mine operations office, fleet maintenance workshop, crib & ablution blocks will be located close to the minerals processing plant (Figure 3).

The management of dangerous goods will be incorporated into the design of these facilities. Diesel fuel will be delivered to the minesite by road. Storage tanks will be located in a specially constructed facility at the infrastructure building complex. Additional storage tanks will be provided at the ROM pads for daily filling of the mine vehicles. An on site fuel tank will refill these tanks. Double skinned storage tanks, which do not require bunding, may be used instead of standard tanks and bunded slabs.

Bulk quantities of oil and lubricants will be stored in storage tanks at the mine workshops. The lubricant storage area has been designed to provide separation between storage vessels and the edge of the bunded slab so that leaks can be contained.

Explosives and detonators will be stored in magazines according to DOIR standards. A separate facility will be constructed near the mining area to receive and store the ammonium nitrate required for blasting.

All hazardous waste, including unwanted or contaminated hydrocarbons and chemicals, will be removed from site and disposed of by a contractor to a licenced facility. Non reusable waste will be disposed of in an approved landfill site in accordance with relevant legislation and standards. Any recyclable materials will be collected separately from general industrial and domestic waste and transported off site for recycling.

4.4.2 Power Supply

A 53MW power station will located adjacent to the mine site. The power station will be gas fired and will use the highest efficiency technology possible for a demanding application in an isolated and heat affected area. The power station will be 24/7 operation and run with a high load factor. Large (4 – 8MW) reciprocating gas engines will be used. Power will be reticulated underground to the various consumption points on the mine site. Power will be reticulated to the accommodation village by overhead transmission lines. Power will also be used for the pumping of the slurry.

4.4.3 Accommodation Village

The operational workforce for the mining and processing operations, visitors, temporary staff and contractors will be accommodated in an accommodation village located approximately 3 km south of the minesite. 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 permanent village will be built around central facilities incorporating dry mess and kitchen, wet mess, common use and administration facilities, sport and recreational facilities and car/coach parking. The facilities will include sewage plant located 500m to the south west of the camp.

The mine site construction workforce will be housed at the Mt Gibson Gold Mine accommodation camp until the project camp is ready.

4.4.4 Realignment of Great Northern Highway and Airstrip

The Great Northern Highway will need to be realigned at some stage in the future to ensure a safe working distance between the pit and the highway. A decision on the optimal timing for realignment of the highway will be made in association with MRWA, DoIR and the Shire of Yalgoo. Figure 3 shows the proposed deviation of Great Northern Highway and the location of the airstrip.

The existing airstrip, which is located to the west of Great Northern Highway and north of Wannara Road, will need to be relocated to accommodate the proposed deviation of the Great Northern Highway and to comply with CASA requirements.

The new airstrip with associated taxiway south of Wannara Road has been planned to meet Civil Aviation Safety requirements and the topographical constraints of the area.

4.5 Transportation of Product / Services Corridor

4.5.1 Services Corridor

The magnetite concentrate will be transported as a slurry within a 450mm diameter steel buried pipeline from the minesite to Berth 5 at Geraldton Port, a distance of 280km. The hematite ore will be stockpiled at the mine until transport alternatives for the hematite have been fully evaluated. The transportation of the hematite will be the subject of a separate referral to the EPA for assessment of the environmental impacts.

The slurry pipeline will be located within a services corridor. The services corridor will also contain a 550mm return water pipeline from Geraldton Port to Three Springs, a 700mm return water pipe from Three Springs to Extension Hill, a 550mm water pipeline from the Tathra Borefield to the return water pipeline near Three Springs and a 200mm gas pipeline from MLV92 on the Dampier Bunbury Gas Pipeline to Extension Hill (Figure 5).

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.

All of the pipelines will be installed in the single services corridor. The width of the easement has been kept to the absolute minimum requirement (15m) in the pastoral section of the route by using the existing road as a construction platform (Figure 7a) 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 vegetation within the agricultural section of the route. Areas of vegetation have been avoided where possible.

The services corridor will take the form of an easement over freehold land and a Crown easement over crown lands (including pastoral leases). There has been extensive consultation with landholders regarding the services corridor, which is detailed in Section 6.

Once the pipelines are constructed the full land use will be regained by the landholder with minor restriction on aspects such as excavation, drilling and blasting.

Selection of Route

The route of the services corridor was selected to avoid disturbance of remnant vegetation, Aboriginal heritage areas, nature reserves, declared rare flora and fauna, residences, towns and sensitive facilities including hospitals and schools, potentially rocky areas, side slopes, minimise bends and in accordance with landholder preferences.

A preliminary pipeline route was selected using 1:250,000 topographic mapping and recent aerial photography applied to a GIS system. Buffer distances from farm buildings to the services corridor are well in excess of those recommended. Pumping stations are located a minimum of 4km from the nearest residences.

The route of the services corridor is not located within any existing or proposed nature reserves or national parks. The services corridor is located approximately 8km from the Burma Road Nature Reserve and 1.5km from the West Perenjori Nature Reserve. The water pipeline is approximately 4km from the Midlands Aboriginal Reserve, 7km from the Yarra Yarra Nature Reserve approximately 10km from the Wotto Nature Reserve and Tathra National Park (Figure 6). It is adjacent to the Dookanooka Nature Reserve, which is located approximately 5 km from the Tathra borefield and to the north of the water pipeline.

On ground verification was undertaken and minor modifications made to the route following flora, fauna and geotechnical assessments.

Route Description

In the pastoral section of the route the services corridor is located on the southern side of Wanarra Road, with minor deviations from the road to avoid populations of significant flora. The service corridor will cross Mongers Lake within the existing causeway on Wanarra Road and most likely will be constructed by Horizontal Directional Drilling (HDD) to minimise impacts.

Within the agricultural section of the route the services corridor will cross largely cleared agricultural lands from Mongers Lake to Perenjori, then east to the Midlands Highway, then northeast to Walkaway, Narngulu, before entering the Southern Transport Corridor to Geraldton Port (Figure 6).

The services corridor crosses the Irwin and Greenough Rivers. These crossings will be constructed by Horizontal Directional Drilling to minimise environmental and heritage impacts. In general, highway and railway crossings will be thrust bored to minimise disruption. While not crossing the Yarra Yarra Lakes, a salt lake system, the services corridor crosses a tributary of the Lakes at Simpson Road. The construction method in the vicinity of the tributary of Yarra Yarra lakes will be dependent on a detailed risk and engineering assessment. The crossing of the tributary of Yarra Yarra Lakes and Lake Monger will be within the causeways of Simpsons Road and Wanarra Road respectively and will not impact on or change surface flows in these areas.

Pipeline configuration

The layout of the slurry pipeline, water pipeline, return water pipeline and slurry pipeline within the easement is shown in Figure 7a & 7b. A number of factors were considered in defining the separation distances between the pipelines and the location of the pipelines in the construction right of way and the final easement including:

- Safe installation.
- Access for potential future repairs.
- Trench collapse.
- Segregation for operational use.
- Land use and underlying tenure.
- Maximum width of bucket wheel excavator trench (1350mm).
- Space for stockpiling vegetation, topsoil and trench spoil.
- Working space.
- Different ‘roping’ bending radii for steel and polyethylene pipe.
- Trench stability.
- Minimum cover of 1200mm in agricultural land, requiring a total trench depth of greater than 1750mm.

The pipelines will be buried throughout their length to a depth of 750-1200mm, depending on land use (Figure 7a, 7b), as dictated by the Pipeline Code and Industry Standards.

4.5.2 Slurry Pipeline

The slurry of iron ore fines (beneficiated magnetite) and water will be transported in a 450mm steel pipe 280km from the mine site to Geraldton Port.

The slurry is transported by pipeline to the port terminal at a solids concentration of about 65% by weight.

Two pumping stations will be required for the slurry pipeline. The pumping stations will be located at the mine site and adjacent to Simpson Road (approximately 20km north east of Three Springs) (Figure 6). The pumping stations will be powered by locally generated electricity to run pumps, control equipment and isolation valves. In the case of pump failure, a standby pump will automatically kick in without impacting on pumping. Should the standby pump fail, the line is immediately isolated and shutdown and pumping and flow ceases in all pumps.

The pump stations will be located within bunded sealed sumps with capacities sufficient to contain a design slurry runoff or overflow during maintenance events. The slurry water from these small maintenance emissions is allowed to evaporate and the iron ore fines are collected and trucked back to the mine or the port or to an approved disposal site. No mass discharges of slurry characterise slurry pipeline operation in the event of a failure.

4.5.3 Return Water Pipeline

The return water pipeline will run from Geraldton Port in the service corridor back to the mine. The return water will have the same characteristics as the slurry water and no further additives are required.

Production water from the mine water supply will be injected into the return water as top up water approximately 20km north east of Three Springs.

The diameter of the return water pipeline will be 550mm from Geraldton Port to Three Springs and 700mm from Three Springs to the mine. The pipeline will be constructed of HDPE.

The quality of the return water is similar to that of the groundwater obtained from the proposed borefield at Tathra, and poses no environmental threat.

There will be 7 pumping stations to pump the return water from Geraldton Port back to the minesite. Two of the pumping stations will be powered by mains power, four will be powered by gas and one will be powered by electricity from gas. The location of the pumping stations for the return water pipeline is shown in Figure 6.

4.5.4 Gas Pipeline

The gas pipeline will run from the Dampier Bunbury Natural Gas Pipeline (DBNGP) (from MLV92) in the service corridor to the minesite. The gas pipeline will be designed and constructed to AS2885 and the Australian Pipeline Code. Maximum operating pressure

will be within this design. A Hydrotest Management Plan will be documented to address sourcing, recycling and disposal of hydrotest water.

4.5.5 Bore Water Pipeline

Water for processing the magnetite will be sourced from a borefield at Tathra, 20km southwest of Three Springs, and will be transported by buried HDPE pipeline (550mm diameter) in a 20m corridor approximately 38km to Simpson Road, where it will enter the services corridor (Figure 6). The pumping station at the Tathra borefield will be powered by electricity from the main grid.

4.5.6 Construction

Construction practices and environmental management will comply with the Australian Pipeline Industry Association (APIA) Code of Environmental Practice and Code of Construction Safety.

There are 3 different pipelines of varying diameters and materials to be installed within the services corridor. Welding production rates for the steel and HDPE pipelines vary considerably due to the different materials and methods required and in turn affect the construction method to be adopted. Due to the varying construction methods and production rates, it is not practical that a construction crew to be involved in the installation of more than one pipeline at a time.

The pipelines will therefore be installed on a staggered basis, commencing with the construction of the gas pipeline, so that each pipeline will be installed in its trench and backfilled for a certain distance prior to the commencement of construction for the subsequent pipeline. This method provides the construction crews installing each pipeline with access to the full working width of the common Right of Way (ROW) and will therefore minimise the impact on landholders and the environment.

Pipeline crossings at major sealed roads and operating railways will be installed using a thrust bore technique. Unpaved roads will be crossed using an open cut construction method. The Greenough and Irwin Rivers will be crossed using horizontal direction drills (HDD). Specialised construction crews will install the thrust bored and horizontal direct drilled sections.

The construction of underground pipelines generally follows a prescriptive procedure involving:

- Clear and grade;
- Removal of topsoil;
- Trenching;
- Pipelaying; and
- Restoration.

The stages of pipeline construction are shown in Figure 8.

Vegetation within the services corridor will be removed where required for construction and safety purposes using a root rake or other machinery as required, and stockpiled at the side of the corridor for later respreading. Topsoil will be stripped from the trench area and stockpiled for later reuse.

Trenching will be undertaken to a depth that will be provide the necessary cover for the pipe required by the appropriate construction standards (AS2885), the pipeline code, service authorities and specific landowner requirements. Trench spoil will be stockpiled separately from vegetation and topsoil to avoid loss and/or mixing of these rehabilitation materials. Construction management is aimed at minimising the time between clearing, trenching and backfilling for environmental, safety and third party reasons.

The pipes will be transported to the site on public roads on road legal vehicles. Consultation will be undertaken with MRWA and local authorities regarding the road transportation of the pipe to minimise impacts on the public.

Lengths of pipe will be strung along the corridor and then welded or bonded. Pipe strings will be lowered into the trench onto appropriate bedding material, covered with suitable material and backfilled. The trench backfill is then compacted as required to minimise subsidence. Work areas are then re-profiled, ripped and scarified before respreading of topsoil and vegetation. All waste materials will be removed to an approved disposal site.

Following construction, the pipelines will be hydrostatically tested. The testing involves filling sections of the pipeline with water and increasing the pressure in excess of operating pressure. The total volume of water for testing will be less than $90m^3$ based on the volumes of the pipelines and water reuse. Water is then disposed of to an approved site for evaporation or recharge.

The construction workforce for the pipeline construction will be accommodated in 2 temporary camps located near Mingenew and Perenjori, with construction personnel operating out of site facilities established at Camp 1 before relocating to Camp 2 as construction progresses. The camp locations will be subject to a thorough site assessment to ensure no environmental or heritage impacts. The camp sites will be fully rehabilitated following completion of construction. The construction workforce undertaking work within the Geraldton area, including within the Geraldton Southern Transport Corridor, will be housed in Geraldton.

4.6 Water Supply

Significant quantities of water are required for processing of magnetite ore, washing of the magnetite concentrate, transportation of the slurry, washdown and for dust suppression around the mine and processing plant.

Demand for water has been reduced by capturing the filtrate water from the slurry at Geraldton Port and returning it to the minesite for reuse, by filtering the tailings to minimise water loss in the tailings to approximately 16% and by using the pit water for dust suppression, washdown and as a source for potable and domestic water (following treatment).

Annual demand volumes are estimated to be:

- Mineral processing and slurry transportation 2 Gl (5,424 m^3/day)
- Mine dust suppression & washdown 0.75 GL (2,055 m^3/day)
- Potable and domestic water 0.03 GL (80 m^3/day)

Process water and water for the slurry transportation will be primarily sourced from the Arrowsmith Groundwater Area at Tathra and supplemented by water obtained by drying of the tailings. Water for dust suppression and washdown will be sourced from dewatering of the pit. Domestic and potable water will be sourced from dewatering of the pit and treated in a Reverse Osmosis Plant.

4.6.1 Processing and Transportation Water

The processing operation will consume approximately 2.0Gl of good quality water per year for the grinding and magnetic separation stages of magnetite liberation, to 'wash' the concentrates clean of contaminating minerals and salts and for transportation. The magnetite will be transported as a slurry to Geraldton as described in Section 4.5.1, where it will be dewatered to 9% moisture content. The filtrate water will be 'captured' and returned to the minesite for reuse.

Process and transportation water will be obtained from a borefield into the Parmelia Aquifer within the Arrowsmith Groundwater Area located to the south west of Three Springs. The water table level in the Parmelia Aquifer ranges from 220mAHD to 230mAHD (140-150m below ground surface). Hydrological modelling undertaken by Water and Rivers Commission has shown the sustainable yield from the groundwater area to be 26GLpa (Aquaterra, 2005). The borefield will consist of 8 bores, with each production bore producing up to 2,000m^3/day and a standby bore. There are no licensed existing users within the 0.5m drawdown zone of impact. A copy of the Aquaterra Report is provided as Appendix 2.

The company has applied for a licence to extract 5.5GLpa under the *Rights in Water & Irrigation Act,* which is conditional on environmental approval for the project under the Environmental Protection Act (Appendix 3).

The water from the borefield at Tathra will be transported 38km by a buried pipeline to the services corridor near slurry pipeline pumping station on Simpson Road, approximately 20km north east of Three Springs (Figure 6), where it will be injected into the return water pipeline and pumped to the minesite.

4.6.2 Water for Dust Suppression, Washdown, Domestic and Potable Uses

Water from dewatering of the pit is expected to generate 2,500m^3/day (Rockwater, 2005b), which will be used for dust suppression and washdown, domestic and potable water (following treatment by reverse osmosis) and as process water.

The salinity of the groundwater underneath the pit ranges from 600 to 10,000mg/L TDS, significantly less than the salinity levels in the paleochannel to the east and north of Extension Hill (Rockwater, 2005d).

In the unlikely event that the pit dewatering yields insufficient water, an alternative water supply for dust suppression and washdown has been identified in the paleochannel located to the east and north of the pit. Initial hydrological investigations of the paleochannel by Rockwater (2005d) concluded that a borefield could be established approximately 10km the north of the mine which would yield 0.75GLpa of brackish to saline water (10,000 to 28,000mg/L TDS) for the life of the mine from 7 bores each yielding 300m^3/day.

An alternative supply for potable water has been located at approximately 50m below ground depth in fractured rock in the Mt Gibson hills.

4.6.3 Construction Water Supply

The dewatering of the pit will commence early in the development of the project and will supply water for construction activities at the minesite.

4.7 Operations at Geraldton Port

Operations at Geraldton Port are located at Berth 5, with the layout of facilities shown in Figure 9.

Once the magnetite slurry reaches Geraldton Port, the slurry will be discharged into 2 agitated slurry tanks with a combined live capacity of 8 hours of flow, or approximately 3,700m^3 located on Berth 5. The tanks provide a buffer between the operation of the filter plant and the operation of the slurry pipeline. Should the filter plant have any problems when the tanks are full, the slurry pipeline is shut down with slurry in the line. There is no need to empty the slurry pipeline. The slurry tanks will be constructed within a bunded area.

The slurry is pumped from the tanks to the filter plant. In the filter plant the slurry is distributed to vacuum filter units each containing rotating filter discs. The discs are covered with a filter cloth and a vacuum is drawn from inside the discs. The solids attach to the cloth and the magnetite cake is removed from the cloth by a scraper. The water (filtrate) is drawn through the cloth by the vacuum and pumped to a clarifier to remove fine magnetite particles and then to a tank before being pumped back to the mine (Figure 9). Any sediment is added to the magnetite cake concentrate in the storage shed for export. There will thus be no loss of slurry or water to the environment.

The magnetite cake, which has a moisture content of approximately 9%, is then transported to the covered storage shed on Berth 5 awaiting ship loading. Any excess water will be pumped to the tank for transport by the return water line to the mine site. Stormwater will be treated prior to discharge.

Although the moisture within the concentrate will be well above the level where dust is generated from the in-loading or out-loading operations, the magnetite shed will be equipped with water sprays as part of the dust management system. There will be a fume extraction and scrubbing system to manage exhaust fumes during the out-load operation.

The filter plant is constructed as a facility that adjoins the concentrate storage shed. After filtering the concentrate is placed directly onto the conveyor that places the concentrate into the stockpile within the storage shed. These conveyors are contained within the filter building and storage shed.

The concentrate will be loaded onto a conveyor in the storage shed by front end loaders and transported on conveyors to a dedicated ship loader on Berth 5 capable of loading Panamax size vessels (60,000DWT). The ship loader will be capable of loading at a maximum rate of 4,000 tonnes per hour and a normal loading rate of 3,500 tonnes per hour. The ship loader will be fed by covered conveyor belts from the storage shed. The ship loader travels along the wharf to reach all the vessel holds.

The ship loader is supported on rails that are part of a piled support structure at the rear of the berthing dolphins. Mooring may be by mooring dolphins or land based moorings.

No dredging is required for the construction of the ship loading facility for the magnetite concentrate and the project will have no impact on sea grass.

All transfer points on the conveying system will be covered and fitted with water sprays that can be initiated should dust be generated as a result of unforseen circumstances causing loss of moisture content. All conveyors will be covered.

Power for the material handling and shiploading operations at Geraldton Port will be supplied from the main grid.

No fuel will be stored on site. Fuel will be delivered directly to the equipment (front end loaders) by mobile tankers or the vehicles will be fuelled off site. The workshop facilities will have a concrete floor and will be fitted with a hydrocarbon collection system. No wash down facilities will be provided.

The magnetite concentrate storage shed will be designed to withstand storm surges in accordance with building standards.

5. EXISTING ENVIRONMENT

5.1 Climate

The Mt Gibson Iron Or Mine and Infrastructure is located within two major climatic regions.

Mt Gibson experiences a semi-desert Mediterranean climate. This climate type is characterised by hot, dry summers with 9-11 months of dry weather and mild, wet winters (Payne *et al.*, 1998). The average annual rainfall for Paynes Find is 283mm and for Ninghan Station is 293mm (Bureau of Meteorology, 2005). Almost 70% of the annual rainfall falls 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 27.9°C, that ranges from 18.4°C (July) to 37.1°C (January).

On the coast, Geraldton experiences an extra-dry Mediterranean climate (Payne *et al.*, 1998) that 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 for Geraldton (Bureau of Meteorology, 2005). Approximately 75% of the total annual rainfall falls between May and October mostly as a result of the passage of cold fronts from the south. The small amount of summer rainfall is usually associated with thunderstorms associated with northerly low pressure systems. The average monthly maximums range from 19.5°C (July) to 32.6°C (February).

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. Wind strength is significantly stronger in all seasons closer to the coast.

5.2 Land Systems

Land system mapping of the Sandstone-Paynes Find area which covers the Mt Gibson Iron Ore Mine and Infrastructure Project has been prepared by the WA Department of Agriculture (Payne *et al.*, 1998). These are broad units that each consist of a series of land units that occur on characteristic physiographic types within the Land System.

The services corridor passes through five Land System units:

1. breakaways, stony plains and sandy surfaced plains on granite with mulga shrublands and minor halophytic shrublands;

2. plains with gritty surfaces and low tors and domes on granite with *Acacia* shrublands;

3. sandplains with *Acacia* shrublands, mallees and heath;

4. plains with deep sandy soils supporting *Acacia* shrublands and occasionally with wanderrie grasses; and

5. plains with minor calcrete inclusions with *Casuarina-Acacia* shrublands and Eucalypt woodlands.

There is also a limestone belt occurring along the coast that consists of rocky ridges, gently sloping soil-covered areas, alluvial flats and lagoons with *Acacia* dominated shrublands and *Banksia* scrubland (Beard & Burns, 1976).

The mine site is located within the Tallering Land System which consists of prominent ridges and hills of banded ironstone, dolerite and sedimentary rocks.

5.3 Geology, Topography and Soils

5.3.1 Regional Geology, Topography and Soils

Most of the area lies within the Archaean Yilgarn Craton (Payne *et al.*, 1998). The Archaean rocks comprise linear to arcuate, north to north-west tending greenstone belts, which have been intruded by granitoid rocks. Overlying the basement rocks, in particular along the palaeodrainages (that are now salt lakes), are alluvial, colluvial, aeolian, lacustrine and calcrete deposits of Cainozoic age (Payne *et al.*, 1998).

The western edge of the continent has subsided considerably, carrying down the Archaean rocks, and younger Proterozoic rocks overlay them to form the Perth Basin. The Basin was submerged and accumulating sediments throughout the Palaeozoic and Mesozoic eras, but sedimentation ceased at the end of the Cretaceous period. An additional feature in the Geraldton area is the Northampton Block, a pile of Proterozoic rocks which did not completely subside with the Perth Basin or was re-elevated by faulting, so that it formed an island in the Basin until the later Mesozoic time when it was finally covered by a thin sequence of flat-lying Jurassic and Cretaceous rocks.

The coastal soils run in a narrow strip parallel to the coast coinciding with the coastal and dune and limestone formations (Beard & Burns, 1976). In a large area inland of these coastal soils, are found soils formed of deep coherent sands characteristic of riverine plains, terraces and pans with shallow, stony sands and loamy soils.

Below the outcrops, colluvial slopes and peneplains give way to broad plains carrying sheet flow down extremely shallow gradients (Payne *et al.*, 1998). These wash plains consist of alluvium derived from pallid zone materials of the lateritic profile and partly weathered granite, gneiss and greenstones. Soil derived from granitic areas is generally siliceous with increasing clay content with depth, while the greenstone-based soils are finer textured and occasionally contain fine ironstone gravels. Deep accumulations of sand as banks of soil occur intermittently on some wash plains. A siliceous brown-hardpan occurs throughout most of the Wheatbelt region. It is almost a continuous layer varying from 1 to 30m in depth underlying many soils. The pan is often at a depth of 30 to 70cm but may be exposed on some shallow hardpan plains and especially in drainage channels (Payne *et al.*, 1998).

5.3.2 Project Geology

Extension Hill is part of a prominent folded ridge of Banded Iron Formation (BIF). The ridge includes Mt Gibson, which attains an elevation of 451AHD, Iron Hill (420AHD), Extension Hill South (425AHD) and Extension Hill (440AHD). Away from the folded ridge, the land has low topography at elevations of 320 to 360mAHD.

The Mt Gibson Range forms part of the Retaliation Belt, which contains successions of mafic volcanics and a sedimentary sequence dominated by banded iron formation (BIF) and chert, with subordinate felsic tuff and agglomerate, and semipelitic schist. The geology of the Mt Gibson area consists of a sequence of Archaean sediments and volcanics (Figure 10).

The western volcanic unit is metabasalt and this extends from the highway to the east for 100-200m, thickening to the south. The basalt is overlain by quartzose sand 1-3m thick, and the basalt is slightly weathered below, rapidly becoming fresh and hard. The next unit to the east is a volcano sedimentary sequence of chert and schist, which may have been originally a waterlain tuff. This unit is deeply weathered to kaolinite and chert to a depth of up to 70 metres, but then rapidly becomes fresh schist and chert over a short distance. The dip is subvertical. This unit is also overlain by sand cover to 2-3metres, and near the hills, a thin layer of Fe cemented BIF/hematite scree occurs, tapering out from the hills.

The Mt Gibson BIFs are jaspilitic and generally well banded, comprising interlayered black hematite- and/or magnetite-rich bands, red jasper bands, white chert bands and very minor sulphides. The BIF have a sub-vertical dip, with minor variations associated with folding, and possibly post-depositional dilation and slumping. The lateral extent of the BIF sequence varies, however widths of the order of 200-250 metres are common, with maximum development occurring at Mt Gibson in a series of large parasitic folds. Aeromagnetic data suggests a depth extent of at least 500m. The BIF strata have been altered in some areas to crosscutting massive magnetite/ silicate, which may be due to dewatering structures during diagenesis. Further alteration also occurs at Extension Hill where areas of carbonate replacement of the chert bands occur. These carbonates comprise a variety including calcite, dolomite, ferroan dolomite and siderite.

Hematite and goethite replace magnetite in weathered zones, forming localised lenses of secondary enrichment. The BIF is succeeded to the east by a thick sequence of metabasalt, which continues for hundreds of metres to the east.

The sediments and volcanics were intruded to the west by a large granitic batholith, which has upturned the sequence to subvertical. Major faulting has caused the BIF to be broken into a range of separate hills separated by faults. Iron Hill East and Mt Gibson have been moved a considerable distance to the north by strike slip faulting. The faults are water filled. Several dolerite dykes of probable Proterozoic age have intruded the faults. Tertiary alluvial deposits have been deposited in channels to the east of the range, and are a source of hypersaline water.

5.4 Surface Drainage

5.4.1 Minesite

Surface drainage in the Mt Gibson area is primarily characterised by ephemeral flows. An ephemeral drainage line flows from Iron Hill North in a south easterly direction to 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.

Lake Karpa, which has been used by Oroya Mining to discharge hypersaline water from dewatering of the Mt Gibson Gold mine, is located 14km south south-east of the minesite. Due to the construction of a bund around the lake, Lake Karpa only receives water from direct rainfall (Rockwater, 2005b)

The paleochannel drainage systems of Lake Moore and Mongers Lake are located 30km to the east and 40km to the west of the minesite respectively.

Hydraulic modelling using 1 in a 50 year annual rainfall event (ARI) was used to assess the surface hydrology of the mine site area. The area of the proposed mine contains 3 catchments (Figure 11). The first catchment has an area of 5km^2 and a length of 2.1km. During a big flood event, the combined runoff from several local runoff paths eventually flows as a wide sheet flow in a S-SE direction. The second catchment has an approximate area of 1.6km^2 and a length of 1.3km. The bigger flood event runoff from several small contributing catchments eventually discharges as sheet flow in a northerly direction. The third catchment area discharges in a general south-westerly direction though a series of minor steep creeks. As the slope flattens, these creeks rapidly disappear. After infiltration and other losses, the remaining discharge flows in a southerly direction as a wide sheet flow (Rockwater 2005c) (Appendix 1).

5.4.2 Service 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 (Figure 6).

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

5.5 Groundwater at the Minesite

The Mt Gibson hills are a prominent folded ridge of Banded Iron Formation. The ridge includes Mt Gibson which reaches an elevation of 451m AHD. Away from the ridge, the land has low topography at elevations of 320 to 360m AHD. Southerly drainage of runoff water from the ridge is to a large claypan about 2km sq lying 2 km south of Mt Gibson. Northerly drainage is to a broad north trending channel with no defined water course, this drainage leads to the Lake Monger paleo-drainage system, 30km to the north of Extension Hill. Alluvial deposits in the surrounding areas contain large groundwater supplies in specific locations, particularly in the sediment filled paleochannel within the broad topographic channel passing to the east of Mt Gibson and running northwards to Lake Monger (Rockwater, 2005a)

Groundwater occurs in small quantities in the bedrock in the Extension Hill area, with moderate quantities contained locally in fractured BIF. The bedrock groundwater is brackish, with salinities of about 3,000mg/L TDS (Rockwater, 2005a) (Appendix 1).

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. Rainfall in the area averages 280mm pa (based on Paynes Find, 60km to the north east) (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 Mt Gibson Gold Mine has an established borefield utilising water from the aquifer. The hydraulic conductivity of the alluvial channel is about 0.0009 (Rockwater, 2005a).

5.6 Tathra Sub Area Groundwater Investigations

Process and transportation water will be obtained from a borefield within the Arrowsmith Groundwater Area located to the south west of Three Springs (Figure 6).

Groundwater conditions in the Tathra Sub Area were extensively investigated by Aquaterra (2005). Investigations involved geological studies, drilling, aquifer testing and the

development of a model of the groundwater system. A copy of the hydrogeological report for Tathra borefield is provided as Appendix 2.

The north Perth Basin is a major sedimentary basin that hosts several significant aquifers. The Parmelia Formation, a significant aquifer, is located within the north Perth Basin and is overlain by the Leederville Formation (also a significant aquifer). The Leederville and Parmelia Formations are in hydraulic connection and are collectively referred to as the Parmelia formation. The Parmelia aquifer is bound to the east by the Darling and Urella faults and to the west by the Dandaragan Scarp. Local perched aquifers are associated with the sandplain.

The interpreted water table for the Parmelia aquifer is approximately 230AHD (140m below ground level.

Recharge is by direct rainfall infiltration. Water level rises in the Parmelia aquifer (in the order of 6m over a 30 year period) are attributed to clearing of native vegetation resulting in greater infiltration of rainfall. The DoE Arrowsmith Groundwater Management Plan estimates recharge to the Tathra Sub Area to be in the order of 37GLpa.

Groundwater flow in the aquifer is from south to north, towards the Arrowsmith River which forms the main outlet for groundwater discharge for the area and to the east and west away from the mound in the south. Springs occur at the western edge of the Darling Scarp where the topography cuts into the Parmelia aquifer water table at 210-220AHD.

Water from the Parmelia aquifer is of good quality, with total dissolved salts approximately 1,100mg/L. The pH is slightly acidic (6.4). Analysis of water quality from a test bore at Tathra is provided in Table 5.

Hydrological modelling undertaken by Water and Rivers Commission has shown the sustainable yield from the groundwater area to be 26GLpa (Aquaterra, 2005). The licensed groundwater abstraction in the Dandaragan Sub Area from the Parmelia aquifer is approximately 3.3GLpa. A further 2GLpa is reserved for public drinking water within the proposed Tathra Sub Area which will replace the Dandaragin area once proclaimed.

TABLE 5
GROUNDWATER QUALITY AT TATHRA

Analyte	Measure	Unit
pH	6.4	pH
EC	1800	uS/cm
TDS	1100	mg/L
Fe (soluble)	2.0	mg/L
Total FE	5.1	mg/L
Na	260	mg/L
K	17	mg/L
Ca	3.1	mg/l
Mg	36	mg/L
Hardness ($CaCO_3$)	160	mg/L
Cl	440	mg/L
SO4	54	mg/L
C03	<1	mg/L
HCO3	20	mg/L
Total Alkalinity	15	mg/L

5.7 Biological Context of Study Area

The route of the services corridor crosses through three IBRA Bioregions (Figure 12). 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.

The Avon Wheatbelt Bioregion is an area of active drainage dissecting a Tertiary plateau in Yilgarn Craton (McKenzie *et al.*, 2003). The vegetation consists of proteaceous scrub-heaths rich in endemics on residual lateritic derived sandplains and mixed eucalypt, *Allocasuarina huegeliana* and Jam-York Gum woodlands on Quaternary alluvials and eluvials.

The Geraldton Sandplains (Geraldton Hills subregion) bioregion incorporates the southern end of the Carnarvon Basin and northern end of the Perth Basin and is recognised as a Biodiversity Hotspot. It comprises mainly proteaceous shrub-heaths rich in endemics on the sandy earths of an extensive undulating and lateritic sandplain mantling Permian to Cretaceous strata (McKenzie *et al.*, 2003). The region is rich and diverse in flora with high endemism.

The Yalgoo Bioregion is an interzone between southwestern bioregions and Murchison. It is characterised by low woodlands to open woodlands of *Eucalyptus, Acacia* and *Callitris* on red sandy plains of the Western Yilgarn Craton and southern Carnarvon Basin (McKenzie *et al.*, 2003). The region is rich and diverse in fauna; however, most species are wide ranging and usually occur in at least one adjoining region.

The mine site and associated infrastructure is located within the Ancient Drainage Subregion of the Avon Wheatbelt Interim Bioregion (Thackway and Cresswell, 1995). 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 minesite and associated infrastructure is located near the junction of the Avon Wheatbelt, Yalgoo

and Coolgardie Interim Bioregions (Thackway and Cresswell, 1995) (Figure 12). As a consequence the floristic composition of the area is considered to be representative of all three Bioregions.

5.8 Conservation Estate

There are a number of small Nature Reserves within the region including West Perenjori, Dookanooka, Yarra Yarra Lake, Mingenew, Burma Rd, East Yuna, Bindoo Hill, Yardanogo and Buntine Nature Reserves. The route of the services corridor was selected to avoid all Nature Reserves. (Figure 6).

The southern boundary of Karara Station, which is managed by CALM for conservation purposes, is located 5km to the north of the services corridor approximately 50km to the east of the mine site.

While not part of the Conservation Estate, the properties adjoining the mine site are managed by private organisations for conservation purposes. The Australian Wildlife Conservancy (AWC) manages the Mt Gibson pastoral lease with the emphasis on habitat recovery for fauna reintroduction. White Wells Station (now named Charles Darwin Reserve) is managed by the Australian Bush Heritage Fund (ABHF). The Ninghan pastoral lease is owned by the Pindiddy Aboriginal Corporation (PAC). A portion of Ninghan has been identified as an Indigenous Protection Area (IPA) with the management objective for the area being income based on conservation activities rather than pastoral activities (Vital Options Consulting, 2004) (Figure 13).

5.9 Vegetation and Flora

5.9.1 Vegetation Surveys

A number of vegetation and flora surveys have been previously conducted in the Mt Gibson area (i.e. Muir Environmental 1995, Bennett 2000, Paul Armstrong & Associates 2004, ATA Environmental 2004 and ATA Environmental 2005e) (Appendix 4).

The subregional significance of the floristic communities on the BIF at Mt Gibson project area and on BIF hills within 20km of Mt Gibson was also assessed (Griffin, 2005) (Appendix 4).

A number of flora and vegetation assessments have been undertaken of the route of the services corridor. Paul Armstrong & Associates (2004) included vegetation mapping along the eastern portion of the proposed slurry pipeline. Vegetation mapping for the western portion of the pipeline within the Southern Transport Corridor was undertaken by Connell Wagner (2000). ATA Environmental undertook a flora and vegetation assessment of the services corridor from Mt Gibson to Geraldton Port (ATA Environmental, 2005f) (Appendix 5).

5.9.2 Vegetation Communities

Regional Mapping

Beard (1976) mapped the vegetation of the Murchison Region at a scale of 1: 1,000,000. The mine site of the Mt Gibson Iron Ore Project 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 *Acacia* low woodland and the *Eucalyptus* medium height woodland on the lower slope soils. The Avon Botanical District is characterised by low shrubs and heath on the sand plain, *Acacia- Allocasuarina* thickets on ironstone gravels, woodlands of York Gum (*Eucalyptus loxophleba*) Salmon Gums *(Eucalyptus salmonophloia*) and Wandoo (*Eucalyptus wandoo*) on loam soils and halophytes on saline soils. The Austin Botanical District is characterised by Mulga (*Acacia aneura*) low woodland on the plains and shrubs on the hills with Eucalyptus spp and *Triodia basedowii* on the sandplains.

According to Beard's (1976) mapping there are four vegetation associations represented in the Mt Gibson project area.

- Sclerophyll Woodland of predominantly York Gum (*Eucalyptus loxophleba*) and Salmon Gum (*Eucalyptus salmonophloia*). Approximately twenty-eight percent (or 266,619ha) of the Pre-European extent of this vegetation association remains in Western Australia (Beeston *et al.*, 2002).

- *Acacia/Casuarina/Melaleuca* Thickets. One hundred percent (or 8,517ha) of the Pre-European extent of this vegetation association remains in Western Australia (Beeston *et al.*, 2002).

- Mixed Acacia Thickets on Sandplains. Approximately ninety percent (320,787ha) of the Pre-European extent of this vegetation association remains in Western Australia (Beeston *et al.*, 2002).

- *Acacia ramulosa/Acacia acuminata* Shrublands. Approximately ninety-six percent (or 704,710ha) of the Pre-European extent of this vegetation association remains in Western Australia (Beeston *et al.*, 2002).

Based on mapping of the Sandstone-Yalgoo-Paynes Find area undertaken by Agricultural Western Australia (Payne et al, 1998), there are five land system units within and in the immediate vicinity of the Mt Gibson project area; Tallering, Moriarty, Illaara, Pindar and Joseph, which are shown in Table 6.

TABLE 6
LAND SYSTEM UNITS IN THE MT GIBSON AREA

Land System Unit	Description
Tallering	Hills with Mixed Shrublands *Tallering* Prominent ridges and hills of banded ironstone, dolerite and sedimentary rocks with mixed shrublands.
Moriarty	Stony plains and lower alluvial plains with predominantly saline soils and halophytic shrublands *Moriaty* Gently undulating stony plains, low rises with limonite and alluvial plains supporting Salmon Gum, Gimlet, and Goldfields Blackbutt woodlands with halophytic and Acacia shrublands.
Illaara	Plains with deep sandy soils supporting acacia shrublands and occasionally with wanderrie grasses *Illaara* Gently undulating plains and occasional low rises with mantles of ironstone gravels supporting Acacia Casuarina shrublands.
Pindar	Plains with minor calcrete inclusions with casuarina-acacia shrubland or eucalypt woodlands. *Pindar* Level plains with Eucalypt woodlands, surrounded by sandplain supporting Acacia shrublands.
Joseph	Sandplains with acacia shrublands, mallees and heath. *Joseph* Undulating yellow sandplain supporting very dense and diverse shrublands with some mallees, sedges and Spinifex.

Vegetation at Minesite

Bennett (2000) identified 24 vegetation associations in the Mt Gibson project area including five woodland associations, four Mallee associations, 12 thicket associations and 2 health associations.

Supplementary vegetation and flora survey of two areas to the west of Great Northern Highway and one area to the east of Extension Hill that were not surveyed by Bennett was undertaken by ATA Environmental (ATA Environmental 2005e), who identified a total of 35 vegetation associations. The supplementary mapping by ATA Environmental was undertaken at a finer level of detail than the Bennett mapping but where possible the vegetation associations of Bennett and ATA Environmental were reconciled.

The vegetation associations identified by Bennett and ATA Environmental are shown in Figures 15a and 15b.

None of the vegetation associations described from the Mt Gibson project area by ATA Environmental (2005e) or Bennett (2000) are classified as TEC's as described by English (2002) or are listed as TECs under the *Environmental Protection Biodiversity Conservation Act* (1999).

Given the coarse scale of Beard's and Payne's mapping, the significance of the floristic communities on the BIF at Mt Gibson and on BIF hills within 20km was assessed (Griffin, 2005). This assessment was based on analysis of floristic data collected from Mt Gibson and surrounding areas surveyed in accordance with CALM's methodology for sampling Banded Ironstone Formations in the Yilgarn. The analysis found that at a sub-regional scale the Mt Gibson area contains floristic communities that are distinct from those in the other areas sampled (Figure 14a and b). There is also variation in the floristic composition of vegetation within the Mt Gibson area. Whether these differences imply that the communities occurring at Mt Gibson are regionally significant cannot be definitively determined as the results from the recent Yilgarn regional surveys conducted by CALM are yet to be published. However the variation in representation of communities both within and outside of the project area is consistent with the variations in vegetation communities found at the Portman Limited Koolyanobbing Iron Ore Expansion Project (Ecologia, 2002).

One hundred permanent 20m x 20m quadrats on areas of BIF both in and within a 20km radius of the Mt Gibson project area were surveyed in Spring 2005 using CALM's methodology for surveying BIF in the Yilgarn to identify potentially restricted floristic communities. PATN analysis (i.e. clustering analysis) was used to identify potentially restricted floristic communities on BIF both in and within a 20km radius of the Mt Gibson project area. Floristic data used in the analysis was collected in Spring 2005 from 100 permanent 20m x 20m quadrats located on the ridges and side slope of BIF formations. The analysis indicated that at a sub-regional scale the Mt Gibson area contains communities that appear to be distinct from those in the other areas sampled (Griffin, 2005) (Figure 14b).

There is also local geographic-related variation in the floristic composition of vegetation within the Mt Gibson area. These differences may be related to the local ridge features which have broadly been recognised in the structural vegetation mapping prepared for the area by Bennett, (2000). The ridges of Extension Hill and Extension Hill South largely contain communities different from the other areas. Iron Hill and Iron Hill East have some similarities but these appear to be more in the vegetation related to the colluvium and less prominent ridges (Griffin (2005) (Figure 14a).

Extension Hill appears to have a geographically definable division within it reflecting differences in the distribution of plant communities. The northern portion contains several communities which are largely not represented in other areas. The southern part is more similar to the Extension Hill South area and to a lesser degree, Iron Hill and Mt Gibson. Six of the twenty floristic communities (Group 40 group) mapped for the Mt Gibson area were assessed as occurring only within the Extension Hill project area (Griffin 2005). The area of each of the twenty floristic communities in the Mt Gibson area is shown below in Table 6a and in Figure 14a.

TABLE 6A
AREA OF FLORISTIC COMMUNITY TYPES (GROUP 40 GROUPS) AT MT GIBSON

Floristic Community Type Number	*Area of FCT proposed to be disturbed at Extension Hill (m^2)	*Total area of FCT in Mt Gibson Area (m^2)	% of total area of FCT proposed to be disturbed
G1	40826	40826	100
G2	35666	35666	100
G3	81066	81066	100
G4	57924	215778	27
G5	39337	57098	69
G6	0	69423	0
G7	0	32067	0
G8	35660	35660	100
G9	5174	5174	100
G10	72494	72494	100
G11	28665	122038	23
G12	81586	81586	100
G13	22886	57988	39
G14	0	8916	0
G16	47102	138973	34
G17	0	18374	0
G18	0	8147	0
G19	0	17078	0
G20	0	8649	0
Total	**548386**	**1107001**	**49**

* Area should be considered indicative only
Floristic Communities are described in Griffin,2005

Vegetation on Services Corridor

The route of the services corridor was selected to minimise the impacts on native vegetation, and species of conservation significance. Within the agricultural portion of the alignment, the service corridor will cross largely cleared agricultural lands. The preliminary route was selected using recent aerial photography applied to a GIS system, with modification to the route made following on-ground flora assessments.

The majority of the route of the services corridor between Mt Gibson and Geraldton Port is on cleared agricultural land. A total of 82 vegetation communities were recorded along the proposed slurry pipeline route (ATA Environmental, 2005f). 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 (Figure 12). A total of 33 of the 82 communities identified were adapted from previous vegetation mapping of portions of the services corridor undertaken by Paul Armstrong & Associates (2004) and Connell Wagner (2000). The remainder of the vegetation communities were identified and mapped by ATA Environmental (ATA Environmental 2005f).

None of the vegetation communities along the route of the services corridor are listed as Threatened Ecological Communities (TEC) on CALM's TEC database, nor listed as a TEC under the EPBC Act (1999) (ATA Environmental, 2005f).

Vegetation Condition

Minesite

Very few introduced flora (21) were recorded in the Mt Gibson project area. The majority of introduced flora were recorded from the former gold mine at Harps Mine (Bennett, 2000), which at 4km to the south, is well outside the area of Mt Gibson tenement holdings (Figure 3a).

Vegetation condition associated with the supplementary survey area (ATA Environmental 2000e) ranged from Good to Excellent according to condition rating scale condition rating scale devised by Keighery and described in Bush Forever (Government of Western Australia, 2000).

Services Corridor

The route of the services corridor was selected and realigned to minimise adverse impacts on native vegetation.

According to the condition scale rating used in Bush Forever, the condition of the vegetation within the services corridor ranged from Very Good to Completely Degraded, with the majority of the vegetation within the corridor Completely Degraded due to extensive clearing for agriculture. The vegetation within the pastoral section of the services corridor is predominately in Very Good condition as it consists of vegetation that has been relatively undisturbed. The condition of the vegetation in the agricultural section of the route ranges from Good to Degraded due to its altered structure and presence of aggressive weeds (ATA Environmental, 2005f).

Flora

Minesite

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 that were not surveyed by Bennett (2000) recorded a total of 193 plant species, including 192 native species (ATA Environmental, 2005e).

Services Corridor

A total of 215 plant taxa was recorded on the route of the services corridor. Of these, 199 are native species and 15 introduced. The list consists of two Gymnosperms, 21 Monocotyledons and 189 Dicotyledons. The families with the greatest representation of species were the Myrtaceae (Eucalypt family - 45 species), Mimosaceae (Wattle family – 16 species, including one introduced), and the Proteaceae (*Banksia* family – 15 species). The largest representation of species was recorded for the Eucalypts (19 species), Wattles (16 species) and *Melaleuca* (11 species) (ATA Environmental, 2005f).

The total number of taxa along the route is low considering the large distance the pipeline route covers, due to the large proportion of the proposed slurry pipeline 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 has been altered significantly by human disturbance.

Significant Flora

Mine site Area

According to CALM's Rare Flora databases, 37 Declared Rare and Priority listed species have been recorded from general vicinity of the Mt Gibson project area (Table 7).

TABLE 7
CALM LIST OF DECLARED RARE AND PRIORITY FLORA PREVIOUSLY RECORDED FROM THE VICINITY OF MT GIBSON

Conservation Classification	*Taxa*
DRF	
	Acacia imitans
	Cyphanthera odgersii subsp. *occidentalis*
	Darwinia masonii
	Eucalyptus cruces subsp. *praecipua*
	Eucalyptus synandra
	Hybanthus cymulosus
	Pityrodia axillaris
Priority 1	
	Acacia cerastes
	Acacia unguicula
	Allocasuarina tessellata
	Baeckea sp. Paynes Find
	Chamelaucium ?sp. Yalgoo (Y Chadwick 1816)
	Dodonaea sp. Ninghan (H Demarz 5121)
	Gnephosis setifera
	Grevillea subtiliflora
	Micromyrtus cuensis
	Micromyrtus racemosa var. *muconata*
	Leptospermum exsertum
	Philotheca nutans
	Rhodanthe collina
	Thryptomene ninghanensis
Priority 2	
	Acacia synoria
	Baeckea sp. Perenjori (JW Green 1516)
	Persoonia pentasticha
Priority 3	
	Acacia acanthoclada subsp. *glaucescens*
	Calytrix uncinata
	Cryptandra imbricata
	Goodenia perryi
	Grevillea asparagoides
	Grevillea eriobotrya
	Grevillea granulosa
	Grevillea scabrida
	Podotheca uniseta
	Psammomoya implexa
	Verticordia insignis subsp. *eomagis*
	Verticordia venusta
Priority 4	
	Grevillea rudis

Two gazetted rare flora (WA legislation) *Darwinia masonii* and *Eucalyptus synandra* listed as vulnerable under the Commonwealth EPBC Act (1999) were recorded from the area. Other significant flora recorded from the project area included *Acacia cerastes* (P1), *Chamelaucium* sp Yalgoo (P1), *Persoonia pentisticha* (P2), *Grevillea scabrida* (P2) and *Acacia acanthoclada* subsp *glaucescens* (P3) (Figure 16a).

The project will not impact on the populations of *Eucalyptus synandra* (DRF), *Chamelaucium* sp Yalgoo (P1), *Persoonia pentisticha* (P2), *Grevillea scabrida* (P2) and *Acacia acanthoclada* subsp *glaucescens* (P3) (Figure 16a).

Rhodanthe collina (P1) has been previously recorded from Mt Gibson but was not recorded by Muir Environmental (1995), Bennett (2000), Paul Armstrong & Associates (2004) nor ATA Environmental (2005e).

***Darwinia masonii* (DRF)** 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, *Darwinia masonii* is likely to respond opportunistically to rainfall events (i.e. tropical cyclonic summer rainfall events and southern winter cold fronts).

There was no evidence of *D. masonii* resprouting from rootstock following fire in the Mt Gibson Ranges (Paul Armstrong and Associates, 2004), contrary to comments by Brown *et al.* (1998). In fact the species appears to be fire sensitive. A wildfire burnt out a significant area in southern and eastern portions of the Ranges in January 2003. None of the *Darwinia masonii* plants burnt during this fire were observed to have survived during spring 2003 by Armstrong and Associates, 2004). Regeneration appears to be restricted exclusively to seed (ATA Environmental, 2004).

Based on field observations and the fact that many bird species are attracted to colourful inflorescences with potential sources of nectar, *Darwinia masonii* is most likely to be pollinated by birds.

Darwinia masonii has a restricted distribution, and is generally only found on the slopes (350m+ ADH), crests and ridges over the 6km length of the Mt Gibson Ranges. Areas with similar geology (banded ironstone formation or chert) and vegetation including hills west of Mt Singleton and south of Ninghan Station; hills north of Ninghan station, hills west of Warro Well; hills south of Warro Well; and Yandhanoo Hill were surveyed by Paul Armstrong & Associates (2004) but no additional populations of the species were located.

Nine discrete populations of *Darwinia masonii* were recorded from the Mt Gibson ranges, with a total population of 14,307 adult plants and 1,725 seedlings (Figure 16a) (ATA Environmental, 2004). *Darwinia masonii* was most abundant on the hill tops and upper slopes of the Mt Gibson Ranges. The most significant populations were recorded from the T3, T6 and HS1 vegetation communities occurring on the crest and east-facing slopes of Mt Gibson. In the majority of locations from where *Darwinia masonii* was recorded, the soil was 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). This is consistent with previous observations by Muir (1995) and Paul Armstrong and Associates (2004).

The Botanic Gardens and Parks Authority (BGPA) genetics laboratory investigated the genetics of the Mt Gibson *Darwinia masonii* populations. This has involved the sampling plants from four of the subpopulations along the Mt Gibson range, using the multilocus the DNA fingerprinting technique Amplified Fragment Length Polymorphism (AFLP). The method is very efficient at detecting variation between individuals, and is one of the most sensitive techniques available for population genetic analysis. Levels of AFLP variation within *D. masonii* were found to be very low relative to species of the related genus *Chamelaucium.* This is consistent with the hypothesis that *D. masonii* may have been through a population "bottleneck" at some time in the recent past. Standard population genetic statistics suggest that the whole Mt Gibson area can be treated as a single provenance unit for *D. masonii* (Botanic Gardens & Parks Authority, 2005). A copy of the Botanic Gardens & Parks Authority Report is provided as Appendix 4.

Further research aimed at ensuring long-term integrated conservation of *D. masonii* is being undertaken by BGPA and funded by MGM including:

- the reproductive biology and factors limiting reproductive success in situ;
- factors limiting the distribution of *D. masonii* (especially ecophysiology);
- seed and germplasm storage ex situ; and
- methods for successful translocation and re-establishment of *D. masonii.*

As part of this research, BGPA undertook a trial reintroduction of *D. masonii* at Iron Hill East, with plants grown from cuttings planted out on site in June 2005. To date, 209 of the 211 cuttings planted have survived.

***Eucalyptus synandra* (DRF)**. The known distribution of *Eucalyptus synandra* is restricted to the northern Wheatbelt from Morawa to near Koorda and east to Karroun Hill and north east to Beacon. There are 24 known populations, including 2 populations near Mt Gibson. It is small mallee which is reported to flower in February. The species was located in the Mt Gibson area in the col 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 & Associates, 2004). The species will not be impacted by mining.

***Acacia cerastes* (P1)** is a low tangled glabrous apparently leafless shrub, growing 0.5 to 1.5m tall with a spread to 2m in diameter. The species has a known distribution from the following locations: Mt Gibson and Mt Singleton (CALM 2004) where it occurs on rocky hills (Maslin, 2002). Bennett (2000) also recorded the species along tracks on Mt Gibson station and the emu farm. Maslin (2001) describes *Acacia cerastes* as a much-branched, intricate, glabrous shrub growing to 1.5m high. The branchlets are tortuous, terete, striate, green or brown in colour. The inflorescences are rudimentary on peduncles 3 to 4mm long with globular golden heads. CALM records indicate there are 11 populations of *Acacia cerastes*. Of these populations at least five, those recorded by Bennett (2000), are in the general area of the project, near the Mt Gibson Range. A small population of approximately 5 plants of *Acacia cerastes* was recorded by ATA Environmental (ATA Environmental 2005e) from Mixed Closed Heath dominated by *Acacia ramulosa, Acacia assimilis* subsp. *assimilis, Melaleuca uncinata* and *Baeckea benthamii* (MGA 511555E ; 6730363N). An additional 1700 plants were opportunistically recorded from the Mt Gibson lease during a targeted survey for a new *Lepidosperma* sp conducted in February 2006 (ATA Environmental, 2006) (Figure 16b).

Persoonia pentasticha (P2) is a small yellow flowering shrub growing 0.3 to 1.8 m tall with a similar spread to 1 m diameter. CALM reports flowering in August. However, during the survey the plants were in full flower, extending the reported flowering period to October. This species has a known distribution from the following locations: Camel Soak, Mingenew, Mullewa, Perenjori, Yuna and Oudabunna Station. Two small populations of this species were recorded by ATA Environmental (2005e) from two areas approximately 4km north of Wanarra Road.

Grevillea scabrida (P2) is a much branched, silvery leafed shrub growing to 1 m tall. CALM (2003) reports flowering between July. This species has a known distribution from Mt Singleton and Mt Gibson. CALM records indicate that there are 13 populations of *Grevillea scabrida*. Of these populations, two are in the general area of the project, located to the north or east of the project area. A total of approximately 20 *Grevillea scabrida* plants from two populations were recorded by ATA Environmental from a Closed Heath to Shrubland dominated by *Baeckea benthamii* (ms*), Acacia ramulosa, Acacia assimilis* subsp. *assimilis* and *Melaleuca uncinata.*

Acacia acanthoclada **subsp** ***glaucescens*** (P3) is a harsh, intricate, spreading shrub with yellow flowers growing to 0.3 to 2 tall and flowering between July and October. The species has a known distribution from Mt Gibson Station, three Springs, Evanston, Paynes Find, Koolanooka Hills, Mt Correll, Mt Jackson and Lochada Station (Paul Armstrong & Associates, 2004).

Lepidosperma sp. Mt Gibson (R.Meissner & Y.Caruso 3). An undescribed species of *Lepidosperma* was recorded from the Mt Gibson ranges by CALM (N. Gibson, pers com. 2006). Known only from Mount Gibson, the species has terete culms, finely ribbed, pale green, fully erect growing to 35-45 cm tall. The leaves are angular and distinctly diamond shaped. ATA Environmental surveyed the Mt Gibson ranges to determine the abundance and distribution of the species (ATA Environmental 2006). A total of 14,939 plants were recorded, with the species appearing to prefer gullies that provide increased water availability throughout the Ranges (Figure 16c). The conservation status of the species is as yet undetermined, however initial discussions indicate that the species is likely to have a conservation status of P1 (ATA Environmental, 2006).

Additionally, *Gastrolobium laytonii,* which was recorded in significant numbers during the supplementary surveys (ATA Environmental, 2000e) from immediately adjacent to and from approximately 5km north of Wanarra Road is considered to be a possible locally endemic species. It has been previously recorded by Bennett (2000) from several vegetation types occurring over the Mt Gibson ranges. There are no other records of this taxon from elsewhere and it may require further investigation.

Services Corridor

According to CALM's significant species database, 159 Priority listed species have been recorded within the vicinity of the proposed slurry pipeline from Mt Gibson to Geraldton Port. In addition, a total of 31 Declared Rare Flora are known from the vicinity of the survey area (ATA Environmental, 2005f).

Botanical surveys confirmed the presence of the seven Priority species occurring within the vicinity of the proposed pipeline route, four of which will potentially be affected by the proposed route (ATA Environmental, 2005f, Paul Armstrong & Associates, 2004). No Declared Rare Flora were recorded or will be impacted upon by the proposed pipeline alignment.

Considerable effort was spent to identify an alignment that minimised impact on vegetation and flora of conservation significance. The Priority Flora that may be affected by the proposed pipeline route are shown below in Table 8.

TABLE 8
PRIORITY FLORA LOCATED ALONG MT GIBSON TO GERALDTON PORT SERVICES CORRIDOR ALIGNMENT

Conservation Classification	**Species**	**Total count within corridor (PAA (a))**	**Total count within corridor (ATA (b))**	**Est. no of plants affected**
Priority 1				
	Chamelaucium ?sp. Yalgoo	<20	23	7
	Gnephosis setifera	?	>300	0
	Philotheca nutans	20-40	21	0
Priority 3				
	Acacia acanthoclada subsp. *glaucescens*	n/a	<10	0
	Cryptandra imbricata	320-340	332	83
	Podotheca uniseta	>200	>8000	1001
	Psammomoya implexa	>4,500	4,500	650

(a) Paul Armstrong & Associates (2004)
(b) ATA Environmental (2005f)

The species *Acacia acanthoclada* subsp. *glaucescens* (P3), a harsh, intricate, spreading shrub with yellow flowers growing to 0.3 to 2 tall and flowering between July and September, will not be affected by the proposed pipeline route.

Chamelaucium ?sp. Yalgoo (P1) is a low shrub growing to 0.3 m 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. However, it should be treated as Priority 1 taxa as a precaution, unless confirmed to be otherwise. A total of 23 plants of this species were recorded at two locations in the vicinity of Wanarra Road. The plants are located at the eastern end of the proposed pipeline alignment along Wanarra East Road, approximately 1.5 and 2.3 kilometres west of Great Northern Highway. Seven plants of this species at the eastern most location will potentially

be affected by the proposed pipeline route. CALM records indicate 4 populations of *Chamelaucium* sp Yalgoo, all of which are located to the north of the project.

Cryptandra imbricata (ms) (P3) 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). A total of 83 plants of this species may be affected by the proposed pipeline route. These were recorded at two locations along the proposed pipeline route. The eastern most population is located along Wanarra East Road approximately 11 kilometres 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 18 kilometres west of Great Northern Highway. A total of 80 plants from this population may be affected by the proposed pipeline route. CALM records indicate there are 8 populations of *Cryptandra imbricata,* of which 2 populations are in the general area of the project with the closest population recorded by CALM being approximately 8km east of the project.

Gnephosis setifera (P1) is a small prostrate annual herb with yellow flowers, which flowers in September. One population of this species is located east of Mongers Lake in the vicinity of the proposed pipeline route. More than 300 plants were recorded at this location, none of which are expected to be impacted by the proposed pipeline route.

Philotheca nutans (P1) is an upright shrub, 0.3m to 0.9m tall, which flowers between April to September. Two populations of this species, with a total of 21 plants, were recorded within the vicinity of the proposed pipeline route. None of these plants will be affected by the proposed pipeline route.

Podotheca uniseta (P3) is a small single stemmed annual daisy with yellow flowers growing to 5 cm 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. CALM records indicate 10 populations of *Podetheca uniseta,* of which one is the western population detailed above.

Psammomoya implexa (P3) is an intricately branched, leafless, white flowering shrub growing 0.5 to 0.9m tall with a spread to 0.6m diameter. CALM reports flowering between August to October. This species has a known distribution from the following locations: Wilroy, White Wells to Ninghan Stations, Wubin, Gabyon Station and Morawa (CALM, 2005). A total of 650 plants from five populations may be affected by the proposed pipeline route. The five populations were all located between 25 to 30km from Great Northern Highway along Wanarra East Road. CALM records indicate 5 populations of *Psammomoya implexa*, two of which may have been along Wanarra Road.

One other significant species, *Grevillea* aff. *yorkrakinensis,* previously identified by Paul Armstrong & Associates (2004) was recorded during the July 2005 survey, The affinity (aff.) taxa is similar to the named species but differed in some significant form. Further taxonomic studies are required on this specimen. Two populations of this species were recorded adjacent to Wanarra Road, approximately 4.5 and 5.0km east of the existing Mongers Lake causeway. A total of 370 and 142 plants were recorded at each location, respectively.

5.10 Fauna

Two fauna surveys have been undertaken in the vicinity of the proposed mine at Mt Gibson (Hart, Simpson & Associates (2000) and ATA Environmental (2005b)). A fauna assessment was undertaken of the route of the Services Corridor (ATA Environmental 2005d). The results of the fauna surveys and assessments are summarised below and presented in detail in Appendices 5 and 6.

5.10.1 Fauna Habitats

Minesite

Four primary fauna habitats were identified in the area of Mt Gibson area based on vegetation structure and landforms are follows: the flat sandplains, the flat woodlands, the hillside slopes and the ironstone ridges. Based on the available information, the faunal assemblage at Mount Gibson appears very similar to that which might be expected in any one of a number of habitats in the region. There was nothing to indicate that at a genetic, species or ecosystem level, that Mount Gibson is important from a biodiversity perspective (ATA Environmental, 2005b).

Services Corridor

The majority of the proposed services corridor route between Mount Gibson and Geraldton Port is associated with cleared agricultural lands. However, there are remnants of native vegetation, particularly along Wanarra Road between Mongers Lake and Mount Gibson, where clearing of vegetation up to 15m in width may be necessary.

The remnant fauna habitat along the pipeline route that is to be disturbed is widely distributed throughout the Midwest region and none of the fauna species recorded in surveys in the region or expected to be found in the immediate vicinity of the pipeline 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. The minimal linear clearance of vegetation and/or disturbance on these habitats is therefore expected to be minimal given the proposed management measures (ATA Environmental, 2005d) (Appendix 5).

5.10.2 Vertebrate Fauna

The results of the two vertebrate fauna surveys undertaken at Mt Gibson were similar. The most recent fauna survey of the Mt Gibson area caught or sighted individuals representing 112 species including 64 species of birds, 38 species of reptiles and 10 species of mammals, of which five were introduced (ATA Environmental, 2005b) (Appendix 6).

Birds

The relatively low number of bird species at Mt Gibson is attributed to low rainfall preceding the 2004 and 2000 surveys and subsequent lack of flowering plants and insect activity within the area. As many arid birds are highly nomadic and regions further north of the study site had recent rainfall (e.g., the Pilbara), it is envisaged that some species that would be expected to occur at Mount Gibson have moved elsewhere to forage. A similar number of bird species were recorded at Mt Gibson by ATA Environmental (2005b) (64 species), Hart, Simpson and Associates (2000) (68 species) and Burbidge *et al.*(1989) (60 species).

In contrast, Emeritus Professor Harry Recher (previously of Edith Cowan University) observed 75 species of birds in the Mount Gibson study area (Recher, pers com). The additional species observed by Professor Recher are likely to be due to an increased survey effort spread over multiple seasons and multiple survey periods (September 2000; October 2000; August 2001; July 2002 and September 2003) compared with the single survey by ATA Environmental and Hart, Simpson & Associates. No additional Threatened or Priority bird species were observed by Professor Recher.

Reptiles

The reptile assemblage at Mt Gibson (five species of agamids, seven species of elapids, 10 species of geckoes, three species of legless lizards, 13 species of skinks and four species of goanna) is typical of the reptile assemblage encountered in most arid and semi-arid areas in Australia.

ATA Environmental (2005b) recorded nineteen additional species of reptile compared with the 2000 fauna survey undertaken by Hart Simpson & Associates (2000) (five additional species of snake, four species of gecko, three species of legless lizard, four species of skink and three species of goanna). One species of gecko and one species of skink were caught in October 2000, but not in March 2004. The increase in reptile species richness recorded in the 2004 survey is most probably due to increased trapping effort and the use of funnel traps, which were not used in October 2000. Burbidge *et al.* (1989) recorded 29 species of reptile.

Thompson *et al*. (2003) reviewed reptile biodiversity at 12 landscape or regional scale sites across Australia. The reptile assemblage at Mount Gibson is not significantly different to that found at these sites. There was no obvious feature of the reptile assemblage that warrants special attention or protection as the reptile assemblage in the surrounding area would be similar. Other than the Woma Python, *Cyclodomorphus branchialis* and Western Spiny-tailed Skink (neither of which have been recorded from the area), none of the reptile species caught or listed as potentially being found in the area are considered rare, have disjunct populations or require special protection.

Mammals

The composition of the small mammal assemblages recorded at Mt Gibson is what would be expected of a semi-arid habitat with none of the species caught representing disjunct populations or requiring special protection (ATA Environmental, 2005b).

Introduced mammal species recorded at Mt Gibson include house mice, goats, rabbits, feral cats and foxes (ATA Environmental, 2005b).

Hart, Simpson and Associates recorded a similar assemblage of mammals in October 2000 to the ATA Environmental March 2004 survey, however, Burbidge *et al*., (1989) recorded a greater diversity during their surveys in September/October and December 1982.

Hart, Simpson and Associates observed two additional mammal species in October 2000 than during the March 2004 survey. They captured a Chocolate Wattled Bat in an old mine shaft and observed an old burrow previously used by a Burrowing Bettong (*Bettongia lesueur*). During the 2004 survey, no bats were present in this mine shaft. ATA Environmental has subsequently found out that training activities conducted by a nearby mining company in the mine shaft may have lead to the disturbance of the bats.

The Burbidge *et al.* (1989) survey of White Wells area recorded a higher number of mammal species than ATA Environmental (2005b). Their records included a mixture of widespread species including the Echidna, Lesser Long-eared Bat and Gould's Wattled Bat, species of arid regions near their south western limit including the Red Kangaroo, Sandy Inland Mouse and Western Broad-nosed Bat and species of the south-west including Gilberts Dunnart, White-tailed Dunnart, Gould's Long-eared Bat and King River Eptesicus. Burbidge *et al.* (1989) made special comment about White-tailed Dunnart an uncommonly recorded species of the inland parts of the south-west and of Gould's Wattled Bat which is at the inland periphery of its range. Burbidge *et al.* (1989) also recorded his highest diversity of bats in the woodlands, with 83 individuals of seven species being caught over 3 nights. It is unknown exactly where the sampling sites where, however, it appears that they are south west of the proposed mining areas.

The Burrowing Bettong record is based on an observation of an old burrow. Burrowing Bettongs are extinct regionally, but the burrows are often still present many years later. Goannas and rabbits usually occupy these burrow systems.

Amphibians

No amphibians were recorded in the two fauna surveys at Mt Gibson (Hart, Simpson & Associates, 2000; ATA Environmental, 2005b). In subsequent site visits by ATA Environmental in Autumn and Winter 2005 two species of frog (*Neobatrachus sutor* and *N. wilsmorei*) were recorded. Burbidge *et al.* (1989) recorded one (possibly two) species of frog (*N. centralis* and *N. sp.*), which are different species to those recorded by ATA Environmental (2005b).

5.10.3 Invertebrate Fauna

The EPA's Guidance Statement No 56 on Terrestrial Fauna Surveys (EPA, 2004b) requires that the potential impact on the conservation of short range endemic fauna be considered. Short range endemics are more common among invertebrates than vertebrate fauna.

A short range endemic survey program in the Mt Gibson Hills was developed in association with the Western Australian Museum and Dr Barbara Main of the University of Western Australia. The survey program focussed on the Diplopoda (millipedes), Pulmonata

(land snails) and Mygalmorphae (trapdoor spiders) which potentially support narrow range taxa. The survey program included a visual searching of likely habitats for Short Range Endemics by WA Museum staff as well as pit fall trapping over a 3 month period in late autumn, with identification of the samples undertaken by WA Museum staff (Dr Mark Harvey and Dr Shirley Slack Smith) and Dr Barbara Main. A copy of the reports are provided in Appendix 6.

Mygalomorph Spiders

Six of the eight families of mygalomorph spiders represented within Western Australia were collected at Mt Gibson during the survey program, with an additional family also likely to be present. Of the 5 families of mygamorph spiders examined in detail, 10 genera and 17 species were represented. Eight of species are known from or recorded from outside the survey area.

Four species (*Missulena* sp 3., *Conothele* sp.1, *Aganippe* sp 1 and *Eucyrtops* sp. 3) have close similarities with existing species and are of possible conservation significance. Since conducting the site survey and initial reporting, Mount Gibson Mining no longer proposes to impact on the sites where these species were found (Sites 13, 14, 15 or 16) and thus will not impact on the conservation status of the species.

A single juvenile specimen of *Kwonkan* was collected. As a juvenile there are no specific diagnostic features present. *Kwonkan* is widely distributed throughout the state but only six species have been named (Main 1983) of what appears to be a speciose genus. Without adult specimens it is not possible to comment on the specific status of the juvenile specimen collected from the Mt Gibson site.

The juvenile *Kwonkan* was the only conservation significant spider recorded to at Mount Gibson. Given that this juvenile *Kwonkan* is expected to be widespread across the state, it is unlikely that the proposed development will impact upon this species at Mount Gibson (Main, 2005)

All other spiders recorded at Mount Gibson were found in areas protected from disturbance (Main, 2005).

Millipedes

Millipedes are an extremely diverse group of animals with nine different orders represented in Australia (Harvey, 2005). The most abundant millipede group in Western Australia is the genus *Antichiropus*. With the exception of one species of *Antichiropus* found in the Jarrah forest, all species of the genus are known to be Short Range Endemics. The Mt Gibson region has been known to accommodate species of *Antichiropus* that have not been found elsewhere.

Five different species were identified from the Mt Gibson region during the survey program. Each of the five species were Short Range Endemics as defined by Harvey (2002). None of the five species occurred solely within the impact zone of the Mt Gibson project. Two of the species, *Antichiropus* Mt Gibson 1 and *Antichiropus* Mt Gibson 3 occur within the proposed mining zone as well outside the impact area. The remaining three

species *Antichiropus* PM1, *Antichiropus* Mt Gibson 2 and *Antichiropus* Mt Gibson 4 occur outside the impact zones, with *Antichiropus* PM1 and *Antichiropus* Mt Gibson 2 being found away from rocky slopes and *Antichiropus* Mt Gibson 4 found on the western slope of Iron Hill.

In summary, no species of *Antichiropus* occur solely within the impact zone of the proposed development. Some species occur within the impact zone, but they also occur in areas not impacted by the Mt Gibson Iron Ore Project (Harvey, 2005).

Land Snails

Four species of land snails were collected during the 2005 Short Range Endemic survey. Three of the species: *Simumelon vagent*e, *Succinea* sp. and *Pupoides sp.cf P.beltianus* are not vulnerable to disturbance from the Mt Gibson Iron Ore Mine and Infrastructure project.

The fourth species, *Bothriembryon* sp, was represented by a single juvenile individual collected from a woodland area with soft substrates (Site 17). Snail species that inhabit soft substrate areas generally burrow into the litter and soil beneath vegetation before the onset of hot weather, emerging when the soil is moistened. They are then able to move across the soil surface, particularly in cool and/or humid weather and at night. Soft substrate dwellers may also be spread to other areas by flood (Slack-Smith, 2005).

Although only one juvenile *Bothriembryon* sp was collected, Slack-Smith (2005) acknowledges that the apparent paucity of specimens in the Western Australian Museum collection from the region may be due to a collecting bias and not rarity of the Genera. The area is less frequented by collectors and periods of activity of inland species would probably be shorter and more closely dependent on infrequent and unpredictable rainfall. It is estimated that only 0.21% of the total current extent of the potential habitat similar to where the species was found (ie Vegetation Association No 142 – Medium Woodland; York Guma and Salmon Gum [Beeston et al., 2002]) will be impacted by the proposed mining development. Given the extent of similar habitat in the area (woodland with soft substrate), it is considered unlikely that the Mt Gibson Iron Ore Mine and Infrastructure Project will adversely impact on the distribution of this species.

5.10.4 Stygofauna

Stygofauna is a general term used to describe obligate subterranean fauna occurring in groundwater (Humphreys, 2000) that have adapted to the subterranean environment. Stygofauna may occur within the Midwest/Yilgarn area in suitable substrates such as limestone strata and paleochannels.

There are a number of sources of water that will be extracted for the project. Process water will be obtained from the borefield at Tathra and from drying of the tailings. Water for dust suppression will be obtained from pit dewatering. Potable water will be obtained from pit dewatering and treated by reverse osmosis (RO).

The bore at the Tathra borefield was sampled for stygofauna in accordance with EPA Guidance Statement 54 (EPA, 2003b), with samples reviewed and identified by The University of Western Australia. The objective of the sampling program was to determine

if stygofauna were present in the groundwater areas affected by water supply. No stygofauna were present in any of the samples from Tathra borefield. (Appendix 5). A bore at Extension Hill was also sampled for stygofauna. No stygofauna were present in any of the samples from Extension Hill (Appendix 6).

In the unlikely event that the pit dewatering yields insufficient water, an alternative water supply for dust suppression has been identified in the paleochannel located to the east and north of the pit. An alternative supply for potable water has been located at approximately 50m below ground depth in fractured rock in the Mt Gibson hills. Should it be necessary to develop a borefield in the paleochannel or to extract potable water from the fractured rock reserves, a Stygofauna Sampling and Management Plan will be developed prior to the commencement of operation of the borefield.

5.10.5 Threatened Fauna

Species of native fauna that are rare, threatened with extinction or have high conservation value are protected by law under the *Wildlife Conservation Act* 1950. The classification of rare and endangered fauna protected under the Act are shown in Table 9. In addition the Commonwealth *Environmental Protection and Biodiversity Conservation Act* 1999 classifies threatened fauna species according to the categories ‘critically endangered’, ‘endangered’, ‘vulnerable’ or ‘conservation dependent’.

TABLE 9
CLASSIFICATION OF FAUNA SPECIES OF CONSERVATION SIGNIFICANCE UNDER THE *WILDLIFE CONSERVATION ACT 1950*

Category	Description
Schedule 1	Fauna which are rare or likely to be extinct and are declared to be fauna in need of special protection
Schedule 2	Fauna which are presumed extinct
Schedule 3	Birds that are subject to an agreement between the Governments of Australia and Japan relating to the protection of migratory birds and birds in danger of extinction which are declared to be fauna in need of special protection
Schedule 4	Fauna in need of special protection, other than for the reasons above
Priority 1	Taxa with few, poorly known populations on threatened lands. Known from few specimens or sight records from one or two localities on lands not managed for conservation
Priority 2	Taxa with few, poorly known populations on conservation lands, or taxa with several, poorly known populations not on conservation lands. Known from a few specimens or sight records from one or a few localities on lands not under immediate threat of habitat destruction or degradation
Priority 3	Taxa with several, poorly known populations, some on conservation lands. Known from few specimens or sight records from several localities, some of which are on lands not under immediate threat of habitat destruction or degradation.
Priority 4	Taxa in need of monitoring; and considered to have been adequately surveyed, or for which sufficient knowledge is available and which are considered not currently threatened or in need of special protection but could be if present circumstances change.
Priority 5	Taxa in need of monitoring; are not considered threatened but are subject to a specific conservation program, the cessation of which could result in the species becoming threatened within five years.

Threatened and priority species listed under the *Wildlife Conservation Act* and the EPBC Act as either recorded from or potentially occurring at Mt Gibson are shown in Table 10. One species of Schedule 1 fauna and one species of Schedule 4 fauna have been recorded from the site. The Rainbow Bee Eater, while not listed at the State level, is listed as 'Migratory' species under the EPBC Act. In addition, three Schedule 1 species, one Schedule 4 fauna species, and three Priority 4 fauna species may potentially occur within the area.

TABLE 10
SIGNIFICANT VERTEBRATE SPECIES RECORDED OR LISTED AS POTENTIALLY OCCURING IN THE MOUNT GIBSON AREA

Species	Status under Wildlife Conservation Act Schedule / Priority *	Status under Commonwealth Environment Protection and Biodiversity Act	Recorded (R) / Predicted (P)	Comment
Malleefowl *Leipoa ocellata*	Schedule 1	Vulnerable	R	Species or species habitat *recorded* within project area
Western Spiny-tailed Skink *Egernia stokesii badia*	Schedule 1	Endangered	P	Species or species habitat *possible* in project area
Cyclodomorphus branchialis	Schedule 1		P	Species or species habitat *unlikely* to occur within project area
Numbat *Myrmecobius fasciatus*	Schedule 1		P	Species or species habitat *highly unlikely* to occur within project area
Peregrine Falcon *Falco peregrinus*	Schedule 4		P	Species or species habitat *possible* to occur within project area
Major Mitchell's Cockatoo *Cacatua leadbeateri*	Schedule 4		R	Species or species habitat *likely* to occur within project area but *unlikely to breed*
Australian Bustard *Ardeotis australis*	Priority 4		P	Species or species habitat *likely* to occur within project area
Bushstone Curlew *Burhinus grallarius*	Priority 4		P	Species or species habitat *possible* within project area
Hooded Plover *Charadrius rubricollis*	Priority 4	Migratory	P	Species or species habitat *unlikely* to occur within project area
Rainbow Bee-eater *Merops ornatus*		Migratory	R	Species or species habitat *recorded* within project area

Malleefowl (*Leipoa ocellata)* Schedule 1, Vulnerable under the EPBC Act 1999.
Malleefowl are present in the Mount Gibson area, and it is probable that the area supports a breeding population. One hundred and thirteen Malleefowl mounds were located within the study area, of which 15 were active. Most mounds were found in thicket communities. These thickets were typically found on the sand plain and pebbly soils on the slopes or base of the ironstone range. Similar habitat is found in the surrounding area and region (ATA Environmental, 2005c).

Male Malleefowl are reported to occasionally return to inactive mounds and re-use them for breeding many years after they were last utilised (R. Johnstone, Western Australian Museum, pers. comm. 2004). Radio-tracking studies (Booth, 1987 and Benshemesh, 1992 cited in Benshemesh, 2000) have shown that over the course of a year Malleefowl may range over one to several square kilometres and that home-ranges overlap considerably.

Malleefowl have been observed at multiple locations in the region over a period of time (Hart, Simpson and Associates, October 2000; Recher August 2001, September 2003; Dell 2001; Thompson 2004, 2005, Northern Malleefowl Conservation Group) (Figure 17).

Numbat (*Myrmecobius fasciatus*) Schedule 1
The Numbat was formally widespread across southern semi-arid and arid Australia. It is now only present at Dryandra and Perup/Kingston area east of Manjimup; however, populations have been reintroduced by translocation to numerous other locations including Karroun Hill Nature Reserve. CALM records show no observations in the Mount Gibson area in the past. Although suitable habitat may be present the Numbat is highly unlikely to be in the study area because of its range restriction.

Western Spiny-tailed Skink (*Egernia stokesii badia*) Schedule 1, Endangered under EPBC Act
The Western Spiny-tailed Skink occurs in semi-arid scrubs and woodlands of Shark Bay and the northern wheatbelt, sheltering in hollow logs, behind the bark of fallen trees and old abandoned buildings. Twenty-two records have been made since 1929 in the region, however, most are west of Mount Gibson. Even though suitable habitat is found in the area, the Western Spiny-tailed Skink is unlikely to be found at Mount Gibson as it is on the eastern margin of its known distribution. None were recorded by Hart, Simpson and Associates or ATA Environmental.

***Cyclodomorphus branchialis* Schedule 1**
Cyclodomorphus branchialis is a medium sized skink found in semi-arid scrubs on heavy soils. It has a restricted distribution in the south-west Murchison and the project area is at the eastern limit of its range. Even though suitable habitat is found in the area, *Cyclodomorphus branchialis* is unlikely to be found at Mount Gibson as this area is outside of its known distribution

Peregrine Falcon *(Falco peregrinus)* Schedule 4
The Peregrine Falcon is uncommon, although widespread throughout much of Australia excluding the extremely dry areas and has a wide and patchy distribution. It shows habitat preference for areas near cliffs along coastlines, rivers and ranges and within woodlands along watercourses and around lakes. It favours hilly or mountainous country and open woodlands and may be an occasional visitor to the study area. They have not been previously observed at Mount Gibson by Emeritus Professor Harry Recher, Hart, Simpson and Associates or ATA Environmental.

Major Mitchell's Cockatoo *(Cacatua leadbeateri)* Schedule 4
Major Mitchell's Cockatoo was observed at Mount Gibson by Hart, Simpson and Associates (2000) and Emeritus Professor Harry Recher. However, it was not observed by ATA Environmental during March 2004 or in subsequent investigations between 20-24 September 2004, 13-21 January, 31 March – 2 April, 14-15 and 29-30 April, 9-13 May and 10-11 June 2005.
Major Mitchell's Cockatoos are birds of the semi-arid and arid zones of all parts of Australia, except Tasmania. Major Mitchell's Cockatoos are most often seen high up in the branches of Salmon Gums (*Eucalyptus salmonophloia*) and similar large eucalypts, in heavily timbered creek-lines or roadside verges, in parts of the wheatbelt of Western Australia. It is these large, hollow eucalypts which the Major Mitchell's Cockatoo require

to breed in. Major Mitchell's Cockatoos are scarce throughout most of WA and the primary cause for its decline is land clearing for agriculture and subsequent fragmentation of remaining habitat.

Australian Bustard *(Ardeotis australis)* Priority 4
Australian Bustards are tall birds that live on open grassy plains and low shrubby areas in northern Australia. The Australian Bustard is possibly found at Mount Gibson due to the availability of suitable habitat. They have not been previously observed at Mount Gibson by Emeritus Professor Harry Recher or during the Hart, Simpson and Associates survey.

Hooded Plover *(Charadrius rubricollis)* Priority 4
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 Mount Gibson, if it was, it would be classified as a vagrant. They have not been observed at Mount Gibson by Emeritus Professor Harry Recher or during the Hart, Simpson and Associates survey.

Bush Stone-curlew *(Burhinus grallarius)* Priority 4
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. CALM records suggest it is likely to occur in the area in question. They have not been observed at Mount Gibson by Emeritus Professor Harry Recher or during the Hart, Simpson and Associates survey.

Rainbow Bee-eater (*Merops ornatus)* (a Migratory species under the EPBC Act)
The Rainbow Bee-eater was observed in the project area. The Rainbow Bee-eater is found across the better-watered parts of Western Australia. It prefers lightly wooded, preferably sandy soil near water. Rainbow Bee-eaters are scarce to very common across their range depending on suitable habitat conditions. Rainbow Bee-eaters were observed during this survey and during surveys by Emeritus Professor Harry Recher and Hart, Simpson and Associates (2000). There are large amounts of suitable habitat for this species in the undisturbed areas adjacent to the proposed mine site.

5.10.6 Other Vertebrate Species of Interest

Carnaby's Cockatoo
Carnaby's Cockatoo (*Calyptorhynchus latirostris*) classified as Endangered under the *EPBC Act* 1999 and Schedule 1 under the *WA Wildlife Conservation Act 1950* is a species of conservation interest through southern WA. Its preferred habitat is woodland where it preferentially feeds on plants of the Proteaceae family. Preferred nesting trees include the smooth-barked Salmon Gum (*Eucalyptus salmonophloia)*, which contain deep hollows. Nesting also occurs in Marri (*Corymbia calophylla)* and Tuart (*E. gomphocephala*).

Carnaby's Black-Cockatoos were not recorded in any of the surveys at Mount Gibson or in the broader region (ATA Environmental, 2005b; Alan Tingay & Associates 1996; Hart, Simpson and Associates, 2003; Bamford Consulting Ecologists, 2003; Bamford & Wilcox,

2004; Burbidge, *et al.* 1989; Dell, 1996a, b). Given that the known distribution of Carnaby's Cockatoo is to the south and west of the proposed Mount Gibson mine site it is highly unlikely that the mine will impact on breeding or feeding areas used by this species.

5.11 Social and Economic Setting

5.11.1 Regional Setting

The mine site and associated infrastructure is located within the Shire of Yalgoo. The nearest towns to the minesite are Wubin, located 80km to the south, Paynes Find 70km to the north and Perenjori 85km to the west of the minesite. Export of product will occur through the Port of Geraldton. The two regional areas most directly impacted by the proposal are Perenjori and Geraldton. Both the Perenjori and Geraldton regions have experienced static socio economic performance in recent times (Economic Research Associates, 2005).

5.11.2 Demographics

Both Perenjori and Geraldton are experiencing falling populations. Perenjori has lost population since the 1991 census, falling from 772 in 1991 to 600 in 2001. Geraldton's population decreased from 20,587 in 1991 to 19,272 in 2001. The proportion of people over 65 in both centres has also increased (Table 11) (Economic Research Associates, 2005).

TABLE 11
POPULATION TRENDS IN GERALDTON AND PERENJORI
1991-2003

	Perenjori (persons)			Geraldton (persons)		
	1991	**2001**	**2003**	**1991**	**2001**	**2003**
Total persons	772	684	586	20,587	19,275	19,485
Aged 15 years & over	538	441		15,298	14,755	
Aged 65 & over	42	50		1,962	2,657	
Unemployed	30	12		1,680	1,128	
Employed	382	319		7,594	7,235	
In the labour force	412	98		9,274	8,363	
Not in the labour force	120	98		5,563	5,746	

The most recent population projections for these areas do no indicate major changes in the underlying trend of negative population growth. Population projections for Geraldton indicate a fall in population from 20,587 in 2001 to 19,798 in 2008/9 while the figures for Perenjori, although smaller in absolute terms are significantly higher in relative terms (Table 12) (Economic Research Associates, 2005).

TABLE 12
PROJECTED POPULATION GROWTH GERALDTON AND PERENJORI 2001-2008/9

	2001	2008/9	% change
Geraldton	20,587	19,485	-5.3%
Perenjori	650	504	-22.4%

In the absence of new projects to stimulate local job growth, the stability of the population is the most optimistic outcome for Perenjori (Economic Research Associates, 2005).

The position in Geraldton is somewhat different as population growth is occurring in nearby areas of Greenough and Irwin (Economic Research Associates, 2005).

5.11.3 Surrounding Land Use

As outlined in Section 5.8 and Figure 13, the minesite abuts the Mt Gibson, White Wells and Ninghan pastoral leases, which are managed by private organisations for conservation purposes.

The services corridor traverses land used for pastoral, agricultural and urban/infrastructure uses. In the pastoral section of the route, the services corridor is located on the southern side of Wanarra Road, with minor deviations from the road to avoid populations of significant flora. Within the agricultural section of the route, the services corridor crosses largely cleared agricultural land from Mongers Lake to Perenjori, then east to the Midlands Highway then northeast to Walkaway, and Narnagulu before entering the Southern Transport Corridor to Geraldton Port (Figure 6). The pipelines within the services corridor will be buried.

The borefield at Tathra is located within land used for agriculture (Figure 6).

5.12 Aboriginal and European Heritage

5.12.1 Aboriginal Heritage

MGM has project agreements with the Badimia People and the Widi Mob, whose Native Title claims cover the area of the mine site. MGM is in the process of negotiating pipeline-only Native Title agreements with the Mullewa Wadjari, Amangu and Naaguja Peoples whose registered Native Title claim areas cover parts of the pipeline corridor.

No sites of significance were identified within the project area at Extension Hill during ethnographic and archaeological surveys undertaken by the Yamatji Land & Sea Council on behalf of the Badimia people in 2001 and 2004. The Pandawn Descendants did not require a heritage survey to be carried out over the project area.

Ethnographic and archaeological surveys of the minesite area were undertaken by Australian Interaction Consultants in 2004 on behalf of the Widi Mob. The ethnographic survey indicated the Mt Gibson hills including the area of the proposed open pit mine and

the playa to the south east of the hills were part of a dreaming story associated with the Widi Mob. In addition, four new archaeological sites were discovered. After consultation, the Widi Mob agreed to support an Application under Section 18 of the *Aboriginal Heritage Act* to permit mining of Extension Hill, provided the tailings storage facility was moved away from the playa. The archaeological sites are outside the proposed areas of disturbance. The Section 18 Application was lodged with the Aboriginal Cultural Materials Committee (ACMC) on 5 November 2004 and has been approved.

Additional heritage surveys have been undertaken with the Badimia People and Widi Mob during 2005 to cover the expanded footprint for the waste dump, the possible water borefield to the west of the Great Northern Highway and additional areas required for highway re-alignment, air strip relocation and hematite stockpiles. One new site of significance was discovered by the Badimia People just outside the northern boundary of the waste dump. By agreement with the Badimia People, MGM has agreed to a 300m wide exclusion zone to protect this site.

Heritage surveys have been undertaken for much of the services corridor route and are proposed for the balance. The route of the services corridor has been deviated to avoid sites which appear on the DIA register of Aboriginal Sites and those located through heritage surveys. Further surveys will be undertaken where necessary on deviations and any sites will be avoided. All relevant Native Title groups will be consulted.

Some additional Section 18 approvals may be required where the pipeline route crosses river systems which have been registered as sites of significance. This will be addressed during the current heritage surveys, in discussion with the relevant Aboriginal groups, to minimise the impact as far as is practicable.

5.12.2 European Heritage

Minesite

The Register of the National Estate, the Commonwealth Heritage List, National Heritage list and World Heritage List were reviewed to determine the cultural significance of the minesite area. The project area is not included in any of these lists/registers.

Mt Singleton is located approximately 20km to the north of the Mt Gibson ranges and is listed on the Register of the National Estate as an Indicative Place for its geological values. Lake Moore 30km to the east has several entries on the Register of the National Estate relating to indigenous values. An area to the south of White Wells Station is also listed on the Register of the National Estate.

Services Corridor

The services corridor will have no impact on sites with European heritage. Gould's Cottage, which has been identified as a significant heritage building, is located approximately 2km west of the Walkaway Road near Narnagulu within the Geraldton Southern Transport Corridor. Preservation of the cottage is incorporated in the plans for the Southern Transport corridor. The slurry pipeline route is within the Geraldton Southern Transport corridor but is located south of the cottage in accordance with corridor planning.

No impacts to the precinct are expected. Workforce and construction activities will not be permitted to access the site. There are no other European heritage sites near the corridor.

Surveys including aerial reconnaissance, ground inspections and consultation with landowners have been undertaken to avoid conflicts with existing buildings.

6. CONSULTATION

6.1 Consultation Program

MGM has undertaken an extensive consultation program with stakeholders as part of the development of the Mt Gibson Iron Ore Mine and Infrastructure Project.

Consultation has included public presentations, government presentations, one on one discussions with landholders, environmental groups, community groups, local members of Parliament, government departments, local government authorities and members of local aboriginal communities.

Key agencies have been actively consulted during the preparation of the PER including:

- EPA Services Unit
- CALM Perth and Geraldton Regional Office
- Botanic Gardens and Parks Authority
- Department of Environment Midwest Office
- WA Muesum

Non government organisations considered key stakeholders and consulted in the development of the project included:

- Australian Bush Heritage Fund (White Wells Station)
- Australian Wildlife Conservancy (Mt Gibson Station)
- Pindiddy Aboriginal Corporation (Ninghan Station)
- Wildflower Society
- Conservation Council
- Northern Malleefowl Conservation Group
- Widi Mob
- Badimia People
- Widi Binyardi People
- Mullewa Wadjari People
- Taylor People
- Amangu people and
- Naaaguja People

A series of community meetings were held in each of the local government authority areas traversed by the services corridor including Mingenew (18 attendees), Three Springs (65 attendees), Perenjori (40 attendees), Irwin (6 attendees), and Greenough (20 attendees). In addition the company had a stand at the September 2005 Mingenew Expo.

All 82 landholders, five local government authorities, 6 public utilities (including the DBNGP Corridor, MRWA, Water & Rivers, Telstra, Public Transport Authority and Western Power) and 3 pastoral lease holders impacted by the services corridor have been consulted to address selection of the services corridor route, construction issues, impacts on existing infrastructure, easement acquisition and any other specific issues. A summary of consultation undertaken by MGM is provided in Table 13.

TABLE 13
STAKEHOLDER CONSULTATION FOR THE MT GIBSON IRON ORE MINE AND INFRASTRUCTURE PROJECT

Consultation	Date
Various presentations and consultation with State Government agencies (ie DoE, DoIR, CALM)	2 December 2004 3 February 2005 1 June 2005
Meetings with CALM Perth &/or Geraldton	25 November 2004 31 January 2005 31 March 2005 10 June 2005 24 October 2005
Meetings with DoE/EPA Services Unit	28 January 2005 4 April 2005 25 May 2005 8 June 2005 19 October 2005 24 October 2005
Meetings with DOIR	23 September 2004 20 October 2004 2 November 2004 18 November 2004 17 February 2005 1 June 2005 19 August 2005 28 September 2005
Site Visit with DoE, CALM, AWC, ABHF and Pindiddy Aboriginal Corporation	3-4 November 2004
Combined meeting with AWC, ABHF & Pindiddy Aboriginal Corporation	21 November 2005
Meetings with Australian Bush Heritage Fund	30 August 2004 27 October 2004 3 November 2004 5 November 2004 24 May 2005 30 June 2005
Meetings with Australian Wildlife Conservancy	22 September 2004 6 October 2004 26 November 2004 13 January 2005 19 January 2005 25 May 2005 3 August 2005
Meetings with Pindiddy Aboriginal Corporation	12 May 2005 11 August 2005 22 August 2005 29 September 2005 29 November 2005 and on an opportunistic basis when in the area
Meeting with Northern Malleefowl Group	21 June 2005
Meetings with Conservation Council	15 November 2005
Meeting with Wildflower Society	31 October 2005
Community Meeting Perenjori	21 July 2005
Community Meeting Mingenew	19 July 2005
Community Meeting Three Springs	20 July 2005
Community Meeting Irwin	26 July 2005

Consultation	Date
Community Meeting Greenough	27 July 2005
Stand at Mingenew Expo	15 & 16 September 2005
Community Meeting Geraldton	30 November 2005
Meetings with Main Roads WA	30 March 2005 5 May 2005 1 September 2005 July 2005 10 October 2005
Meetings with Public Transport Authority	29 June 2005 12 August 2005
Meeting with MidWest Development Commission	6 April 2005
Meetings with Geraldton Port Authority	10 January 2005 16 March 2005 13 May 2005 10 June 2005 12 July 2005 28 October 2005
Meetings with Botanic Gardens and Parks Authority	March 2004 May 2004 June 2004 24 August 2004 8 October 2004 26 November 2004 9 December 2004 13 January 2005 19 January 2005 25 May 2005 3 August 2005
Meeting with WA Museum	18 February 2005
Site Visit with WA Museum	9-12 May 2005
Meetings with Perenjori Shire Council/ CEO/President	24 January 2005 29 March 2005 12 May 2005 19 May 2005 21 July 2005 1 August 2005 8 August 2005 28 September 2005 and opportunistically when in town
Meetings with Mingenew Shire Council	5 April 2005
Meetings with Three Springs Shire Council	20 April 2005
Presentation to Three Springs community	3 December 2005
Meetings with Irwin Shire Council	26 July 2005
Meetings with Greenough Shire Council	6 April 2005 19 July 2005
Meetings with Geraldton City Council	10 January 2005 6 April 2005 30 Jun 2005
Meetings with Shire of Yalgoo	22 March 2005 24 October 2005
Mingenew Field Day Exhibition	15/16 September 2005
Meetings with landholders	April 2005 and ongoing on a regular basis through correspondence, phone calls and face to face meetings.
Widi Mob Project Agreement in place)	3/4 August 2004 3 Feburary 2005(project agreement

Consultation	Date
	signed) 25 February 2005 22 March 2005 20 April 2005 August 2005
Badimia (Project Agreement in place)	3 December 1999 29 May 2000 7 July 2000 31 July 2000 20 August 2001(project agreement signed) 31 October 2001 30 November 2001 17 June 2004 10-12 August 2004 14 June 2005 8 August 2005 28-30 September 2005
Naaaguja People (registered claimant for Greenough River crossing only)	25 July 2005 28 November 2005 5 December 2005
Amangu people (registered claimant for Greenough River crossing only)	25 July 2005 28 November 2005
Mullewa Wadjari People (registered claimant for Greenough River crossing only)	Pipeline heritage surveys carried out in December 2005
Taylor People (not a registered claimant)	13 December 2005
Widi Binyardi People (not a registered claimant) (formerly known as the Pandawn descendents)	24 May 2005 Pipeline heritage survey carried out in December 2005

6.2 Issues Raised

Key issues raised during the consultation process and the section of the document in which the issue is addressed is summarised in Table 14. As outlined in Section 6.1, consultation has been extensive and ongoing. Consultation with stakeholders had significant influence on key components of the project including:

- Transportation of product by slurry pipeline rather than by road or rail.
- Design and location of facilities at Geraldton Port.
- Structure of Environmental offset developed in consultation with stakeholders.

A copy of the Access protocol for liaison with landholders is provided in Appendix 8.

TABLE 14
KEY ISSUES RAISED DURING CONSULTATION

Issue	Section of PER Addressing the Issue
Regional Conservation Values	8.2/8.3
Impacts on the DRF *Darwinia masonii*	8.3
Impact on vegetation at the minesite	8.3
Future development within Mt Gibson hills	2.2.2
Alternatives to road transportation on Wanarra Road	2.2.1
Alternative locations for Tailings Facility	2.2.3
Potential impact of minesite on landscape values, visual amenity, and visitor enjoyment	8.17
Construction issues related to services corridor including weeds, timing of construction, rectification of roads/access tracks, impact of construction crews on local amenities, construction methodologies, compensation, reinstatement/rehabilitation, government approvals processes, access protocols prior to construction, landholder rights in relation to access and permission to construct through their property.	4.5.6 Appendix 8
Sustainability of water extraction from Tathra	8.6
Visual amenity at the Port	8.17

6.3 Peer review

The vegetation/flora and fauna reports for the Mt Gibson Iron Ore Project were submitted to the EPA Services Unit, CALM Perth and CALM Midwest for review.

The methodology used by the Botanic Gardens and Parks Authority to determine the population genetics of *Darwinia masonii* was reviewed by Margaret Byrne and David Coates to ensure it met the requirements of the WA Threatened Species and Communities Unit.

The PATN analysis of the impact of the proposal on flora and vegetation at a regional scale using CALM's procedures for surveys of Banded Iron Formation within the Yilgarn Block was reviewed by Dr Neil Gibson of CALM.

7. ENVIRONMENTAL PRINCIPLES, SUSTAINABILITY & MANAGEMENT

7.1 Sustainability

The Western Australian Government released a Sustainability Strategy for Western Australia: *Hope for the Future: the Western Australian State Sustainability Strategy* (Government of Western Australia, 2003). The broad goals of the State Sustainability Strategy are to:

- Ensure that the way we govern is driving the transition to a sustainable future.
- Play our part in solving the global challenges of sustainability.
- Value and protect our environment and ensure sustainable management.
- Plan and provide settlements that reduce the ecological footprint and enhance quality of life at the same time.
- Support communities to fully participate in achieving a sustainable future.
- Assist business to benefit from and contribute to sustainability.

The strategy sets out a vision for the State's mining industry that includes some key future actions:

- work towards assessment of projects using sustainability criteria.
- foster local community involvement (particularly Aboriginal communities, pastoralists and local shires).
- establish a transparent process to enable community awareness of the day-to-day regulatory system for the resources industry.
- implement strategies that support the use of local employment in mining ventures, particularly using regional centres and employment hubs and encourage mining companies to maximise their purchasing of goods and services within regions.

Following changes to the *Environmental Protection Ac 1986*, the EPA now requires all formal environmental impact assessments to address the principles of sustainability. The application of the principles of sustainability to the Mt Gibson Iron Ore Mine and Infrastructure Project is summarised in Table 15.

Subsequent to the release of the Western Australian State Sustainability Strategy, the EPA published a revised Position Statement 6: Towards Sustainability (EPA, 2004f), which attempts to describe appropriate approaches to this complex and evolving subject in WA, where mining, petroleum and agriculture are the mainstays of our economy and underpin the standard of living generally enjoyed by West Australians. It includes a checklist for sustainability to be considered for new projects (Table 16).

TABLE 15
APPLICATION OF THE PRINCIPLES OF SUSTAINABILITY TO THE MT GIBSON IRON ORE MINE AND INFRASTRUCTURE PROJECT

Principle	Relevant Yes/No	If yes, consideration	Addressed (Yes/No)	Section(s) in PER
1. The Precautionary Principle Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In application of this precautionary principle, decisions should be guided by: (a) careful evaluation to avoid, where practicable, serious or irreversible damage to the environment; and (b) an assessment of the risk-weighed consequences of various options.	Yes	Sufficient knowledge to address potential environmental impacts. Specialist studies (eg flora, fauna, groundwater) have been undertaken to assess the environment and potential impacts.	Yes	Section 5
2. The Principle of Inter-generational Equity The present generation should ensure that the health, diversity and productivity of the environment is maintained and enhanced for the benefit of future generations.	Yes	Emissions not long term. Information is provided on long term emissions and greenhouse emissions with respect to EPA Guidance Statement 12	Yes	Section 8.10
3. The Principle of the Conservation of Biological Diversity and Ecological Integrity The conservation of biological diversity and ecological integrity should be a fundamental consideration	Yes	Conservation of biological diversity and ecological integrity is a fundamental consideration. The Project will result in disturbance of approximately 900ha. Baseline flora and fauna surveys have been undertaken. Environmental offsets will be negotiated with stakeholders	Yes	Section 7.3
4. Principles relating to improved valuation, pricing and incentive mechanisms (a) Environmental factors should be included in the valuation of assets and services;	Yes	Environmental factors have played a significant part in determining the preferred option. The project has been designed to ensure pollution impacts	Yes	Section 8.13 Section

Principle	Relevant Yes/No	If yes, consideration	Addressed (Yes/No)	Section(s) in PER
(b) The polluter pays principle – those who generate pollution and waste should bear the cost of containment, avoidance and abatement (c) The user of goods and services should pay prices based on the life cycle of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste (d) Environmental goals, having been established, should be pursued in the most effective way, by establishing incentive structures, including market mechanisms, which enable those best placed to maximise benefits and/or minimise costs to develop their own solution and responses to environmental problems.		are minimised. The full life cycle costs of mining and processing iron ore, including the use of natural resources and assets, the ultimate disposal of any wastes and decommissioning and close of operations has been estimated. Costs are provided over the life of the operation on a production unit basis.		7.3
5. The Principle of Waste Minimisation All reasonable and practicable measures should be taken to minimise the generation of waste and its discharge to the environment.	Yes	All reasonable and practicable measures will be taken to minimise waste. The preferred management options are to avoid, reduce, reuse, recycle and recover waste management Waste management will be addressed in the EMP	Yes	Section 8.13

The Mt Gibson Iron Ore Mine and Infrastructure Project will make a significant contribution to regional development of the Midwest Region in both the construction and operational phases of the project. It is recognised that construction provides a short lived economic boost and that greater benefits result from the operational phase. During operation the project will employ around 300 people, with most mine site workers living in a village on site in a fly in fly out arrangement.

The Mt Gibson Iron Ore Mine and Infrastructure Project will have a multiplier effect on employment, with total employment resulting from the project expected to be approximately 828 (based on the earlier estimate of a workforce of 200) in Western Australia (McLeod, 2005). The Mt Gibson Iron Ore Mine and Infrastructure Project will also result in employment growth at Geraldton Port, with up to 40 additional jobs generated at the Port due to the constant non seasonal nature of the product (McLeod, 2005). A small number of workers are expected to live locally in places like Perenjori.

While the local employment numbers are relatively low, they are highly significant to the regional economy that requires a number of new projects to secure economic and population growth. This is especially so in the area of Perenjori where the population and employment growth is static (McLeod, 2005).

The Mt Gibson Iron Ore Mine and Infrastructure Project involves the mining of a finite resource and the use of fuel resources that will one day be depleted. However the project will be planned, constructed, operated and decommissioned in a manner that meets the principles of sustainability. MGM, in managing impacts across the quadruple bottom line of Social Capital, Economic Wealth, Environmental Assets and Corporate Governance, will address sustainability principles in a number of ways including:

- establishing sustainability principles in purchasing and contracting;
- ensuring efficient energy and water use;
- minimising waste and encouraging recycling;
- providing for industry and community partnerships.

The application of the EPA's sustainability checklist (EPA, 2004) to the Mt Gibson Iron OreMine and Infrastructure Project is provided in Table 16.

TABLE 16
APPLICATION OF SUSTAINABILITY CHECKLIST TO THE MT GIBSON IRON ORE MINE AND INFRASTRUCTURE PROJECT

Question	Response	Comment
Does the project significantly delete non renewable resources	No	The estimated resource of magnetite bearing BIF is 230Mt and of hematite is 13Mt. Relative to the volumes of other resources in WA this is minor
Does the project deplete assimilative capacity significantly	No	Environmental discharges are minimised. There are no similar operational discharges due to the remote location of the project hence no significant impact on assimilative capacity
Does the project use natural resources responsibly	Yes	Water from slurry pipeline will be returned to minesite for reuse. Dewatering water will be used to supplement process water. Tailings will be filtered with filtrate returned to the process plant.
Does the project satisfactorily restore any disturbed land	Yes	The waste dump will be progressively rehabilitated. All facilities will be removed and the site rehabilitated at end of mine life. The services corridor incorporating the slurry pipeline will be buried and the area rehabilitated immediately following construction. In common with most iron ore projects, the pit will not be amenable to revegetation due to the depth of the pit, the steep sides and the nature of the material in the pit wall
Does the proposal follow the waste hierarchy and manage satisfactorily any waste produced	Yes	Waste will be reduced, reused, & recycled where possible
Does the proposal incorporate best practice in water and energy efficiency	Yes	Water from the slurry pipeline will be returned to the minesite for reuse. Water will be removed from the tailings to minimise water loss. The power supply at the minesite will be a gas fired power station using the highest efficiency technology available for a demanding application in an isolated and heat affected area. The pumping stations for the slurry and return water pipelines will be powered by either mains power or locally generated electricity
Does the proposal make good use of best technology to prevent pollution	Yes	Prevention of pollution is in accordance with industry best practice.
Does the proposal increase the use of non renewable transport fuels	Yes	The mining fleet will use diesel
Does the proposal use energy efficient technologies	Yes	A number of energy efficient technologies have been used on the project including: 1. High pressure grinding rolls (HPGR's) have been employed in the comminution circuit in the place of traditional gyratory crushers reducing crushing energy and providing additional material breakage. Capital cost is higher. 2. Three stages of grinding and separation allows waste material to be rejected early reducing the energy lost in over grinding of waste material. 3. Drying of the tailing/waste to transport on conveyor which uses 1/10 the power of traditional pipe and pumping. 4. Slurry pipe line transportation of the concentrate

Question	Response	Comment
		costs 1/10 of the operating cost of truck/rail transportation of concentrate to the Port. Has major environmental advantages but at high capital cost. 5. HDPE liner in slurry pipeline reduces friction loss reducing power cost. 6. Gas used to generate power where appropriate. More efficient and economical than diesel fuel fired power stations. 7. Process plant designed to maximise the reuse of water. Reduces the power requirements to deliver fresh water. Capital cost is higher
Does the proposal result in net improvements to biodiversity	Yes	• Proposal will result in support for Charles Darwin Reserve (White Wells Station), Mt Gibson Station and Ninghan Station to undertake on-ground works aimed at maximising biodiversity and regional sustainability values. • Proposal will result in the establishment of and support for the Regional Conservation Association will result in a net improvement in biodiversity in the region through support for on ground works within the northern Avon Wheatbelt and Southern Yalgoo bioregions, an area of approximately 2,600,000ha including areas in private ownership managed for conservation and approximately 900,000ha managed by CALM for conservation.. • Proposal will result in the preparation and implementation of a Recovery Plan for the DRF Darwinia masonii, a Conservation Plan for Malleefowl beyond the immediate project area and a Fire Management Plan
Does the proposal increase greenhouse gas emissions	Yes	The mining fleet will use diesel and vegetation will be cleared in the short term. Transportation of magnetite concentrate will be powered by gas or mains fired pumps
Does the proposal involve acceptable levels of risk	Yes	All aspects of the project have been risk assessed including financial, safety, environment.
Does the proposal have a secure foundation of scientific understanding	Yes	Baseline studies have been carried out including for flora, fauna, stygofauna, short range endemic invertebrate fauna, groundwater, aboriginal heritage and genetics of *Darwinia masonii*
Does the proposal minimise the ecological footprint	Yes	Considerable effort has been spent designing the project to ensure it has a minimal ecological footprint by having a co-located waste dump and tailings facility, a single services corridor, transportation of the concentrate as a slurry in a buried pipeline
Does the proposal avoid or minimise adverse impacts and promote beneficial impacts on the surrounding community	Yes	Economic and social benefits (employment, regional development) will be directly and indirectly attributable to the project. Adverse impacts minimised through transportation of concentrate in a buried pipeline, route selection of services corridor
Does the proposal produce sustainable net	Yes	The project will have important economic benefits to

Question	Response	Comment
sustainable economic benefits		the Midwest region especially Perenjori and Geraldton by providing a stable, non seasonal product
Does the proposal produce sustainable net sustainable social benefits	Yes	The MidWest region is suffering from economic and population pressures and needs several new projects to sustain economic and population growth.
Does the proposal add to heritage protection and provide a sense of place	Yes	Aboriginal heritage surveys have been conducted, giving expanding knowledge on local heritage
Does the proposal provide net environmental benefits	Yes	The proposal will result in expanded knowledge base for flora and fauna, the development and implementation of a recovery plan for *Darwinia masonii*, implementation of a conservation plan for the Malleefowl, a regional approach to fire management, establishment of and funding for a Regional Conservation Association charged with enhancing the protection and conservation of biodiversity and regional sustainability values around the Mt Gibson mine and within the Avon Wheatbelt and Yalgoo IBRA bioregions and rehabilitation of disturbed areas
Does the proposal contribute to a more equitable and just society	Yes	Economic and social benefits will be directly and indirectly attributable to the project
Does the proposal interact positively with other likely developments	Yes	The project will utilise gas from the Dampier to Bunbury Natural Gas pipeline, provide ship loading facilities on Berth 5 at Geraldton Port. The services corridor will be located within the Geraldton Southern Transport Corridor
Does the proposal provide new opportunities (social, economic, environmental)	Yes	The project has created an opportunity to establish a Regional Conservation Association aimed at protecting and enhancing conservation and sustainability values within the northern Avon wheatbelt and Southern Yalgoo bioregions, an area of approximately 2,600,000ha including areas in private ownership and approximately 900,000ha managed for conservation.. The project will also result in new opportunities for local employment.

7.2 Environmental Management

7.2.1 Environmental Management System

Mount Gibson Mining is committed to developing an Environmental Management System based on ISO14001 to promote excellence in environmental management and to ensure continual improvement. The Environmental Management System will include assessing environmental risk and legal requirements, developing objectives and targets for improvement, training, operational controls, communication, emergency response, corrective actions, regular audits and review.

7.2.2 Environmental Training

MGM is committed to best practice environmental management. All employees and contractors will participate in an environmental awareness training program. The program

will include an overview of the environmental management responsibilities that all staff, contractors and visitors will be required to adhere to.

7.2.3 Environmental Management Plan

An Environmental Management Plan (EMP) is a key component of an Environmental Management System and includes plans for the management of specific environmental aspects of the project.

An EMP will be developed for the construction and operational stages of the Mt Gibson Iron Ore Mine and Infrastructure Project and will outline management strategies for the environmental issues associated with both the construction and operational phases of the project including:

- Flora (including Declared rare and priority species), vegetation communities and land clearing
- Weeds
- Terrestrial fauna
- Fire
- Surface and groundwater
- Water supply
- Dust
- Noise and vibration
- Waste management
- Acid rock drainage
- Hydrocarbon management
- Aboriginal heritage
- European heritage
- Rehabilitation, revegetation and decommissioning
- Stakeholder liaison
- Reporting and auditing
- Training.

The EMP will include:

- Key Issues – the key environmental issues associated with the construction and operation of the Mt Gibson Iron Ore Project that require specific management.

- Objectives – the standard of environmental management that MGM will achieve in the construction and operation of the Mt Gibson Iron Ore Project.

- Management Strategies – The management strategies for each issue will provide clear and concise direction to staff and contractors on how construction and operational activities will be undertaken to avoid environmental impacts wherever possible, and to manage and mitigate where avoidance is not possible.

- Monitoring. The environmental impacts of constructions and operation will be monitored to ensure the impacts are minimised and managed in accordance with commitments given in the PER and relevant legislation.

- Auditing and Reporting. MGM will be required to report to Regulators and other key stakeholders on a regular basis. Reporting will include general environmental management performance, compliance with and review of existing environmental commitments and compliance with other environmental requirements.

- Training. All staff and contractors will be required to undergo training that will include an overview of the environmental management responsibilities that all staff, contractors and visitors will be required to adhere to.

The implementation of the management strategies and the results of the monitoring programs required under the EMP will be detailed in an end of construction environmental report and submitted to the relevant government agencies. Ongoing operational environmental reporting will be undertaken in a coordinated manner to meet the requirements of the various government agencies.

7.3 Environmental Offset

The EPA released a Position statement outlining its proposed Environmental Offsets policy (EPA, 2006). The Position Statement recommends a hierarchal approach to the management of environmental impacts including (in order of preference) Avoidance, Minimisation, Rectification, Reduction and Offsets.

MGM has attempted to reduce the predicted impact by implementing on-site impact mitigation as outlined in Table 17.

TABLE 17
HIERARCHY OF MANAGEMENT OF ENVIRONMENT IMPACTS RESULTING FROM THE MT GIBSON IRON ORE MINE AND INFRASTRUCTURE PROJECT

Strategy	Application to Mt Gibson Iron Ore Project
Avoid	Avoiding all impacts is not possible, some clearing is essential for the establishment of a mine and associated infrastructure including the services corridor.
Minimise	MGM has designed the clearing footprint to the minimum required for safe and efficient operations and return on investment. (i) The co-location of the tailings facility and waste dump reduces the extent of clearing compared with separate location of tailings and waste dump. (ii) Considerable effort was spent examining transportation options, with the option selected, a slurry pipeline, having less environmental impacts than road/rail options. The width of the services corridor will be restricted in vegetated areas to the absolute minimum possible for construction & operation. (iii) The route of the services corridor/slurry pipeline was deviated to avoid populations of significant flora and minimise impacts on vegetation and sites of heritage significance.
Rectify	the mine is planned to be operational for a minimum of 20 years. Backfilling the pit will preclude further mining and is not technically feasible due to the depth of the pit and the quantity of materials required. The waste dump will be progressively rehabilitated. All facilities will be removed and the site rehabilitated at end of mine life. The services corridor incorporating the slurry pipeline will be buried and the area rehabilitated immediately following construction.
Reduce	Some impacts will be reduced over time, however iron ore pits are not usually amenable to revegetation due to the depth of the pit, the steep sides and the nature of the material in the pit wall.
Offset	This requires an offset package be proposed that contains both primary and secondary benefits aimed at generating a net benefit to the environment.

The Position Statement No 9 discusses examples of offsets such as rehabilitation, re-establishment and secondary offsets such as acquiring land for conservation. The Preliminary Position Statement includes a number of guiding principles for the development of offsets. The Preliminary Position Statement encourages the development of innovative approaches aimed at improving environmental outcomes.

MGM's Draft Offset's Package has been designed in accordance with the EPA's Position Paper No 9 to result in **a net benefit to environmental values in the area**. It recognises the significant contributions being made to the conservation values in the region by the private organisations Australian Wildlife Conservancy (AWC), Australian Bush Heritage Fund

(ABHF) and the Pindiddy Aboriginal Corporation (Pindiddy), and has been developed in association with stakeholders.

The Offsets Package includes:

- Support for the ABHF, AWC and Pindiddy for suitable projects on White Wells, Mt Gibson and Ninghan Stations that are aimed at enhancing the protection and conservation of biodiversity and regional sustainability values. Each organisation will receive up to $50,000 pa (a total of $3 million over the life of the mine). An emphasis will be placed on on-ground works and may include feral animal and weed control, rehabilitation works, seed collection. MGM would report the expenditure of funds, and on the outcomes of the various projects on White Wells, Mt Gibson and Ninghan Stations receiving financial support as part of the company's compliance reporting.

- Establishment of, and funding for, a Regional Conservation Association with the objective of enhancing regional sustainability, biodiversity, visitor and cultural values around the Mt Gibson mine through the conservation and protection of the environment, the provision of employment and the enhancement of visitor and cultural programs. The activities of the Regional Conservation Association may extend to any areas in the northern Avon Wheatbelt and Southern Yalgoo IBRA bioregions, generally focussing roughly between Morawa and Beacon (a distance of 200km from west to east) and Wubin to Paynes Find (approximately 130km north south), an area of approximately 2,600,000ha. In addition to Mt Gibson, White Wells and Ninghan Stations, the area of focuss for the Regional Conservation Association includes approximately 900,000ha managed by CALM for conservation of biodiversity including the former Kadji Kadji, Lochada, Warriedar, Burnerbinmah, part of Barnong pastoral leases and Karroun Hill Nature Reserve.

  The Regional Conservation Association may include representatives of ABHF, AWC, Pindiddy, the Shires of Yalgoo, Dalwallinu and Perenjori, a Landcare Group, and MGM (MGM's Environmental Manager). Representatives of CALM, PLB, DoA, DoE, other neighbours and DoIR would also be invited participate.

  Funding for the Regional Conservation Association would be based on a contribution per tonne, which would equate to $100,000pa or $2 million over the life of the mine. Activities to be funded would have an emphasis an on-ground works aimed at enhancing the protection and conservation of biodiversity and regional sustainability values and may also include research, educational and cultural activities, the purchase of land or any other activities as seen fit by the Regional Conservation Association. For example the Association may fund activities such as goat and weed control within the region, fencing, seed collection, research, visitor access, facilities and centres, guides to biodiversity of the area, indigenous cultural programs etc. The Regional Conservation Association may also consider assisting with the purchasing of additional properties that are suitable for conservation management.

  Draft Objectives for the Regional Conservation Association are presented in Appendix 7.

The Ninghan Regional Conservation Association will prepare a report annually detailing the acquittal of funds. The contribution of the various projects to the objective of ensuring the biodiversity and regional sustainability of the region will be detailed in the Association's reports. The operation of the Regional Conservation Association will be reviewed triennially by a current member of the EPA. MGM will report on the allocation of monies as part of its compliance reporting.

MGM believes this Offsets Package for the Mt Gibson Iron Ore Mine and Infrastructure Project is an innovative approach that recognises the significant contributions being made to the conservation values in the region by private organisations and will result in a net benefit to the environment within the region. As such it meets the intent of the EPA's Position Statement No 9 on Environmental Offsets.

8. ENVIRONMENTAL IMPACTS AND MANAGEMENT

8.1 Environmental Factors

The significant environmental issues relevant to the proposed Mt Gibson Iron Ore Mine and Infrastructure Project, and the environmental factors associated with these issues, were identified using EPA Guidelines and stakeholder consultation. A summary of the potential environmental issues and environmental factors is given below:

Biophysical
- Regional Biodiversity Values
- Vegetation and Flora
- Declared Rare and Priority Flora
- Fauna
- Surface Hydrology
- Groundwater Abstraction
- Landform/Landscape Values (Geoheritage)
- Mine Planning, Decommissioning and Rehabilitation

Pollution Management
- Dust/particulates
- Greenhouse Gas Emissions
- Air Emissions other than Greenhouse Gas Emissions
- Noise
- Liquid and solid waste

Social Surroundings
- Aboriginal Heritage and Culture
- European Heritage
- Light Spill
- Public health & safety
- Visual amenity

The following section provides a detailed discussion of the potential environmental impacts and management strategies for each environmental factor. The EPA has prepared a generic list of environmental factors and associated environmental objectives in its *Guide to EIA Factors and Objectives* (EPA, 2004a).

8.2 Vegetation and Flora

8.2.1 Management Objectives and Applicable Standards and Guidelines

The EPA's objective for the management of terrestrial flora and vegetation communities is to maintain the abundance, diversity, geographic distribution and productivity of flora at species and ecosystems levels through the avoidance or management of adverse impacts and improvement in knowledge.

Applicable guidelines include:

- EPA Position Statement No 2: Environmental Protection of Native Vegetation in Western Australia (EPA, 2000c).
- EPA Position Statement No 3: Terrestrial Biological Surveys as an Element of Biodiversity Protection (EPA, 2002c).
- EPA Guidance Statement No 51 Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia (EPA, 2004e).
- EPA Position Statement No 9 Environmental Offsets (EPA, 2006).

8.2.2 Potential Impacts

Minesite

Clearing of Vegetation

The proposal will result in clearing of 872ha of vegetation at the minesite (Table 18, Figure 15a, b). Eight vegetation associations will be impacted by proposal.

TABLE 18
AREA OF VEGETATION IMPACTED BY PROPOSED MINE & RELATED INFRASTRUCTURE AT MT GIBSON

	Area (Ha)
Hematite and Magnetite Mine (Extension Hill) Pit	152
Hematite Stockpile area and conveyor	26
Waste Dump and Tailings	552
ROM Pad x 2	18
Plant, Internal Roads, Admin Buildings	68
Accommodation Village & associated services	19
Airstrip	29
Deviation of Great Northern Highway	8
Total	**872**

The vegetation associations are not regarded as regionally significant by Bennett (2000). However based on the PATN analysis of the floristic data collected from areas of BIF in the Mt Gibson area in Spring 2005, the project area contains floristic communities that are distinct from other areas of BIF within a 20km radius of Mt Gibson. There is also local geographic-related variation in the floristic composition of vegetation within the Mt Gibson area. The ridges of Extension Hill and Extension Hill South largely contain communities different from the other areas. Iron Hill and Iron Hill East have some similarities particularly in the vegetation related to the colluvium and less prominent ridges. Extension Hill appears to have a geographically definable division within it reflecting differences in the distribution of plant communities. The northern portion of Extension Hill contains several communities which are largely not represented in other areas. The southern part is more similar to the

Extension Hill South area and, to a lesser degree, Iron Hill and Mt Gibson. Six of the 20 floristic communities (Group 40 group) identified and mapped for Mt Gibson area occur only within the Extension Hill area (Figures 14a, 14b).

Introduction and or Spread of Weeds

Few weed species are currently present at the minesite or within the lease area. Invasive weeds are known to occur at Harp Mine, a former gold mine located outside Mt Gibson's tenement holdings. Physical disturbance and additional movement of vehicles may result in the introduction of additional weed species, or the spread of existing weed populations.

Dust

Dust generated during construction and operation has the potential to negatively affect surrounding vegetation, but this is considered likely to be minor impact provided standard dust suppression measures are implemented

Services Corridor

Clearing of Vegetation

The alignment of the services corridor has been selected to minimise impacts on vegetation. Within the pastoral section, the services corridor will impact on 67ha of vegetation generally located immediately to the south of Wanarra Road. The width of the easement has been kept to the absolute minimum requirement (15m) in the pastoral section of the route by using the existing road as a construction platform (Figure 7a), to limit impacts on vegetation. In the agricultural section of the route, the services corridor will impact on a total of 23ha of vegetation, which ranges from good to degraded condition. The easement in the agricultural area is 20m to allow for access, with the construction right of way being 40m (Figure 7b).

None of the vegetation communities identified along the alignment of the services corridor are listed as Threatened Ecological Communities (TEC) on CALM's TEC database, nor listed as a TEC under the EPBC Act (1999) (ATA Environmental, 2005f).

Introduction and Spread of Weeds

Invasive weeds are widespread in the agricultural section of the Services Corridor (ATA Environmental, 2005f). In contrast there are few weeds in the pastoral section of the route. Physical disturbance and additional movement of vehicles may result in the introduction of additional weed species, or the spread of existing weed populations.

8.2.3 Management Strategies

Vegetation

The management and monitoring of vegetation impacts will be addressed in the construction and Operational EMP. Strategies to be employed to minimise the impacts on vegetation include:

- Clearing boundaries to be well defined in the field including the use of fencing where appropriate, personnel educated on the importance of adhering to clearing limits to minimise disturbance to existing vegetation.
- Cleared vegetation to be stockpiled for use in rehabilitation
- Site disturbance to be minimised, with vegetation retained between facilities in accordance with Health, Safety and Operational requirements.
- Vehicles to use designated tracks and park in allocated areas.
- Disturbed areas to be recovered with topsoil to a depth of 100mm where practicable.
- Identification of environmentally sensitive vegetation (eg river crossing).
- Local provenance seed material to be used for seeding in rehabilitation works.
- Quantitative monitoring of vegetation regrowth in rehabilitated areas.
- Remediation of areas showing inadequate regrowth.
- Progressive rehabilitation of disturbed areas (see Section 8.8).

Fire Management

Prevention of fire is a key priority of MGM's operations. MGM will prepare and implement a Fire Management Plan as part of the Project EMP to minimise the risk of unplanned fires. A regional approach (ie broader than the project area) will be adopted to fire management and suppression at the mine site**.** Fire management and suppression will build on research undertaken by ABHF in relation to fire management and suppression in the region. Fire suppression equipment will be present in vehicles, machinery, work areas, fabrication and servicing workshops. Machinery work bans requirements as imposed by local authorities will be observed and cleared areas will be maintained around permanent above facilities.

Weed Management

Weed control measures will be developed and implemented to prevent the introduction or spread of weeds within MGM's lease area. MGM will work closely with adjoining land managers to ensure where possible, a regional approach to weed management is adopted.

A Weed Management Plan will be included in the Construction and Operational Environmental Management Plan. The Weed Management Plan will be developed in consultation with CALM and will include:

- The weed species present on the MGM lease and a map showing their approximate location;
- The potential impacts of the weeds;
- Environmental objectives;
- Performance indicators;

- Management measures to control existing weeds and minimise spread of weeds;
- Monitoring;
- Contingency actions; and
- Reporting;

Off road driving will be prohibited. Equipment and vehicles will be clean of soil and weed free. Topsoil and mulch from areas of heavy weed infestations will be kept separate from soil and mulch from unaffected areas to minimise the spread of weeds.

Dust

Water sprays will be used during construction and operation to minimise the impact of dust on vegetation. Vegetation health will be monitored in dusty areas and construction will be undertaken outside the summer months, particularly in coastal areas, wherever possible. Dust management will be addressed in the Construction and Operational Environmental Management Plan.

8.2.4 Predicted Outcome

Given the proposed management strategies and the environmental offsets, it is considered the EPA's objective for the conservation of vegetation will be met.

8.3 Rare and Priority Flora

8.3.1 Management Objectives and Applicable Standards and Guidelines

The EPA's objective for the management of rare and priority flora are to:

- protect Declared Rare and Priority Flora, consistent with the provision of the *Wildlife Conservation Act 1950* and the *Environmental Protection and Biodiversity Act 1999*; and

- protect other species of conservation significance.

8.3.2 Potential Impacts

Minesite

Both direct and indirect impacts can potentially result during construction and operational phases of the project and can include the removal of individuals and the partial loss of populations of species of Declared Rare/Priority status or taxa of conservation significance

Darwinia masonii (DRF)
Darwinia masonii is generally found on the upper slopes (350m+ADH), crests and ridges of the Mt Gibson area (ATA Environmental, 2004). Two thousand one hundred mature plants or 14% of the known population will be impacted by the proposal to mine Extension Hill (Figure 16a). Nine discrete populations have been recorded (ATA Environmental, 2004).

The most significant populations were recorded from the T3, T6 and HS1 vegetation communities occurring on the crest and east facing slopes of Mt Gibson (Figure 16a).

The genetic diversity of the known population of *Darwinia masonii* is being investigated by the Botanic Gardens and Parks Authority as part of the development of a recovery plan for the species. Standard population genetics statistics suggest that the whole population can be treated as a single provenance unit for *Darwinia masonii* (Botanic Gardens and Parks Authority, 2004) and the removal of 14% of the population will not impact on the genetic diversity of the species.

Acacia cerastes (P1)
The species has a known distribution from Mt Gibson and Mt Singleton (CALM 2004) where it occurs on rocky hills (Maslin, 2002). Bennett (2000) also recorded the species along tracks on Mt Gibson station and the emu farm while ATA Environmental (2005e) recorded a small population to the west of Great Northern Highway.

CALM records indicate there are 11 populations of *Acacia cerastes*. Of these populations at least five, those recorded by Bennett (2000), are in the general area of the project, near the Mt Gibson Range. Armstrong (2004) recorded nine populations of *A. cerates* (P1) from the Mt Gibson area. ATA Environmental (2006) opportunistically recorded an additional 1700 plants from the Mt Gibson lease during a targeted survey for a new *Lepidosperma* sp conducted in February 2006 (Figure 16b).

The estimated population of *Acacia cerastes* within the MGM lease areas at Mt Gibson is 1700 plants, with an additional 40 plants located immediately outside the lease area. The proposal will impact on approximately 118 plants of *Acacia cerastes* (Figure 16b).

Eucalyptus synandra (DRF), *Chamelaucium* sp Yalgoo (P1), *Persoonia pentisticha* (P2) and *Acacia acanthoclada* subsp *glaucescens* (P3)
The Mt Gibson Iron Ore Project will not directly impact on other significant flora present in the area including *Eucalyptus synandra* (DRF), *Chamelaucium* sp Yalgoo (P1), *Persoonia pentisticha* (P2) and *Acacia acanthoclada* subsp *glaucescens* (P3).

There is potential for indirect impacts associated with the project such as the generation of dust to impact on the populations of *Eucalyptus synandra* (DRF), *Chamelaucium* sp Yalgoo (P1), *Persoonia pentisticha* (P2) and *Acacia acanthoclada* subsp *glaucescens* (P3). However it is considered unlikely that indirect impacts associated with the construction and operation of the project will have a significant impact due to the location of the populations.

Other Species of Conservation Significance
Lepidosperma sp. Mt Gibson (R.Meissner & Y.Caruso 3).
Lepidosperma sp Mt Gibson is known only from Mount Gibson where it appears to prefer gullies associated with increased water availability from the slopes throughout the Mt Gibson ranges (Figure 16c). The conservation status of the species is as yet undetermined however initial discussions indicate the species is likely to have a conservation status of P1.

The estimated population of *Lepidosperma sp Mt Gibson* at Mt Gibson is 14,939 plants (ATA Environmental, 2006). The proposal will impact on approximately 8,200 plants (Figure 16c).

Service Corridor

The route of the services corridor was selected and realigned to minimise impacts on priority flora. Seven Priority species occur within the vicinity of the proposed pipeline route, four of which will potentially be affected by the proposed route (ATA Environmental, 2005f, Paul Armstrong & Associates, 2004). No Declared Rare Flora were recorded or will be impacted upon by the proposed pipeline alignment.

The Priority Flora that may be affected by the proposed pipeline route are shown in Table 8. As shown in Table 8, up to seven of the 23 *Chamelaucium* ?sp. Yalgoo (P1), 83 of the 332 *Cryptandra imbricata* (P3), 1001 of the >8000 *Podotheca uniseta* (P3) and 650 of the 4500 *Psammomoya implexa* (P3) within the services corridor will be impacted by the construction of the corridor.

8.3.3 Management Strategies

Minesite

MGM will provide support for a three plus year research program undertaken by the Botanic Gardens and Parks Authority leading to the preparation and implementation of a Recovery Plan for the DRF *Darwinia masonii*. This research has already commenced and includes

- the reproductive biology and factors limiting reproductive success in situ;
- factors limiting the distribution of *D. masonii* (especially ecophysiology);
- seed and germplasm storage ex situ; and
- methods for successful translocation and re-establishment of *D. masonii.*

As part of this research, BGPA undertook a trial reintroduction of *D. masonii* at Iron Hill East, with plants grown from cuttings planted out on site in June 2005. To date, 209 of the 211 cuttings have survived.

Lepidosperma is currently known from gullies at Mt Gibson. MGM will undertake surveys of areas of potential habitat (gullies in upper slopes) in areas of BIF in the Midwest to locate additional populations of *Lepidosperma sp Mt Gibson*. Depending on the results of the additional surveys, MGM will hold discussions with CALM and BGPA with a view to supporting a research program leading to the preparation and implementation of a Recovery Plan *for Lepidopserma sp Mt Gibson.*

A Threatened Flora Management and Conservation Plan will be prepared as part of the Environmental Management Plan for the project, which will address the management of threatened flora impacted by the project. The Plan will be prepared in consultation with CALM and will detail the known distribution of the species, management measures to minimise impacts on the populations including no-go areas, clear delineation of areas to be cleared, environmental inductions, performance indicators, on-going monitoring, and reporting.

Given the poor regeneration of *Darwinia masonii* in areas of recent hot fires, fire is considered to one of the threatening processes to the species. Fire management will be addressed in the Construction and Operational EMP.

The procedures for the management of vegetation outlined in Section 8.2.3 including marking clearing limits to limit the extent of clearing, also apply to the management of Threatened Flora.

Service Corridor

A Threatened Flora Management and Conservation Plan will be prepared as part of the Environmental Management Plan for the project, which will address the management of threatened flora impacted by the project. Several of the management strategies for the protection of vegetation will also apply to the management of priority flora.

In addition populations of priority flora adjoining the services corridor will be strategically fenced off during construction to prevent direct physical impact. The use of priority species in the rehabilitation of disturbed areas will be investigated and the environmental induction program will include information about Declared Rare and Priority flora.

8.3.4 Predicted Outcome

The project will impact on 14% of the total known adult population of *Darwinia masonii*. Removal of 14% of the population is not expected to change the conservation status of the species (currently listed as Vulnerable), nor to impact on the genetic diversity of the species. The research by BGPA and the development and implementation of a Recovery Plan for the species will assist in the long term protection and sustainability of the species.

Except for *Lepidosperma* sp.Mt Gibson, whose conservation status has not yet been determined, the project is not expected to have a significant impact on populations of priority flora, nor to affect the conservation status of the species.

Given the proposed management strategies, it is considered the conservation of Declared Rare and Priority flora will not be adversely impacted by the project.

8.4 Fauna

8.4.1 Management Objectives and Applicable Standards and Guidelines

The EPA's objective for the management of terrestrial fauna is to maintain the abundance, diversity, geographic distribution and productivity of fauna at species and ecosystem levels through avoidance and management of adverse impacts and improvement in knowledge; and to protect Specially Protected (Threatened) Fauna, consistent with the provisions of the *Wildlife Conservation Act*.

Applicable guidelines include *EPA Guidance Statement No 56: Terrestrial fauna surveys for Environmental Impact Assessment in Western Australia* (EPA, 2004b)

8.4.2 Potential Impacts

Minesite

Loss of Habitat

The main impact to fauna will be the loss of fauna habitat at the minesite due to clearing of vegetation. Four primary fauna habitats were identified in the area of Mt Gibson area based on vegetation structure and landforms are follows: the flat sandplains, the flat woodlands, the hillside slopes and the ironstone ridges.

The proposal will result in the clearing of approximately 872 ha of native vegetation. Based on the available information, the faunal assemblage at Mount Gibson appears very similar to that which might be expected in any one of a number of habitats in the region (ATA Environmental, 2005b). There was nothing to indicate that at a genetic, species or ecosystem level, that Mount Gibson is important from a biodiversity perspective. Given that the faunal assemblages at Mount Gibson are similar to published datasets, and that the proposed area of clearing is minor in comparison with the amount of uncleared habitat available in the surrounding area the loss of habitat will have a localised impact on fauna but is not considered to be significant in a regional context (ATA Environmental, 2005b).

Loss of Individual Fauna

It is inevitable that there will be some localised loss of fauna due to direct mortality as a result of construction activities. Ongoing impacts may also result from more frequent vehicle movements and machinery operations. For all vertebrate fauna it is it is considered unlikely that the loss of individuals associated with direct mortalities would affect the conservation status of any of the species recorded from the project area. Impacts on significant species will be avoided where practicable.

Noise and Blasting

Noise from mining activities, including blasting, has the potential to impact on fauna. Studies indicate that fauna are quick to adapt to man-made noises if other threats are absent (Fortescue Metals Group, 2005).

Fire Regimes

Construction activities have the potential to increase the frequency of fires in adjacent areas, which in turn can affect fauna habitats. Fire is a natural part of the ecological cycle in the Midwest, with many fires started naturally by lightning strikes (Don Bell, pers com).

Significant Fauna

Malleefowl

Malleefowl are present in the Mount Gibson area, and it is probable that the area supports a breeding population. One hundred and thirteen Malleefowl mounds were located within the

study area, of which 15 were active. Three active and twenty five inactive nesting mounds will be directly impacted by the proposed development (Figure 17).

There are extensive areas of habitat suitable for Malleefowl at Mount Gibson. Malleefowl mounds were not commonly found in the open Eucalypt woodlands but were instead found in the thickets towards the base of hill slopes and on the sand plain west of the Ironstone range. Similar habitat is found in the surrounding area and region, including areas within the lease area that will not be impacted upon. The area that will be impacted upon during the mining development at Mount Gibson is small in comparison to the surrounding available habitat (ATA Environmental, 2005c).

Any clearing of land or disturbance associated with developing a mine site will have an impact on individual species, species assemblages and the functional values at the site level. However the proposed disturbance at Mount Gibson is not anticipated to have a significant impact on any of these scales in a regional context. The Malleefowl has been observed at multiple locations within the region over a period of time (Hart, Simpson and Associates, October 2000; Recher August 2001, September 2003; Dell 2001; Thompson 2004, 2005, Northern Malleefowl Conservation Group) (Figure 18), which suggests that the disturbance impact associated with the project will not be significant in a regional context.

It is possible that further surveys in the region may show that the regional population is denser than current data suggests. Foxes and cats are known to be significant predators of Malleefowl, with freshly killed Malleefowl observed at Mt Gibson (ATA Environmental, 2005c).

Male Malleefowl are reported to occasionally return to inactive mounds and re-use them for breeding many years after they were last utilised (R. Johnstone, Western Australian Museum, pers. comm. 2004). Radio-tracking studies (Booth, 1987 and Benshemesh, 1992 cited in Benshemesh, 2000) have shown that over the course of a year Malleefowl may range over one to several square kilometres and that home-ranges overlap considerably.

Rainbow Bee-eater

Although the Rainbow Bee-eater (a Migratory species listed under the *EPBC Act 1999*) was observed in the study area, it is unlikely that development activity associated with the mine will appreciably modify, destroy or isolate an area of important habitat, or seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significantly proportion of the population (ATA Environmental, 2005b).

Major Mitchell's Cockatoo

Major Mitchell's Cockatoo, classified as Schedule 4 under the *WA Wildlife Conservation Act 1950,* have been recorded at Mount Gibson. The habitats utilised by this species are widespread in the surrounding area and the sites that will be impacted upon during the mining development are small in comparison to the surrounding habitat. It is estimated that only 0.21% of the total current extent of potential Major Mitchell's Cockatoo habitat associated with the project area (i.e. Vegetation Association No. 1063 – "Medium-Low Woodland; York Gum and Cypress Pine") (Beeston *et al.,* 2002) will be impacted by the proposed mining development. The impacts associated with further disturbances at each of these sites will have a low impact on Major Mitchell's Cockatoo.

Carnaby's Cockatoo

Carnaby's Cockatoo (*Calyptorhynchus latirostris*) classified as Endangered under the *EPBC Act* 1999 and Schedule 1 under the *WA Wildlife Conservation Act 1950* is a species of conservation interest through southern WA. Its preferred habitat is woodland where it preferentially feeds on plants of the Proteaceae family. Preferred nesting trees include the smooth-barked Salmon Gum (*Eucalyptus salmonophloia),* which contain deep hollows. Nesting also occurs in Marri (*Corymbia calophylla)* and Tuart (*E. gomphocephala*).

Carnaby's Black-Cockatoos have not been recorded from any of the surveys at Mount Gibson or in the broader region (ATA Environmental, 2005b; Alan Tingay & Associates 1996; Hart, Simpson and Associates, 2003; Bamford Consulting Ecologists, 2003, Bamford & Wilcox, 2004; Burbidge, *et al.* 1989; Dell, 1996a, b). Given the known distribution of Carnaby's Cockatoo is to the south and west of the proposed Mount Gibson mine site it is highly unlikely that the mine will impact on breeding or feeding areas used by this species.

Other Significant Fauna

It is considered unlikely that other specially protected or vulnerable species listed under the EPBC Act 1999 or WA *Wildlife Conservation Act 1950*, such as *Morelia spilota imbricata, Aspitdites ramsayi, Egernia stokesii badia* and *Cyclodomorphus branchialis*, are present in the vicinity of the proposed mine and associated infrastructure (ATA Environmental, 2005b).

Services Corridor

The majority of the proposed services corridor route between Mount Gibson and Geraldton Port is associated with cleared agricultural lands. However, in the pastoral section of the route, particularly along Wanarra Road between Mongers Lake and Mount Gibson, clearing of vegetation up to 15m in width may be necessary. The clearing of vegetation associated with the construction of the services corridor will mostly affect terrestrial species that inhabit the thicket, heath and woodland vegetation communities between Mount Gibson and Mongers Lake. Except for a few patches of roadside vegetation, most of the land west of Mongers Lake has been cleared for agriculture.

While there is likely to be a direct impact resulting from clearing of the vegetation, the construction of an open trench and other earthworks associated with the stripping and return of vegetation and topsoil, it is not considered to result in significant impacts on fauna habitat and faunal assemblages. Given the significant amount of intact vegetation to the north and south of Wanarra Road, little impact is expected on most species in the area as the clearing associated with the pipeline is linear and at most only 15m wide. The remnant fauna habitat along the pipeline route that is to be disturbed is widely distributed throughout the Midwest region and none of the fauna species recorded in surveys in the region or expected to be found in the immediate vicinity of the pipeline route have ranges restricted to the immediate vicinity.

The salt lakes and associated vegetation provide isolated habitat types throughout the Wheatbelt and Midwest regions. Although the salt lakes are often geographically isolated the faunal assemblages found among these similar habitat types are quite uniform throughout the region. The minimal linear clearance of vegetation and/or disturbance on these habitats is expected to be minimal given the proposed management measures.

Seven Scheduled or Priority species are likely to visit, be resident, or have been recorded along the pipeline route. The Malleefowl occurs within the areas of native thicket, woodland and shrubland between Mount Gibson and Mongers Lake. Given the proposed management strategies outlined in Section 8.4.3 it is unlikely that any Malleefowl or Malleefowl mounds will be significantly impacted (ATA Environmental, 2005d).

The Western Spiny-tailed Skink may occur in the woodland areas between Mount Gibson and Mongers Lake, although no individuals or their characteristic scat piles were located. The impact on this species should be minimal given the proposed management strategies outlined in Section 8.4.3.

Other species of conservation significant fauna likely to be resident along the pipeline include the Shield-backed Trapdoor Spider, Peregrine Falcon, Major Mitchell's Cockatoo, White-browed Babbler, Hooded Plover, Rainbow Bee-eater and other Migratory species. Given the minimal clearing and linear construction of the pipeline, it is unlikely to substantially modify, destroy or isolate an area of important habitat for these species, or seriously disrupt the lifecycle of an ecologically significant proportion of the population of any of these species (ATA Environmental, 2005d).

The proposed open pipeline trench will act as a very long pit-trap for terrestrial fauna. High levels of fauna mortality have occurred in previous pipeline construction projects and specific management strategies are needed to prevent this occurring on the Mt Gibson Iron Ore Mine and Infrastructure Project.

Habitat Connectivity

Remnant vegetation retained in road reserves may provide important linkage corridors between areas of remnant vegetation.

A survey of road verges in the Wheatbelt indicated that they are probably of little to no significance for the conservation of small native mammals and the majority of mammals utilising the roadside verges are introduced (Arnold *et al.*, 1987). The reptiles and amphibians collected in the road verges appear to be common and widespread (Arnold *et al*., 1987). However, road reserves do appear to have considerable value for birds, especially smaller species (Arnold *et al*., 1987). The woodland verges may provide shelter and breeding sites for large birds that forage on farmland, whilst the areas with more of a shrub layer may be important refuges for small insectivorous birds.

Most of the alignment within the agricultural section of the route has been cleared for agriculture. However, in the pastoral section of the route, particularly along Wanarra Road between Mongers Lake and Mount Gibson, clearing of vegetation up to 15m in width may be necessary immediately abutting the existing Wanarra Road.

The pipelines will be buried and rehabilitated immediately following construction .

The clearing of vegetation associated with the pipeline is unlikely to have a significant impact on habitat connectivity as most of the pipeline route has already been cleared for agricultural purposes and the alignment follows roads, railway reserves and powerline easements for large distances.

The services corridor is therefore not expected to present a barrier for the movement of smaller, less mobile species.

8.4.3 Management Strategies

Minesite

Fauna Management Plan

The management of fauna will be addressed in the Construction and Operation EMP. Clearing of vegetation will be minimised. Disturbed areas will be progressively rehabilitated and will aim to reflect the pre disturbance state as closely as possible. Vegetation debris, logs and rocks will be returned to areas that have been disturbed as they provide microhabitats for recolonising fauna.

Appropriate waste management will be undertaken (Section 8.13) to limit opportunities for scavenging by feral animals. A feral animal control program will be undertaken as part of the Malleefowl Conservation Plan.

All drill holes will be temporarily capped on completion of drilling and permanently capped as soon as possible.

An Environmental Induction Program will be undertaken by all staff to educate them about the environmental management strategies associated with the project, focussing particularly with the management strategies directly relevant to the personal actions of onsite staff. These strategies will include the prohibition of firearms, traps and domestic pets on site, the legal status of native fauna and the procedures to be followed in the event of encountering native fauna including potentially dangerous fauna. Vehicles will be driven at safe speeds to minimise the chance of road fauna deaths. All fauna deaths during the construction of the project will be reported to CALM.

Malleefowl Conservation Plan

MGM will prepare and implement a Malleefowl Conservation Plan, which will involve working closely with other stakeholders including the Malleefowl Conservation Group to facilitate the long term sustainability of the Malleefowl in the area. Discussions with Professor Stephen Davies (Stephen Davies, pers comm.) indicated that Malleefowl will readily utilise man made mounds as nests. The construction of artificial mounds will be considered in the Malleefowl Conservation Plan. The preparation and implementation of a Malleefowl Conservation Plan would strongly complement work being undertaken by the CRC for Invasive Animal Control on Mt Gibson Station.

The Malleefowl Conservation Plan will examine the causality of the apparently high concentration of Malleefowl at Mt Gibson. Given the limited information on Malleefowl in the broader region, it is not clear whether the apparently high concentration of Malleefowl at Mt Gibson is a consequence of the detailed grid searches undertaken at Mt Gibson resulting in greater numbers being recorded. It is possible that detailed surveys in the broader region may show the regional population to be denser than current data suggests.

MGM will contribute to a regional on-ground feral animal control program of foxes in particular, which are known to predate on malleefowl in the Mt Gibson area.

Stygofauna

No stygofauna were present in samples collected from bores adjacent to the proposed pit. However there is the potential for stygofauna to be present in the area. MGM will undertake stygofauna monitoring prior to the commencement of operations. Should stygofauna be located, a long term plan will be developed to ensure the project does not impact adversely on stygofauna.

In the unlikely event that the pit dewatering yields insufficient water, an alternative water supply for dust suppression has been identified in the paleochannel located to the east and north of the pit. An alternative supply for potable water has been located at approximately 50m below ground depth in fractured rock in the Mt Gibson hills. Should it be necessary to develop a borefield in the paleochannel or to extract potable water from the fractured rock reserves, a Stygofauna Sampling and Management Plan will be developed prior to the commencement of operation of the borefield.

Fire Management

A regional approach (ie broader than the project area) will be adopted to fire management and suppression**.** Fire management and suppression will build on research undertaken by ABHF in relation to fire management and suppression in the region. Fire management will be addressed in the Construction and Operational EMP.

Services Corridor

Comprehensive fauna management during will be undertaken to minimise fauna mortality construction of the services corridor. A Fauna Management Plan will be prepared prior to the commencement of construction and will build on experiences with the construction of other pipelines.

Wherever possible the alignment of the services corridor will overlay existing tracks or clearings, particularly where the route passes through tracks of remnant vegetation. The sections of the route containing suitable habitat for malleefowl will be walked prior to clearing to ensure no malleefowl mounds are present. If present they will be flagged and avoided by construction staff. Habitat trees, particularly those with hollows will be marked and avoided where possible and all hollow logs and branches will be returned intact as part of the vegetation rehabilitation

No open trench construction will be undertaken in vegetated areas in the period of highest environmental temperatures and the period when reptiles are most reproductively active (typically November/December to February) to minimise fauna mortality without prior approval from CALM. The open trench will be limited to 10km at any one time (ie two parallel trenches each 10km long) through vegetated areas, and 25km in cleared areas. No part of the trench will remain open for longer than 7 days without prior approval from CALM. In areas such as between Mongers Lake and Mt Gibson the length of open trench may be reduced or additional fauna clearing personnel may be utilised, depending on the numbers of fauna initially found in the trench.

A minimum of two fauna clearing personnel will be employed for the duration of the construction per 10km of open trench. The fauna clearing personnel will be able to demonstrate sufficient suitable experience to enable them to get a handling licence from CALM and will be appropriately trained and experienced. All species caught in the trench will be recorded in accordance with the conditions of the CALM collecting permits; the location and observed status (dead or alive) will be recorded for each capture. All captures will be temporarily marked to measure the rates of recapture and all fauna mortalities will be offered to the Western Australian Museum. All captures of fauna of conservation significance will be reported to CALM as per licence conditions.

The temperature in the trench will be recorded regularly. Trenches will be cleared of fauna at least once each day before 10am, at appropriate times during the day thereafter and prior to backfilling the trenching. No fauna will remain in the trench for greater than 4 hours between 10am and 3pm and shade shelters (e.g. heavy duty Hessian bags) will be installed in open trenches at intervals not exceeding 50m. Trench ramps will be installed in vegetated areas at intervals of 500m along the open trench to allow fauna to exit. Water in the trench with the exception of groundwater shall be pumped out on a daily basis and discharged via a mesh to adjacent vegetated areas.

All fauna observations, including scats, tracks or other traces (e.g. Malleefowl mounds) and deaths of individual fauna during construction will be reported to CALM.

Construction personnel will undergo an Environmental Induction Program, which will include the recognition of Malleefowl mounds, and will detail the legal protection afforded to all native fauna. Firearms, traps and domestic pets will be prohibited on site.

Fire Management will be addressed in the Construction EMP

8.4.4 Predicted Outcome

There will be limited loss of fauna habitats and associated direct impacts to individual fauna and fauna populations. Some loss of larger fauna is expected from road fauna deaths, but these impacts will be minimised through appropriate management.

The regional impact on fauna is expected to be negligible as representation of fauna habitats and their associated fauna communities will be maintained in the project area and surrounds.

Preparation and implementation of the Malleefowl Conservation Plan will ensure the project will not impact on an ecologically significantly proportion of the population.

8.5 Surface Hydrology

8.5.1 Management Objectives and Applicable Standards and Guidelines

The EPA's objective for the management of watercourses is to maintain the integrity, ecological functions and environmental values of watercourses and sheet flow.

The EPA's objective for surface water quality is to ensure that emissions do not adversely affect environmental values or the health, welfare and amenity of people and land uses by meeting statutory requirements and acceptable standards.

Applicable standards and guidelines include *ANZECC/ARMCANZ Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC/ARMCANZ, 2000).

8.5.2 Potential Impacts

Mine Site

Surface drainage in the Mt Gibson area is primarily characterised by ephemeral flows. An ephemeral drainage line flows from Iron Hill North in a south easterly direction to 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 (Rockwater,2005c) (Appendix 1).

Lake Karpa, which was used by Oroya Mining to discharge hypersaline water from dewatering of the Mt Gibson Gold mine, is located 14km south south-east of the minesite. Due to the construction of a bund around the lake, Lake Karpa only receives water from direct rainfall (Rockwater, 2005b).

The paleochannel drainage systems of Lake Moore and Mongers Lake are located 30km to the east and 40km to the west of the minesite respectively.

Hydraulic modelling using 1 in a 50 year annual rainfall event (ARI) was used to assess the surface hydrology of the mine site area. The area of the proposed mine contains 3 catchments (Figure 11). The first catchment has an area of 5km^2 and a length of 2.1km. During a big flood event, the combined runoff from several local runoff paths eventually flows as a wide sheet flow in a S-SE direction. The second catchment has an approximate area of 1.6km^2 and a length of 1.3km. The bigger flood event runoff from several small contributing catchments eventually discharges as sheet flow in a northerly direction. The third catchment area discharges in a general south-westerly direction though a series of minor steep creeks. As the slope flattens, these creeks rapidly disappear. After infiltration and other losses, the remaining discharge flows in a southerly direction as a wide sheet flow (Rockwater 2005c).

The construction and operation of the mining and processing operations have the potential to impact on the hydrology and water quality of watercourses. Impacts to watercourses may include alteration of natural sheet flow, increased erosion and sediment deposition and pollution (eg hydrocarbon runoff from workshops etc).

To the south of the proposed pit, a large proportion of the catchment area will be taken up by the pit and the catchment will be significantly reduced. The ROM pad is not located in a significant flow path of any defined surrounding or upstream catchment and will not impact

on the surrounding and downstream catchments. The hematite stockpile will not alter or significantly affect the downstream flow path.

There are no sensitive receiving waters that would be adversely impacted by the project. (Rockwater, 2005c)

Service Corridor

The services corridor crosses the Lockier, Irwin and Greenough Rivers. There are several crossings of salt lakes systems and numerous crossings of small water courses and drainage lines. A number of artificial drainage lines in the form of contour banks to redirect surface flows are also crossed by the services corridor.

Much of the services corridor is located on soil types of a sandy nature with good internal drainage, which generally have low water erosion capacity. Exceptions to this are the alluvial loamy soils of the Irwin district and at watercourses.

The construction of the services corridor may potentially impact on watercourses by altering natural flows, increasing erosion and destabilising banks. Increased sediment load in flow waters can decrease water quality. Poorly placed construction material may impede flows. The service corridor is unlikely to have any impacts on surface hydrology once construction and rehabilitation is completed.

8.5.3 Management Strategies

Minesite

Hydraulic modelling based on 1 in a 50 year annual rainfall event (ARI) was used to assess the surface hydrology of the mine site area and develop appropriate management of surface runoff (Rockwater, 2005c). A copy of Rockwater (2005c) is provided as Appendix 1.

Site specific surface drainage controls will be implemented where required. Sumps will be constructed immediately around ore processing and the waste dump area. Drainage from these areas will flow to retention basins installed to contain and settle out sediment from surface runoff**.**

Potentially contaminated runoff from around the process plant and workshop will be treated to remove all contamination prior to discharge to the environment.

Surface water management will be implemented for the waste dump and dry tailings facility to ensure that the natural flow paths do not alter or deviate to other locations. A set of perimeter drains designed according to hydraulic computations (Rockwater, 2005c) will be implemented for the waste dump and dry tailings facility.

The surrounding and downstream catchments at the ROM Pad will not be impacted by the project and a local drainage system will be designed to manage local runoff from the ROM pad (Rockwater, 2005c).

The flow path downstream of the hematite stockpile location will not be altered or significantly affected by the project. A perimeter drain will be constructed around the hematite stockpile to ensure cohesive merging of runoff with the natural flow, as recommended by Rockwater (2005c).

A large proportion of the catchment area to the south of the pit will be taken up by the pit. The catchment will be significantly reduced and will not be adversely affected by the proposed works. No surface water management works are required in this area as the catchment is undefined and large flood events will discharge as sheet flow, most of which is expected to infiltrate into the semi-sandy soil (Rockwater, 2005c).

Drainage sumps will be inspected regularly. Excess surface water runoff will be released to the environment after passing through a retention basin to remove silt.

The heavy and light vehicle washdown facility will incorporate a sediment trap and oily water treatment plant.

All hydrocarbons and chemicals will be stored according to Australian Standards to minimise contamination (see Section 8.13).

Service Corridor

Pollution and contamination of surface and groundwater during the construction of the services corridor will be prevented through the adoption of appropriate waste management practices (see Section 8.13). Pipeline construction does not require significant quantities of hazardous materials (see Section 8.13). Hazardous wastes including fuel and oils will be managed in accordance with Australian Standards.

Erosion control structures such as silt fences, diversion and collection bunds, sediment dams and holding sumps will be installed temporarily as required in areas of the service corridor identified as having a high risk of erosion or sedimentation to ensure no impact on surface water quality. The structures will be temporary in nature and will be removed completely as part of the rehabilitation of the construction area.

Specific construction measures will be implemented for the crossing of natural or artificial watercourses to ensure the construction of the services corridor does not impact on surface hydrology or water quality. Construction and restoration measures for the major crossings including the temporary diversion of surface flow to suitable drainage areas by the construction of erosion control banks. Drainage lines and watercourses that are crossed by the service corridor will be reconstructed and re-profiled following construction of the corridor. Rehabilitation of major watercourses will include replacement and compaction of bank material and later topsoil. Where required, specific bank stability measures will be utilised including placement of cement stabilised sandbags, stone mattresses and reseeding.

Vegetation will be cleared and stockpiled for respreading. Topsoil will be stripped from the banks and stockpiled separately to trench excavation material. Material will not be stockpiled in the beds of watercourses to prevent the impoundment and loss of materials.

The crossings of the two salt lake systems (the tributary of the Yarra Yarra Lakes and Mongers Lake) will be within the causeways of Simpson Road and Wanarra Road respectively, and will not impact on or change the existing surface flows in these areas.

The final restored profile of the services corridor will be such that flow in drainage systems will not be affected.

8.5.4 Predicted Outcome

The natural functions and environmental values of watercourses within and downstream of the project will not be adversely affected by the project. There will be no unacceptable impacts on surface water quality.

8.6 Groundwater

8.6.1 Management Objectives and Applicable Standards and Guidelines

The EPA's objective for the management of groundwater is to maintain the quantity of water so that existing and potential environmental values, including ecosystem maintenance, are protected.

The EPA's objective for the management of groundwater quality is to ensure that emissions do not adversely affect environmental values or the health, welfare and amenity of people and land uses by meeting statutory requirements and acceptable standards.

Applicable standards and guidelines include *ANZECC/ARMCANZ Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC/ARMCANZ, 2000) and WRC report HG6 *Mine Void Resource Issues in WA (WRC, 2003*).

8.6.2 Potential Impacts

Minesite

Mine dewatering may result in short or long term changes to water table level and the hydraulics of the aquifer. Unsustainable groundwater abstraction may result in adverse short term and long term impacts to groundwater supplies. The main potential impacts are outlined below.

Groundwater Levels

The hydrogeology and dewatering of the mine pit was examined by Rockwater (Rockwater 2005a, Rockwater 2005b) (Appendix 1). The pit from which magnetite ore is to be mined at Extension Hill will be excavated in rock of mainly low permeability except for part of the western wall where there is a deeply weathered moderately permeable material. Excavation to about 100m AHD, 220m below the natural water table, will require dewatering at a rate of 2,500m^3/day (based on 50m/year advance) based on numerical modelling of the aquifer response to pit dewatering. The dewatering will occur via a series of bores and the abstracted

water will be used for dust control, processing water and potable and domestic water (following treatment in a Reverse Osmosis Unit).

Groundwater levels in the bedrock aquifers will be lowered in a steep cone of depression around the pit and extend up to 2km radially. Beyond this distance the drawdown would be negligible (Rockwater 2005b) (Figure 11c)

With the exception of the paleochannel located approximately 4km east of Extension Hill, groundwater levels in the area are naturally deep and do not support phreatophytic vegetation nor stygofauna (Appendix 6). Around Extension Hill the water table lies at 50-120m below ground surface (bgs). The material in which groundwater levels will be lowered around the pit is bedrock. Vegetation may potentially draw water from the saturated aquifer along the paleochannel, however the paleochannel will be unaffected by the drawdown due to the distance from the pit and the fact that the aquifer in the paleochannel is underlain by clay, which would inhibit hydraulic connection with the bedrock (Rockwater 2005a).

Impacts on Other Groundwater Users

Groundwater is extracted for watering of livestock on Mt Gibson and Ninghan Stations. The amount of water drawn for this purpose is small, with the closest bore located approximately 4km to the northwest of the pit (Figure 11b). The project will not affect abstraction for pastoral use.

The Mt Gibson Gold mine has an established borefield in the paleochannel aquifer, located 4km to the east of the mine at its closest point. Groundwater in the paleochannel is predominately saline. Groundwater levels in the paleochannel supporting the water supply borefield for the Mt Gibson Gold mine will be unaffected by the drawdown as a result of the distance from the pit (>3km), and the paleochannel being underlain by clay, inhibiting any hydraulic connection between the paleochannel and the bedrock (Rockwater, 2005a).

Final Mine Void

It is expected the pit water level will stabilise at an elevation below the present static water level (320mAHD), with the pit persisting as a groundwater sink, attracting low rates of groundwater inflow. This type of void occurs in rocks of low permeability and the water in the void becomes highly saline but remains within and below the void and will have no impact on the regional groundwater table (Rockwater 2005a, Rockwater 2005b).

The salinity of the water in the void is likely to increase with time after dewatering ceases, probably to hypersaline levels. The water level in the pit is expected to remain close to the pit floor as a result of inflow and evaporation being approximately equal at about 290,000m^3pa. Given a groundwater salinity of 3,000mg/L TDS, the salinity of the water at the base of the pit will increase by 3,000mg/L pa, reaching 100,000mg/L after 34years. The salinity levels may be less as no allowance has been made for the dilution effect of rainfall and conservation estimates for water inflow into the pit (Rockwater 2005a, Rockwater 2005b).

Saline water will not move into the surrounding aquifers (Rockwater 2005a, Rockwater 2005b) and the final mine void will have no impact on the regional groundwater table (Rockwater 2005a, 2005b).

Groundwater Quality

Groundwater quality may be impacted through pollution from chemical and hydrocarbon materials and wastewater streams.

Service Corridor

Underground pipelines have no impact on quantities or quality of surface or underground water sources. Trench excavation for the services corridor will be above the water table for the majority of the route. In restricted areas including the crossing of the Irwin, Lockier, and Greenough Rivers, Mongers Lake and the Yarra Yarra drainage system, excavation may be below ground level. In this case there may be a requirement for localised trench drainage, with drainage water discharged downstream and back into the same water course, in a similar manner to a roadside culvert. There is no addition or removal of water from the water course or change in water quality.

Tathra Borefield

Process and transportation water will be obtained from a borefield within the Arrowsmith Groundwater Area located to the south west of Three Springs. Groundwater conditions in the Tathra Sub Area were extensively investigated by Aquaterra (2005) (Appendix 2). Hydrological modelling undertaken by Water and Rivers Commission has shown the sustainable yield from the groundwater area to be 26GLpa (Aquaterra, 2005). The abstraction of up to 5.5GLpa through a borefield consisting of 8 bores located 500m apart is therefore sustainable. In principle agreement to this abstraction has been obtained from the DoE (Appendix 3).

Aquaterra modelled the impacts of groundwater abstraction on the water table and potentiometric level. At the end of year 20 the maximum drawdown in the potentiometric surface at a 50m radius from a production bore is in the order of 8.3m. The maximum drawdown in the water table at a 50m radius of a production bore is in the order of 4.7m. There are no licensed existing users within the 0.5m drawdown zone of impact (Aquaterra, 2005).

The aquifer is located at depth (estimated 140m below ground surface) and no impact is expected on groundwater dependent ecosystems or vegetation in the vicinity of the borefield.

8.6.3 Management Strategies

Minesite

Groundwater Levels
The regional hydrogeology at Mt Gibson is described in Section 5.5.

Dewatering of the pit is not expected to have a significant effect on local or regional groundwater resources and usage. Mine dewatering will used for dust suppression, potable water and production. It is not anticipated that disposal of excess groundwater production will be required as mine dewatering and water supply abstraction will be integrated to reduce, where possible, impacts of groundwater abstraction. In the unlikely event that the

rate of pit dewatering exceeds water requirements, abstraction from the Tathra borefield would be reduced, with the dewatering water making an increased contribution to the processing water.

The construction and management of dewatering bores will be subject to the terms and conditions of a groundwater extraction licence from the Department of Water.

Comprehensive monitoring will be undertaken to ensure the hydrogeological modelling is correct. Where required, the groundwater model will be updated with the results of the operational monitoring data to confirm the predictions remain valid. The proposed monitoring program will include:

- regional groundwater levels on a monthly basis;
- pumping water levels and pumping volumes on a monthly basis;
- water quality monitoring;
- regular review and assessment of all monitoring data.

Once mining and groundwater abstraction ceases, water levels in the pit will stabilise at a level where the water level rise in the pit induced by groundwater inflow and rainfall is balanced by evaporation. It is predicted that the pit will persist as a groundwater sink, with water levels below the present static water level. The salinity of the water in the void is likely to increase with time after dewatering ceases, probably to hypersaline levels. The water level in the pit is expected to remain close to the pit floor as a result of inflow and evaporation being approximately equal at about 290,000m^3pa. Given a groundwater salinity of 3,000mg/L TDS, the salinity of the water at the base of the pit will increase by 3,000mg/L pa, reaching 100,000mg/L after 34 years. The salinity levels may be less as no allowance has been made for the dilution effect of rainfall and conservation estimates for water inflow into the pit (Rockwater 2005a, Rockwater 2005b). Saline water will not move into the surrounding aquifers (Rockwater 2005a, Rockwater 2005b) and the final mine void will have no impact on the regional groundwater table (Rockwater 2005a, 2005b).

No stygofauna were present in samples collected from bores adjacent to the proposed pit (Appendix 6). However there is the potential for stygofauna to be present in the area. MGM will undertake stygofauna monitoring prior to the commencement of operations. Should stygofauna be located a long term plan will be developed.

Groundwater Quality

Pollution and contamination of groundwater will be prevented through the adoption of appropriate waste management practices (see Section 8.13). Sewage and grey water from the mine operations buildings, plant and accommodation camp will be treated on site using package sewage treatment plants. Hydrocarbons and chemicals will be stored according the Australian Standards to minimise the risk of contamination. Overburden, waste rock and dry tailings will be stockpiled in a large, purpose designed dump and progressively rehabilitated. Potentially acid forming material will be encapsulated in designated and appropriately designed waste dumps to minimise the potential for acidic materials leaching from waste rock into the groundwater or surface water bodies.

Service Corridor

Pollution and contamination of groundwater during the construction of the services corridor will be prevented through the adoption of appropriate waste management practices (see Section 8.13). Pipeline construction does not require significant quantities of hazardous materials (see Section 8.13). Hazardous wastes including fuel and oils will be managed in accordance with legislative requirements.

Trench excavation will be above the water table for the majority of the route. In restricted locations including the crossing of the Irwin, Lockier and Greenough Rivers, excavation may be below the groundwater level and there may be a requirement for localised trench drainage. Where required, trench drainage will be undertaken locally with drainage water discharged downstream and back into the same watercourse, in a manner similar to a road culvert. There will be no addition to or removal from or change in the water quality of the affected watercourse.

Surface water will be managed to minimise erosion and sedimentation impacting on surface or ground water quality (Section 8.5).

Tathra Borefield

Groundwater abstraction from the Tathra borefield will be licensed and managed through the Department of Water.

A groundwater monitoring program will be developed to ensure the sustainable use of groundwater for the life of the project. Monitoring will address water levels, water quality and production history. The results of the monitoring program will be reported in accordance with the conditions of the Groundwater Abstraction Licence.

8.6.4 Predicted Outcome

Water abstraction will be managed in a sustainable manner. Groundwater drawdown and water quality will be monitored. No unacceptable impacts on groundwater levels or groundwater quality are expected.

8.7 Landform/Landscape Values (Geoheritage)

8.7.1 Management Objectives and Applicable Standards and Guidelines

The EPA's objective for the management of landscape and geoheritage is to maintain and protect any significant landscape and geoheritage values and to maintain the integrity, ecological functions and environmental values of the soil and landform.

The applicable guideline includes the Tasmanian Parks and Wildlife Service, *Concepts and Principles of Geoconservation* (TPWS, 2002).

8.7.2 Potential Impacts

The Tasmanian Parks and Wildlife Service (2002) defines 'geodiversity' as '*the natural diversity of geological, landform and soil features and processes*' and geoconservation' as '*the conservation of geodiversity for its intrinsic, ecological and (geo)heritage values*'.

The Canadian Geoheritage Committee defines a geoheritage site as a site that meets one or more of the following criteria (Hamersley Iron, 2005):

- it exposes a unique or critical record of natural history;
- it contributes to understanding of the natural history of the region;
- it is scientifically important, or has scientific educational values; or
- it offers distinct aesthetic and cultural values.

Activities that may potentially affect the landform and landscape include:

- earthworks which include removing topsoil, overburden and ore during mining, which will create voids in the landscape;

- establishment of waste dump to form a new raised landform; and

- placement of infrastructure temporally altering the appearance of the natural environment.

The landscape of the proposed mine area is not considered to be unique, with similarly elevated areas of BIF occurring in the Midwest and at Mt Gibson. The area proposed to be mined is one of up to 9 hills, with the remaining hills including Iron Hill, Iron Hill East, Mt Gibson and Mt Gibson South, being more elevated than Extension Hill.

Mt Singleton is located approximately 20km to the north is recognised for its geological values on the Register of the National Estate as an Indicative Place and is used for teaching geological processes. The project will not impact on Mt Singleton.

The project area is not included on the Register of the National Estate, the Commonwealth Heritage List, National Heritage list and World Heritage List for natural values.

No significant geoheritage values have been identified, which is supported by the results of the biodiversity survey finding similarities between the hills within Mt Gibson and the absence of natural places within the project area identified as being significant by the Aboriginal groups (see Section 8.14).

8.7.3 Management Strategies

Rehabilitation of disturbed areas at the mine site will be undertaken progressively and in accordance with legislative requirements (See Section 8.8). Surfaces will be contoured to create a post mining landform that resembles as closely as possible the pre mining landform.

8.7.4 Predicted Outcome

There will be no significant impact on the landscape and geoheritage values in the area as a result of the project.

8.8 Mine Planning, Decommissioning and Rehabilitation

8.8.1 Management Objective and Applicable Standards and Guidelines

The EPA's objective for the management of rehabilitation and decommissioning is to ensure, as far as is practicable, that rehabilitation achieves a stable and functioning landform which is consistent with the surrounding landscape and other values.

Applicable standards and guidelines include:

- *Strategic Framework for Mine Closure* (ANZMEC & Minerals Council of Australia, 2000);
- *Mine Void Water Resource Issues in Western Australia* (Water & Rivers Commission, 2003)

8.8.2 Potential Impacts

The project will disturb approximately 872ha of land at the minesite. If these areas are not decommissioned and rehabilitated appropriately, it could result in unstable landforms, contamination of groundwater and surface water, impacts on flora and fauna and health and safety issues. In addition, poor closure planning may result in insufficient allocation of funds/resources for closure, particularly in the event of unforseen closure.

The Extension Hill pit will remain as a permanent void upon the cessation of mining, and will be partially filled with water. Due to the project schedule and pit depth, the 'in-pit' storage of waste rock is not feasible.

A corridor 15m – 20m in width, depending on location (15m in pastoral section, 20m in cleared agricultural section) will be disturbed for the construction of the services corridor. The services corridor will be rehabilitated following pipeline laying. Construction management is aimed at minimising the time between clearing, trenching and backfilling for environmental, safety and third party reasons.

8.8.3 Management Strategies

A Conceptual Closure Concept Plan has been prepared and is provided as Appendix 9. The plan addresses preliminary land use objectives and completion criteria and draws on the company's experience in undertaking rehabilitation at other minesites (eg Tallering Peak).

The Conceptual Closure Plan will be prepared prior to the commencement of mining and reviewed and updated at least every 2 years throughout the life of the operation, with a final

Rehabilitation and Closure Management Plan submitted at least 2 years prior to mine closure. Accounting methods will be used for managing financial closure provisions.

Rehabilitation of the combined waste dump and dry tailings facility will be undertaken progressively throughout the life of the mine. Rehabilitation of the services corridor will be undertaken immediately following completion of construction.

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. Research and development will be undertaken as required to ensure successful rehabilitation. Monitoring results will be used to assess the effectiveness of progressive rehabilitation and where remedial works may be required.

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. Detailed procedures and completion criteria will be established in accordance with applicable legislation and standards at the time of closure, and will be documented in the detailed Mine Closure Plan.

The company's specific closure planning objectives are to:

- describe the company's approach to decommissioning, rehabilitation and closure;
- ensure the company's operations are closed in accordance with industry practice;
- provide a plan of the closure measures so that all parties have a clear understanding of what will be required to achieve adequate closure;
- estimate the total closure costs with an accuracy of +/-20%;

- identify any closure methods that require investigation to confirm their effectiveness;
- assist in identifying potential liabilities that can be reduced by adopting appropriate management practices during the life of the operation;
- ensure that any programs required to facilitate closure are initiated early enough in the life of the operation to meet the closure requirements; and
- engage the community and stakeholders in the closure planning process.

The final Closure Plan will address rehabilitation and closure planing for the mine pit, waste dump, processing plant and associated infrastructure. The plan will also address post closure environmental monitoring and reporting requirements.

8.8.4 Predicted Outcome

Rehabilitation will minimise the impact of land disturbance, resulting in safe, stable and functioning landforms consistent with the surrounding landscape.

8.9 Air Quality - Dust

8.9.1 Management Objective and Applicable Standards and Guidelines

The EPA objective for the management of air quality/dust is to ensure that emissions do not adversely affect environmental values or human health by meeting statutory requirements and acceptable criteria.

Applicable standards and guidelines include *EPA Guidance Statement No 18: Prevention of Air Impacts from Land Development Sites* (EPA, 2000b).

8.9.2 Potential Impacts

The project is located in the Midwest, which has high ambient dust levels due to climatic conditions. 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. Wind strength is significantly stronger in all seasons closer to the coast (Bureau of Meterology, 2005).

Minesite

Dust is likely to be generated during construction and mining operations. Stripping and stockpiling of topsoil, waste rock and/or overburden will also generate dust.

There is potential for vegetation to be adversely affected through the repeated deposition of dust on foliage. High levels of dust may also impact on visibility on Great Northern Highway.

Dust emissions are not expected to impact on residences during construction and operation of the mine site due to the isolated nature of the mine. The closest residences to the minesite are White Wells Homestead, which is located approximately 15km to the west, Mt Gibson Homestead, located approximately 20km to the east of the mine and Ninghan Homestead located approximately 20km to the north.

Services Corridor

Magnetite concentrate will be transported in a buried pipeline as a slurry and will not generate dust. Construction of the services corridor may result in dust.

Geraldton Port

Loading operations at Geraldton Port are unlikely to result in dust due to the high levels of moisture in the magnetite concentrate (approximately 10%), the storage of the magnetite in an enclosed shed, and transportation of the concentrate using covered conveyors.

8.9.3 Management Strategies

Mine site

Dust will be actively managed during construction and operations to ensure that dust does not create a hazard or impact on human health or environmental values. Significant quantities of water (sourced from dewatering of the pit) will be used to control dust.

The Construction and Operational Environmental Management Plan will address dust management and will identify specific management measures to minimise the generation of dust during construction and operation, including:

- the incorporation of dust control measures into project design (eg covers on conveyors and transfer points and installation of sprinklers on stockpile areas where appropriate);
- use of water carts in high traffic areas;
- scheduling blasting activities to coincide with favourable weather conditions wherever possible;
- primary and secondary crushing of hematite and magnetite will be fitted with water sprays located in areas where dust is generated (eg transfer points);
- progressive rehabilitation of disturbed areas to minimise the potential for the generation of dust;
- minimising clearing of vegetation;

- optimising vehicle movements;
- daily visual inspections of construction areas to ensure dust control management measures are implemented and effective;
- monitoring of vegetation health in dusty areas; and
- ambient dust monitoring where appropriate.

Services Corridor

Dust management will be addressed in the Construction and Operational Environmental Management Plan. Dust management measures that may be considered include:

- construction outside the summer months, particularly in coastal areas, where possible;
- use of water sprays in dust prone areas; and
- minimising the areas to be cleared.

Geraldton Port

At approximately 10%, the moisture within the magnetite concentrate will be well above the level where dust is generated from the in-loading or out-loading operations. Despite this, the magnetite shed will be equipped with water sprays as part of the dust management system. There will be a fume extraction and scrubbing system to manage exhaust fumes during the out-load operation.

All transfer points on the conveying system will be covered and fitted with water sprays that can be initiated should dust be generated as a result of unforseen circumstances causing loss of moisture content. All conveyors will be covered.

8.9.4 Predicted Outcome

The implementation of dust management measures and monitoring will ensure that dust emissions will not adversely affect environmental values or human health.

8.10 Greenhouse Gas Emissions

8.10.1 Management Objective

The EPA's published environmental objective in relation to the assessment and management of greenhouse gases as prescribed in the EPA's *Guidance for the Assessment of Environmental Factors No. 12 – Guidance Statement for Minimising Greenhouse Gas Emissions* is to minimise emissions to levels as low as practicable on an on-going basis and consider offsets to further reduce cumulative emissions (EPA, 2002b).

8.10.2 Potential Impacts

Since the pre-industrial era, human activities are known to have significantly increased the atmospheric concentrations of greenhouse gases. Scientific observations generally support the argument for changes in the global climate system that are linked to this increased atmospheric concentration of greenhouse gases. The Intergovernmental Panel on Climate Change (IPCC) estimates that the global average surface temperature increased by about 0.6°C over the 20th century, and that most of the observed warming over the past 50 years is likely to be attributable to human activities (IPCC, 2001). The modelling in the IPCC's Third Assessment Report shows that the smallest predicted increase in temperature, based on the most optimistic scenario of fossil fuel use reduction and the most cautious interpretation of the science, is a further 1.5 degrees by the end of this century, with associated changes in rainfall and sea level, as well as in the frequency and severity of extreme events.

The 1997 Kyoto conference saw recognition by leaders of the world community that climate change demands concerted political action. Under the Kyoto Protocol the developed world as a whole, which has been responsible for about 80 per cent of the human production of greenhouse gases from fossil fuels, is obliged to reduce emissions to 95 per cent of the 1990 level by the 2008-2012 period. Australia has ratified the Framework Convention but not the Kyoto Protocol. During the recent United Nations Climate Change Conference in Montreal, more than 150 nations endorsed the need to extend the effective timeframe of the protocol. Whilst Australia did not support the motion, Australia's 1997 commitment to limit its emissions (up to 2012) to 108 per cent of the 1990 figure stands.

During the construction and operation of the Project, greenhouse gases will be released to the atmosphere as a result of:

- decomposition of cleared vegetation and release of carbon from the soil;
- combustion of diesel fuel for equipment at the minesite;
- combustion of natural gas for the power supply to the project;
- gas fired motors to drive the pumping stations for the slurry, return water and water pipelines;
- use of explosives during 'drill and blast' activities; and
- indirect emissions associated with the drawing of power from existing electricity grid to for the majority of port related activities (conveyors, ship loaders, administration offices), and for selected return water pump stations.

Greenhouse gases covered by the Kyoto Protocol to the United Nations Framework Convention on Climate Change are carbon dioxide, methane, nitrous oxide, ozone, hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride. The major direct and indirect greenhouse gas emissions relevant to this Project is carbon dioxide.

The EPA's *Guidance for the Assessment of Environmental Factors No. 12 – Guidance Statement for Minimising Greenhouse Gas Emissions* requires proponents of new projects to

develop a Greenhouse gas emissions inventory using approved methodologies to estimate the gross emissions of greenhouse gases that are likely to be emitted from the proposed project for each year of its operation in absolute and in carbon dioxide equivalent figures. The Statement also prescribes the need for proponents to assess the project lifecycle greenhouse gas emissions and the greenhouse gas efficiency of the proposed project (per unit of product) and to compare these with similar projects.

The estimated greenhouse gas emissions for the Project are summarised in Table 19 below, segregating the influence from hematite and magnetite production separately. The estimates are based on a combination of design specifications (for power generation and pump systems), estimated energy and fuel consumption, and approved methodologies and factors prescribed by the Australian Greenhouse Office (AGO) (AGO, 2004).

TABLE 19
SUMMARY OF GREENHOUSE EMISSIONS ESTIMATE

AREA	SOURCE	CONTRIBUTION ($t CO_2$-e/yr)		
		HEMATITE	MAGNETITE	SUB-TOTAL
Minesite	Transport Fuel Use	1553	27483	40399
	Power Station	11609	205391	217000
	Explosives	64	1133	1890
Service Corridor	Slurry Pipeline Power Station		24000	24000
	Water Pumps		2938	2938
Port Facility:	Filters & Conveyors		7846	7846
	Front End Loaders		765	765
	Conveyors and Ship-loader		13846	13,846
	Offices, buildings & area lighting		923	923
Mine and Service Corridor	Vegetation clearing/decomposition	208	3680	3,888
TOTAL				**301,441**
CONSTRUCTION/PRE-PRODUCTION	Transport Fuel Use			11,363
	Explosives			692

On average, the Project will generate just over 301kT of CO_2-e each year during operations. Approximately 4.5% of this is attributable to hematite mining and processing and the remainder to magnetite mining, processing, handling and export. Construction phase emissions (excluding clearing) contribute just over 11kT of CO_2-e and are predominantly associated with pre-production blasting, transport and mobile equipment usage.

The reported emissions are considered to overestimate actual emissions and are based on the following assumptions:

- Fuel and energy consumption rates are normalised for the duration of the 20 year mine life in order to present average annual emission quantities expressed as tonnes of CO_2-e.

- Power generation facilities operating continuously.

- The estimated 890 hectares of cleared vegetation with 31 t/ha plant biomass will decay uniformly over a period of 10 years commencing from the time of clearing. (The factor relates to the upper bound of plant biomass for vegetation sampled at locations in the Pilbara with the following description: foothills, skeletal soil, with low open woodland and open hummock grassland. The lower biomass bound for this environment was determined to be 2.8 t/ha plant biomass (Adams, et al, 2001).

- The release of soil carbon release (from an assumed 70 t of carbon/ha in soils) will occur consistently over a period of 20 years (Fortescue Metals Group, 2005) commencing from the time of clearing.

- Full Fuel Cycle emission factors have been utilised for power generation and fuel consumption (AGO, 2004).

- No influence from sequestration has been considered as a result of progressive rehabilitation initiatives to be undertaken.

- Emissions from biodegradable domestic (solid and liquid) wastes have been ignored on the basis that these would present an insignificant contribution (less than 1%).

- The project scope includes the Geraldton Port and incorporates emissions associated with shiploading, and does not extend to product export via vessels and downstream (off shore) processing.

The contribution of greenhouse emissions from hematite and magnetite have been segregated given the significantly different production process. The hematite will be mined, crushed and screened then stockpiled on site for future transportation by road and rail. The transportation of hematite will be a separate referral to the EPA for determination of a level of assessment. Magnetite bearing Banded Iron Formation (BIF) will be mined and processed by crushing, grinding and magnetically separating to produce 5Mtpa of magnetite concentrate. The magnetite concentrate will be transported to Geraldton as a slurry by buried pipeline within a services corridor for filtration, storage and loading onto ships at Geraldton Port.

Table 20 below compares the emissions from hematite and magnetite production for the Project with other recent iron ore developments in Western Australia. Whilst suitable comparisons in greenhouse intensities may be made for hematite production, such a comparison is more difficult for magnetite production activities given that there is only one other producer of magnetite concentrate in Australia (at Savage River in Tasmania), which is not signed up to the Greenhouse Challenge. Accordingly, benchmarking greenhouse emissions for the magnetite production component of the Project may not be possible at this point.

The data suggests that emissions for hematite per tonne of product generated each year are substantially lower compared with other similar projects involving standard mining ore processing, transportation and support infrastructure. The estimated intensity is comparable to that reported for Yandicoogina (Hope Downs, 2000). Clearly, once the proposal for

transportation of hematite to Geraldton is refined, the emission intensities will be expected to increase and is expected to be in line with other West Australian hematite iron ore operations. It is reiterated that the assumptions previously described that were used to determine the estimated emissions and calculated intensities present an overestimation of actual emissions.

Other factors that should be considered when comparing emissions from this project with other similar projects include:

- potential differences in emission factors applied for determination of transport related emissions and power generation/consumption;
- variances in assumptions adopted to assess emissions related to the decay of cleared vegetation and soil losses; and
- potentially significant variations in the methodology and production process, particularly in relation to magnetite concentrate production.

TABLE 20
COMPARISON OF GREENHOUSE EMISSIONS INTENSITIES OF RECENT IRON ORE DEVELOPMENTS

PROJECT	KEY OPERATIONS	GREENHOUSE GAS EMISSION INTENSITY ($kg CO_2$-e per tonne of production)
Robe River Iron West Angelas	Open pit mining, ore processing, rail, port facilities, ancillary and support infrastructure	10-13
BHP Mining Area C	Open pit mining, ore processing and beneficiation, rail, ancillary and support infrastructure	12
Hamersley Iron Nammuldi Silvergrass	Open pit mining, wet/dry ore processing, rail, ancillary and support infrastructure	9-12
Hope Downs	Open pit mining, ore processing, rail, ancillary and support infrastructure	14-15
Fortescue Metals group Stage A and B	Open pit mining, ore processing and beneficiation, rail, ancillary and support infrastructure	14.3
Hamersley Iron Yandicoogina	Open pit mining, ore processing, rail, ancillary and support infrastructure	6.70
Mount Gibson Iron	Open pit Hematite and Magnetite mining, ore processing, Magnetite concentration, transfer of magnetite slurry via pipeline to port, ancillary and support infrastructure at mine and port	Hematite - 6.7 Magnetite - 57.6

The high Greenhouse Gas emissions Intensity for the magnetite concentrate compared with that of hematite is a result of the energy required to reduce the size of the BIF to a point where the mineral grains of magnetite can be mechanically separated from the host siliceous material. The process involves the use of high pressure grinding rolls to achieve a product size of approximately 34micron. In contrast the hematite is crushed and screened into much larger particle sizes (fines <6.3mm; lump >6.3mm).

8.10.3 Management Strategies

Whilst the greenhouse intensity estimate for magnetite appears to be substantial, it is considered that the proposed method of transporting the material from the minesite to Geraldton Port via a slurry pipeline offers a significant reduction in greenhouse emissions given that the alternatives such as rail or road transport are more carbon intensive than natural gas driven slurry pumps. The project involves a number of technologies that are energy efficient including:

- The use of high pressure grinding rolls (HPGR's) in the comminution circuit in the place of traditional gyratory crushers reduces the energy required for crushing and provides additional material breakage.

- Three stages of grinding and separation allows waste material to be rejected early, thus reducing the energy lost in over-grinding of waste material.

- Drying of the tailing/waste to transport on conveyor uses 1/10 the power of traditional pipe and pumping.

- Use of a HDPE liner in slurry pipeline reduces friction loss thus reducing power requirements.

- The use of gas to generate power where appropriate, which is more efficient and economical than continuous operation of diesel fuel fired power stations.

- Designing the process plant designed to maximise the reuse of water, which in addition to water savings, also reduces the power requirements to deliver fresh water to site.

Rehabilitation initiatives during the life of the Project are discussed in Section 8.8 of this PER. A site Rehabilitation and Closure Plan will be developed in accordance with the *Strategic Framework for Mine Closure* ANZMEC/MCA (2000) which prescribes the mechanisms to ensure progressive rehabilitation is adopted into the mine plan for the Project. Implementation of the progressive rehabilitation plan will offset the estimated emissions through increased sequestration of greenhouse gases as revegetated areas mature.

In regards to power generation for the Project, reference is made to the EPA's Position Statement No. 6 "Towards Sustainability" (EPA, 2004f) which discusses the greenhouse issues in the context of sustainability and energy. The EPA concludes that meeting any realistic Australian emissions targets will involve a gradual move towards less carbon intensive forms of energy, such as the direct use of natural gas. The Mt Gibson Iron Ore Mine and Infrastructure Project is evidence of this trend towards lower carbon intensive power generation, with liquid fuels solely being used as back-up.

The use of synthetic gases such as hydrofluorocarbons (HFC's), perfluorocarbons (PFC's) and Sulphur hexafluoride (SF_6) in fire management systems and electrical switchboard components will be avoided wherever practicable.

Emissions associated with the generation of biodegradable solid and liquid wastes will be minimised through the implementation of a Waste Management Plan that adopts the philosophy of the Waste Hierarchy.

Staff will be made aware of the implications of their activities on the Project's greenhouse emissions profile, and will be educated on practical ways to save energy and fuel so as to reduce the overall greenhouse impact of the Project.

The *Western Australian Greenhouse Strategy* (Government of Western Australia, 2004) outlines the Governments' actions to reduce greenhouse gas emissions from industry. The strategy prescribes that emitters will be required to report greenhouse emissions from their premises based on the following mandatory reporting triggers and timeframes:

- 2004-05 – more than 500,000 tonnes of carbon dioxide equivalent (CO2-e)/year.
- 2005-06 – more than 250,000 tonnes of CO2-e/year.
- 2006-07 – more than 100,000 tonnes of CO2-e/year.

MGM will report on its greenhouse emissions in accordance with WAGGI requirements. Reporting will be based upon approved emission estimation techniques and Australian Greenhouse Office (AGO) approved emission factors as appropriate.

8.10.4 Predicted Outcome

Based on the management measures described, it is considered that the EPA's objectives for this Project will be achieved.

8.11 Air Emissions – non Greenhouse Gases

8.11.1 Management Objective and Applicable Standards and Guidelines

The EPA's objective for air emissions (other than greenhouse gases) from industrial sources are:

- To ensure that best practicable measures are taken to minimise discharges of gaseous and particulate emissions to the atmosphere, and to meet statutory requirements and acceptable standards.

- To protect surrounding land users such that gaseous and particulate emissions (including dust) will not adversely affect their welfare and amenity or cause health problems.

- To ensure that conditions which could promote the formation of photochemical smog are managed to minimise the generation of smog and any subsequent impacts.

The EPA encourages proponents to achieve best practice and states that in general, a proposal which embraces best practice, meets appropriate standards and EPA objectives would be recommended for approval. To promote this outcome, the EPA has also released Guidance Statement No. 55 *"Implementing Best Practice in proposals submitted to the Environmental Impact Assessment process"* (EPA, 2003). The Guidance Statement emphasises that:

- All relevant environmental quality standards must be met.
- Common pollutants should be controlled by proponents adopting Best Practicable Measures (BPM) to protect the environment.
- Hazardous pollutants (like dioxins) should be controlled to the Maximum Extent Achievable (MEA), which involves the most stringent measures available.
- Proponents are responsible not only to minimise adverse impacts, but also to consider improving the environment through rehabilitation and offsets where practicable.

The EPA's Guidance Statement Number 15 *"Emissions of Oxides of Nitrogen from gas turbines"* (EPA, 2000a), focuses on the preferred outcomes when assessing installations or upgrades to existing gas turbines in WA. It is therefore not applicable to this Project which will incorporate gas fired reciprocating engines for power generation.

The NSW Protection of the Environment Operations (Clean Air) Amendment Industrial and Commercial Activities and Plant Regulations (NSW Govt, 2005), prescribe general standards for stack emissions from various sources including stationary reciprocating internal combustion engines. Whilst the regulations are solely applicable in NSW under state legislation, the criteria prescribed are widely considered to present Best Practice standards in Australia. Table 21 below summarises the relevant criteria:

TABLE 21
NSW CRITERIA FOR STACK EMISSIONS FROM VARIOUS SOURCES INCLUDING RECIPROCATING ENGINES (NSW Govt, 2005)

Pollutant	Standard[1]
NOx	450 mg/m^3
Total hydrocarbons	40 mg/m^3 as Volatile Organic Compounds
CO	125 mg/m^3
Particulates	50 mg/m^3

Notes:
1) Stack Emission Standards for Stationary Reciprocating Internal Combustion Engines
2) Gas volumes expressed dry at 0°C and at an absolute pressure equivalent to one atmosphere.
3) Oxides of nitrogen calculated as NO_2 at a 15% oxygen reference level.

The criteria for NO_X in the NSW Regulations were developed from the use of reciprocating engines to burn landfill gas, which generally has lower combustion temperatures and lowers NO_X emissions and therefore is not considered to be applicable to the Mt Gibson project. Other standards/guidelines for NO_X throughout the world that are considered to be of more relevance include:

- World Bank 1998 Guideline NO_X limits for diesel engine (including gas fired) with a 2000mg/Nm^3 (dry,15% O_2, 0 deg C) limit for a non-degraded airshed and 400mg/Nm^3 for degraded airshed.

- TA Luft (German) emissions for gas engines with a limit of 500mg/Nm^3 (5% O_2). It is understood that this value is applicable to 2003, with a value of 250mg/Nm^3 (5% O_2) currently applicable.

- Bay Area Air Quality Management District (BAAQMD,2001) in California which has a limit for leanburn engines of 140ppmv @ 15% O_2, equivalent to 861 mg/m^3 @3% O_2. [This limit was originally proposed for the NSW regulations until it was decided to use stack test results from gas engines running on land fill gas to set the emission limits (Air Emissions, 2006)].

CO and VOC emission criteria was based on emission limits for Hazardous Wastes burned in Boilers and Industrial Furnaces, CFR 40 266.104. Whilst power station CO and VOC emissions were screened against these criteria, it is not appropriate to apply waste combustor/incinerator limits to a gas engine due to the different processes involved. Waste incinerators are designed to ensure high temperatures and that the gas stream is in the high temperature zone for at least two seconds so as to destroy any VOCs. The low limits for the VOC are specifically to ensure very high levels of combustion are achieved. Gas engines utilise completely different technology, with short residence times in the cylinders and thus higher emissions of CO and VOCs. To achieve the lower levels oxidation catalysts SCR and oxidation catalyst are required (Air Emissions, 2006).

In Europe, the Best Available Technology (BAT) does not specify limits for CO and VOCs. Rather, BAT for the minimisation of CO emissions is complete combustion, which goes along with good furnace design, the use of high performance monitoring and process control techniques and maintenance of the combustion system. Beside combustion conditions, a well optimised system to reduce emissions will also keep the CO levels below 100mg/Nm^3 (at 15%O_2). In addition the application of an oxidation catalyst for CO can be seen as BAT when it is operated in densely populated urban areas (Air Emissions, 2006).

As such, it is considered that the adoption of lean burn technology and proper maintenance and combustion systems that are proposed for Mt Gibson are appropriate.

For ambient ground level concentrations, the WA EPA applies the National Environmental Protection Measure (NEPM) standards (NEPC, 1998) presented in Table 22 below. These specify a maximum ambient air quality concentrations to be achieved within 10 years.

TABLE 22
NATIONAL ENVIRONMENTAL PROTECTION MEASURE AMBIENT AIR QUALITY STANDARDS AND GOALS (NEPC, 1998)

Pollutant	Averaging Period	Maximum Conc^{n} ppm (µg/m^3) unless otherwise stated	Goal within 10 years Max. Allowable Exceedences
1. Carbon monoxide	8 hours	9.0 ppm (11.25mg/m^3)	1 day a year
Nitrogen dioxide	1 hour	0.12 ppm (246)	1 day a year
	1 year	0.03 ppm (61)	None
Photochemical	1 hour	0.10 ppm (214)	1 day a year
Oxidants (as ozone)	4 hour	0.08 ppm (171)	1 day a year
Sulfur dioxide	1 hour	0.20 ppm (572)	1 day a year
	1day	0.08 ppm (228)	1 day a year
	1 year	0.02 ppm (57)	None
Lead	1 year	0.50 µg/m^3	None
Particles as PM 10	1 day	50 µg/m^3	5 days a year

Notes: Modified from Schedule 2, NEPC 1998
Refer to the full document for definitions

Impacts from ambient concentration of an emitted pollutant on vegetation may be assessed against the World Health Organisation (WHO) guidelines for protection of vegetation from the direct affect of gaseous sulphur dioxide, oxides of nitrogen and ozone (WHO, 2000). The guidelines for oxides of nitrogen are shown in Table 23.

TABLE 23
AIR QUALITY GUIDELINES FOR THE PROTECTION OF VEGETATION IN EUROPE (WHO, 2000)

Pollutant	Vegetation Category	Guideline (µg/m3)	Time Period
Oxides of nitrogen	All Vegetation	75	24-hour
	All Vegetation	30	Annual Mean

8.11.2 Potential Impacts

A 53MW Power Station will located adjacent to the mine site. The power station will be gas fired and will use large (4 – 9MW) reciprocating gas engines. The power station will be operate 24hours a day, 7 day per week operation and will run with a high load factor.

The power station will operate on gas. An insignificant amount of diesel will be used for black start capability in a small diesel generating set. During operation, atmospheric emissions of interest include NOx, and to a lesser extent particulates and unburnt hydrocarbons. Carbon dioxide is important due to its contribution to the greenhouse effect rather than local air quality, and is more fully described in Section 8.10.

NO_2 is a reddish-brown gas. It is a strong oxidant and soluble in water. Young children and asthmatics are the groups at greatest risk from ambient NO_2 exposures. Other environmental effects of NO_2 and NO_x compounds can include increased acidic deposition (acidification of

rain, mists and fogs), deposition of nitrogen to the soils adding to soil nitrogen levels and vegetation effects.

Particulate matter is a complex mixture of organic and inorganic substances, present in the atmosphere as both liquids and solids. Fine particulates can have adverse respiratory and health implications.

Sulphur dioxide (SO_2) is a colourless gas. It reacts on the surface of a variety of airborne solid particles, is readily soluble in water and can be oxidised within airborne water droplets. High concentrations of SO_2, together with suspended particles have been implicated in major smog events in parts of Perth's metropolitan area and in the Pilbara coast. There is evidence that some species of plants are affected by SO_2. Notwithstanding, the expected emissions of any oxides of sulphur from power generation for the Project are insignificant given that liquid fuels will be solely utilised in black start generators.

The maximum emissions of key pollutants from the power station are presented in Table 24.

TABLE 24
AIR EMISSIONS FROM PROPOSED WARTSILA 20V34SG RECIPROCATING ENGINE

Emission Type	NOx	Total Hydrocarbons	CO	Particulates
Emission Rate burning natural gas	90ppmv @15% O_2 or 1.3g/kWhe (185 mg/m^3)[3]	6.5 g/kWhe (implies 925 mg/m^3)[3]	260.00 ppmv @ 15% O_2 or 2.1 g/kWe (implies 300 mg/m^3)[3]	0.03 g/kWhe (implies 4.3 mg/m^3)[3]
Annual emission (55MW generated 24h/day, 365 days pa [482GWh pa generated])	627tpa	3,132tpa	1,011tpa	15tpa
NSW Regulations 2005	450 mg/m^3	40 mg/m^3 (VOC's)	125 mg/m^3	50 mg/m^3

Notes:
1) Gas volumes expressed dry at 0°C and at an absolute pressure equivalent to one atmosphere.
2) Oxides of nitrogen calculated as NO_2 at a 15% oxygen reference level.
3) Informal advice (Air Assessments, 14 Dec 2005)

A screening assessment and preliminary modelling of impacts on air quality resulting from the power station was undertaken by Air Emissions (2006) (Appendix 10) using the model AUSPLUME v 6. Predicted concentrations of NOx, NO2, CO and PM are shown in Table 25.

TABLE 25
PREDICTED CONCENTRATIONS OF AIR EMISSIONS OUTSIDE THE MINE AREA

Pollutant	Averaging Period	Basis of Standard/ Guideline	Standard/ Guideline (ug/m3)	Predicted Concentration (ug/m3)		% of Standard or Guideline	
				Worst Case Meterology & USEPA Factors	Kalgoorlie Met file	Worst Case Meterology & USEPA Factors	Kalgoorlie Met file
Nitrogen Oxides	1 hour 24 hour Annual	Vegetation	NA 75 30	135 (20-54) (4-11)	136 51 2.7	NA 27-72 13-37	NA 68 9
Nitrogen Dioxide	1 hour 1 Year	Human Health	246 62	71 (4-11)	71 2.7	29 6-18	29 4.4
Carbon Monoxide	8 hour	Human Health	11,240	(176)	181	1.6	1.6
Particles as PM_{10}	1 day	Human Health	50	(0.5 – 1.3)	1.2	1-2.6	2.4
VOC	1 hour	NA	NA	55	55	NA	NA

Notes:
(1) Concentrations of gaseous emissions have been converted from the NEPM standard quoted at 0 deg C and 101.3kPa
(2) Concentrations form the artificial METSAMP File in round brackets were converted using the USEPA 1 hour to 24hour rations etc with the lower values from the CTSCREEN factors and the higher values from the general SCREEN2 factors
(3) NO2 concentrations were estimated using the ozone limiting method
(4) PM10 concentrations have been predicted assuming all PM is less than 10um.

The concentrations for nitrous oxides, nitrogen dioxide, carbon monoxide, particles and VOCs were predicted to be below the adopted standards and guidelines (Table 24).

Concentrations for the 24-hour NOx on the nearby hills were estimated to be up to 72% of the WHO vegetation guideline. However this concentration is considered to be an overestimate, as AUSPLUME employs a simplistic treatment for modelling of elevated terrain and has been shown in a number of studies to over-predict concentrations by up to a factor 2 and 4 (Air Emissions, 2006).

The maximum 8-hour CO concentration was predicted to be 1.6% of the NEPM criteria. The maximum PM_{10} concentration was predicted to occur on the top of the hills, and to be 2.6% of the standard. Predicted concentrations of NO2 at all locations outside the mine boundary were below the NEPM standard, with a maximum of 29% of the standard occurring on Mt Gibson. At the accommodation village, the nearest receptor where the NEPM is considered appropriate, the concentration is predicted to be 9.8% of the NEPM 1-hour standard (Air Emissions, 2006).

Concentrations for VOCs will be below the adopted criteria with the predicted acrolein concentrations 31% of the adopted criteria, followed by formaldehyde at 1.3%. It is considered that the acrolein concentration at Mt Gibson will be lower that the predicted concentration as the generic USEPA emission factor used for all 4 stroke lean burn engines is conservative compared with the newer engines proposed for Mt Gibson (Air Emissions, 2006).

8.11.2 Management Strategies

The technology selected for the generation of power for the Mt Gibson Iron Ore Project is considered to be the most efficient technology possible for an isolated and heat affected area given the nature of the process load. The selected technology is large reciprocating engines, in the range of 4 to 9MW, which is the very best technology available for this application. MGM considered a number of technologies including an alternative gas turbine which was found to generate more emissions for the same energy output. The efficiency of the proposed equipment is higher than the best 30MW to 60MW aero derivative turbines, and it has lower overall emissions than most Gas Turbines of a comparable size.

Other benefits that have been considered in the selection of reciprocating engines for power generation include (Consumer Energy Council of America (CECA, 2003)):

- proven reliability;
- strong maintenance support networks;
- rated output that is not impacted by higher ambient temperatures or elevations;
- high partial load efficiency;
- heat recovery capabilities for combined heat and power;
- low initial capital cost;
- no requirements for external inlet fuel compression.

Prior to installation, the power station design emission rates will be confirmed by emission dispersion modelling and then by measurement as part of the hot commissioning process to ensure the plant meets prescribed specifications. The modelling will enable an assessment against the NEPM 1998 standards as well as relevant occupational, health and safety requirements. Where necessary, the design of the facility will be modified to ensure compliance with all relevant criteria including any prescribed Works Approval conditions and Environmental Protection licence limits.

Oxides of nitrogen and sulphur dioxide can effect vegetation through the deposition of nitrogen to the soils adding to soil nitrogen levels and the acidification of rain, mists and fogs. However, given the small source of emissions and the very infrequent use of liquid fuels in black start scenarios, the potential impacts on vegetation are considered minor. Notwithstanding, the proposed air emissions modelling studies will enable an assessment against the WHO European guidelines for direct impacts on vegetation.

An Environmental Management Plan will be developed and implemented to ensure optimum operation and efficiency of the facility. The Environmental Management Plan will include appropriate logging, reporting and periodic review of performance. Given the location and plant type, ongoing emissions monitoring at set intervals is not considered necessary.

The proposed technology for the power station is regarded as the Best Practicable Measures (BPM) possible for an isolated and heat affected area given the nature of the process load with associated energy efficiency, small quantity of discharge, and minor potential for impacts on the environment.

8.11.4 Predicted Outcome

Given the technology selected and the proposed management, the EPA's objectives in relation to air emissions will be met.

8.12 Noise

8.12.1 Management Objective and Applicable Standards and Guidelines

The EPA's objective for the management of noise and vibration is to protect the amenity of nearby residents from noise impacts resulting from activities associated with the proposal by ensuring that noise levels meet statutory requirements and acceptable standards.

Applicable standards and guidelines include:

- EPA Draft Guidance Statement No 8: Environmental Noise (EPA, 1998)
- Environmental Protection (Noise) Regulations 1997.

8.12.2 Potential Impacts

Minesite

White Wells Homestead is located approximately 15km to the west of the proposed mine. The Mt Gibson Homestead is located approximately 20km to the east of the mine while Ninghan Homestead is approximately 20km to the north.

An acoustical screening assessment was undertaken by Herring Storer Acoustics (2006a) in accordance with the *EPA's Draft Guidance Statement for the Assessment of Environmental Factors No 8 – Environmental Noise* (Appendix 11). The assessment determined the sound power level of the mining operations to be 126dB(A). Mining operations will be a 24 hour per day operation. Noise received at the neighbouring residential premises therefore need to comply with the assigned night L_{A10} period noise level of 35dB(A). With the nearest residential premises located 15km from the minesite, the maximum sound power level of a facility to achieve compliance with the L_{A10} 35dB(A) is 130dB(A). The sound power level of the mining operations will therefore comply with the requirements of the *Environmental Protection (Noise) Regulations 1997* at all times and the homesteads are expected to receive minimal acoustical impact from the project. .

Blasting will be undertaken during daylight hours as part of mining operations. Prior to the realignment of Great Northern Highway, the highway will be closed to traffic for up to 20 minutes at a time during blasting operations at the northern end of the pit where required under the Mining Regulations. The length of highway that will be closed during blasting will be calculated to ensure compliance with the specifications of the *Environmental Protection (Noise) Regulations* 1997 of 115dB $L_{\text{Linear Peak}}$ for 9 out of every 10 consecutive blasts between 0700 and 1800 hours on Sundays and Public. Blasting operations will therefore comply with the requirements of the *Environmental Protection (Noise) Regulations 1997* at all times (Herring Storer Acoustics, 2006d) (Appendix 11).

Occupational health and safety exposure levels specify that noise levels are not to exceed 85dB(A) at 1m, except in the immediate vicinity of the primary crusher, and that noise exposure of personnel is not to exceed 85dB(A) over any 12 hour shift. This will be achieved in the primary crusher area using Personnel Protective Equipment.

Aircraft Overflights

Aircraft overflights have the potential to impact on rural properties or towns in the vicinity of the airstrip. Mining operations will be a fly in fly out operation ,with one flight (2 plane movements) a day. The plane will be a mid size passenger aircraft. The nearest homestead is 11.5km to the west of the proposed airstrip.

Services Corridor

The route of the services corridor was selected and diverted to achieve significant setback distances from rural and urban residences. The route passes south of the township of Perenjori and sufficient setbacks have been observed. Further west the residential township of Walkaway is over 2km from the route. The services corridor enters Geraldton along the Southern Transport Corridor through Mt Tarcola and Mahomet's Flats and is located close (50m) to residences.

Pumping stations will be located at a sufficient distance from residences or sensitive premises to not constitute a noise nuisance.

The construction of the trench for the services corridor has the potential to impact on residences in Mt Tarcola and Mahomet's Flat.

The operation of the services corridor is not expected to result in any discernable noise impact.

Geraldton Port

Operations at the Port are expected to comply with the *Environmental Protection (Noise) Regulations 1997*. The magnetite concentrate is transported to Berth 5 through a buried pipeline, resulting in minimal noise. The movement of concentrate from the filter plant to the storage shed will be by conveyors which are contained within the filter building and storage shed. Due to the nature of the product (very fine, moist powder) transfer of the concentrate from the shiploader to the ship is a quiet operation.

An acoustical assessment of operations at Geraldton Port was undertaken by Herring Storer Acoustics (2006b). As the facilities at Geraldton Port will operate 24 hours a day, noise received at the neighbouring residential premises will need to comply with the assigned night LA10 period noise level of between 39-43dB(A), depebnding on the location. However as the proposed facilities at the port are part of a group of industries that could be received at the neighbouring residence, noise recieced at this residence needs to be considered as not significantly contributing to to the noise received at these residence, or 34-38dB(A). The lower assigned noise levels are associated with the residence to the south, while the higher levels are associated with the residences located to the east and north east of the Port.

Noise received at the closest residences to the west and south of the Port facility Single point and noise contour calculations were carried out using the environmental noise modelling computer program *SoundPlan* V6.2. The noise level received at the residence west of the port was calculated to be 32dB(A) while the level received at the residence south of the Port was calculated to be 33 dB(A) and therefore comply with the requirements of the *Environmental Protection (Noise) Regulations* 1997. The facilities at Geraldton Port will therefore have minimal acoustical impact (Herring Storer Acoustics, 2006b) (Appendix 11).

8.12.3 Management Strategies

Minesite

MGM will employ all reasonable and practicable measures to minimise noise emissions from the project. Noise management will be addressed in the Environmental Management Plan. Noise management measures that may be considered include:

- modification of blasting practices to reduce noise emissions;
- incorporation of a buffer in the length of Great Northern Highway closed during blasting operations;
- monitoring of blast noise on Great Northern Highway, to determine allowable blasting mass in accordance with Regulation 11 of the Environmental Protection (Noise) Regulations;
- consideration of meteorological data during general operations and blasting; and
- purchase of heavy equipment with reduced sound power levels.

Prior to realignment, Great Northern Highway will be closed to traffic (for up to 20 minutes at a time) during blasting operations in the northern end of the pit where deemed necessary under the Mining Regulations. The length of road that will be closed will be based on the results of measurements to ensure compliance with the 115dB $L_{\text{Linear Peak}}$ for 9 out of every 10 consecutive blasts between 0700 and 1800 hours on Sundays and Public Holidays as specified in the *Environmental Protection (Noise) Regulations*. A buffer distance will be incorporated into the length of road closed prior to realignment to ensure the standards for impulse noise are complied with. Blasting operations will therefore comply with the requirements of the *Environmental Protection (Noise) Regulations* (Herring Storer Acoustics, 2006d)..

All personnel in areas subject to noise from heavy machinery or other sources will be supplied with personnel protective equipment.

Aircraft Overflights

The flight plan for aircraft flying to and from the minesite will be designed to minimise noise impacts on the homesteads and rural towns in the general area.

Services Corridor

The operation of the services corridor will not result in any discernable noise. Pumping stations will be located at a sufficient distance from residences or sensitive premises so as to not constitute a noise nuisance.

It is expected that noise from pipeline construction machinery including excavation and metal fabrication equipment will comply with the *Environmental Protection (Noise) Regulations 1997*. Construction equipment will be equipped with industry standard noise suppression. Construction activities will generally be undertaken in daylight except where night time operations are unavoidable such as PE pipe fusion welding. Activities undertaken outside the hours of 0700 and 1900 Mondays to Saturdays will require the approval of the City of Geraldton and the Department of Environment. Construction camps and operation centres will be located in areas remote from noise sensitive communities to minimise impacts. A Noise Management Plan will be developed to manage noise emission from the construction of the pipeline once the specific plant and equipment to be used in construction is known, and detailed design and planning of the pipeline has been completed (Herring Storer Acoustics, 2006c) (Appendix 11).

Geraldton Port

Operations at Geraldton Port will comply with the *Environmental Protection (Noise) Regulations* 1997 due to the design of the facilities and the nature of the product. Noise management will be addressed in the Environmental Management Plan.

8.12.4 Predicted Outcome

Noise will be managed in accordance with the *Environmental Protection (Noise) Regulations* 1997.

8.13 Solid & Liquid Waste

8.13.1 Management Objective and Applicable Standards and Guidelines

The EPA's objective for waste management is to ensure that waste is contained and isolated from ground and surface water surrounds and treatment or collection does not result in long term impacts on the surrounding environment.

Applicable Guidelines and Standards include EPA Position Statement No 7: Principles of Environmental Protection (EPA, 2004d) and the Department of Minerals and Energy Guidelines for Mining in Arid Environments (1996).

8.13.2 Potential Impacts

Incorrect storage and disposal of waste and hazardous materials have the potential to result in contamination of groundwater, surface water and/or soil, impacts to flora and fauna, poor visual amenity and health and safety issues.

The main waste streams associated with the Mt Gibson Iron Ore Project will be:

- General wastes;
- Overburden; and
- Dry tailings from the magnetite concentration process.

General Wastes

General wastes to be generated on the Mt Gibson Iron Ore Project will include:

- Construction wastes;
- Maintenance wastes (eg hydrocarbons, tyres, scrap metals);
- Sewage and grey water from site amenities and on-site accommodation; and
- Miscellaneous wastes (eg putrescible wastes, old equipment).

Hazardous Materials

Hazardous materials that will be used on the Mt Gibson Iron Ore Project include:

- Hydrocarbons; and
- Explosives.

Overburden and Waste Rock

A geotechnical assessment of the project was undertaken by Coffey Geosciences as part of the assessment of the pit stability (Coffey Geosciences, 2005). Coffey Geoscience advise that geo-physical characterisation was considered but not undertaken as the amount of clay and the inferred shape of the weathered zone suggested that this work should be carried out after the initial starter pit was developed. In addition detailed testing and analysis was undertaken by Orica to determine the fragmentation of rock following blasting. Core samples were analysed for their clay content in the weathered area on the north west side of the pit (Roger Townsend & Associates, 2005). The assessments concluded that the rock is hard, geologically competent with little clay in the overall deposits. The clay present shows no swelling properties.

The physical properties of the ore and waste material at Extension Hill are therefore not expected to impact adversely on the long term stability or rehabilitation of the waste dump. This information has been used in the design of the waste dump and (dry) tailings facility. The potential clay material will be mined in the early development of the mine and will be selectively placed in the base of the waste dump. Further detailed assessments will be undertaken as part of the detailed design of the waste dump.

The waste material has been geochemically characterised by Graeme Campbell & Associates (2005a,b). The waste material and low grade ores is geochemically benign (other than the small amount of potential acid generating material). The soils and regoliths to be produced during open pit mining will geochemically benign and hospitable as a rooting medium for the native vegetation occurring at the mine site.

Overburden material that overlies the mineralisation will be removed prior to mining of the magnetite ore. The overburden at Extension Hill is generally around 40m thick and will take around 12 months to remove (Year 0). The life of mine strip ratio of waste:ore is approximately 1.5:1.0. The overburden and waste rock will be placed in a waste dump to the east of the pit, which if not appropriately engineered, could result in unstable landforms and erosion, and may present health and safety issues. The final design of the waste dump will be based on the surrounding topography. The waste dump has been designed in accordance with DOIR Guidelines. There is little or no oxide material between the pit and the edge of the waste dump and abandonment bunds can be constructed in accordance with DOIR guidelines.

The waste dump will be rehabilitated and revegetated (see Section 8.8).

Tailings

The production of magnetite involves the size reduction of the BIF to a point where the mineral grains of magnetite are able to mechanically separate from the host siliceous material. At that point the magnetic properties of the magnetite are used to recover the magnetite. The concentration of magnetite does not involve the use of chemical additives and therefore will not result in the production of chemical pollutants. (Dry) Tailings are produced in the grinding and magnetite separation of the magnetite.

The tails will comprise mostly the fine silica with small amounts of magnetite, carbonates, pyrite, hematite and silicates. Tails will be deposited as a filter cake containing on average 16% moisture. The solids fraction will be finely ground particles at less than 60 micron size. Approximately 56Mm^3 of dry tailings will be produced by Year 20.

Acid Mine Drainage Potential

Rock containing sulphide materials can react with air and water to produce acid drainage water, resulting in acid generation, release of heavy metals, contamination of surface and groundwater and dieback of vegetation.

Geochemical test work on the waste rock and tailings indicates there will be negligible potentially acid forming material (Graeme Campbell & Associates 2005a, Graeme Campbell & Associates 2005b). The waste rock consists primarily of weathered BIF, clay and chert and basalt, all of which is classified as non acid forming, with minor amounts of chert/choritic tuff. The chert/chloritic tuff, which is less than 1% of the ore body, is classified as potentially acid forming. The volume of chert/chloritic tuff classified as potentially acid forming is 1-2 million tonnes. The material is located in the middle of the ore body and is expected to be removed by Year 10.

Hydrotest Water

Pipelines are hydrostatically tested following construction. Testing involves filling sections of the pipelines with water and increasing the pressure in excess of the operating pressure. The total water requirement for testing is less than 90m^3 and is based on the volume of the pipes lines and reuse of test water wherever possible. Hydrotest water is typically dosed with a reducing agent which oxidise readily on aeration.

8.13.3 Management Strategies

General Wastes

A Waste Management Plan will be prepared prior to construction, which will be based on the principles of Reduce, Reuse, Recycle. Waste management practices and requirements will be outlined during environmental inductions and a module on waste management will be included in the site Environmental Awareness training program.

Reduce

MGM will aim to reduce project waste where possible. This will be achieved through:

- purchase of stock in bulk to reduce packaging;
- purchase stock in refillable containers;
- purchase stock packaged in recyclable containers; and
- minimising the use of disposable containers

Reuse

Reuse of materials without substantially altering their form may be achieved by, refilling containers such as bulkaboxes containing oil and lubricants, refilling printer cartridges and mulching vegetative wastes.

Recycle

Recyclable materials will include scrap metals, batteries, waste oils and filters, paper and cardboard, aluminium and tin cans, PET plastic containers/bottles and glass. These materials will be stored in dedicated areas on-site for periodic transportation to an off site recycling facility.

Waste to Landfill

Non hazardous, non-reusable and non-recyclable wastes will be disposed of in a landfill approved by the DoE and operated in accordance with relevant legislation and standards. Waste will be covered regularly to minimise wind blown litter, odour and animal scavenging.

Hydrocarbons and Hazardous Wastes

The transport of hazardous materials will be undertaken in accordance with the *Dangerous Goods (Transport) (Road and Rail) Regulations 1999* and the Australian Code for the Transportation of Dangerous Goods by Road and Rail.

Hydrocarbons and other potentially polluting substances will be stored correctly according to Australian Standards and will minimise the risk of contamination at all times. Storage of bulk fuel will be in above ground tanks, either within impermeable, bunded enclosures or in double skinned tanks that do not require bunding.

Hydrocarbon and chemical waste will be removed from site by a licenced contractor for disposal to an approved facility in accordance with the controlled waste regulations. Oil

drums, oil filters and batteries will be collected and stored appropriately prior to removal by a licensed contractor. Workshops will be constructed in such a manner to allow the safe and efficient storage of these wastes.

Storage of explosives will be remote magazines in accordance with the *Explosives and Dangerous Goods Act 1961*.

Sewage and Grey Water

Sewage and greywater from the mine operations buildings, plant and accommodation camp will be treated on site using sewage waste water treatment system in accordance with Health Department and local government requirements.

Overburden and Waste Rock

The overburden and waste rock material from the hematite/magnetite pit will be stockpiled in a large, purpose designed dump to the east of the Extension Hill pit (Figure 3). Some overburden may be used in construction activities.

Backfilling the pit with overburden and waste rock is not technically viable as backfilling the pit would prevent further mining at depth. The final mine void will have no impact on the regional groundwater table (See Section 8.6.2)

Design and construction of the waste rock dump will incorporate features to control surface runoff, facilitate progressive rehabilitation and minimise visual impacts after mine closure. The waste dump area will be progressively rehabilitated, capped with topsoil and revegetated as part of MGM's standard procedures. Rehabilitation and decommissioning is addressed in Section 8.8.

The management of the overburden and waste rock will be addressed in the Construction and Operation EMPs.

Tailings

The tailings from the processing of the magnetite will disposed of concurrent with the waste rock in a combined waste dump located to the east of the Extension Hill pit (Figure 3). The dewatered (dry) tailings will not require a supernatant pond and will have no effect on the regional hydrology (Section 8.6). The waste dump will be progressively rehabilitated, capped with topsoil and revegetated as part of MGM's standard procedures. The management of the tailings will be addressed in the Construction and Operation EMPs.

Acid Mine Drainage Potential

Potentially acid forming material will be encapsulated in designated and appropriately designed waste dumps to minimise the potential for acidic materials leaching from the waste rock into the groundwater or surface water bodies. Acid rock drainage will be addressed in the Construction and Operational EMPs.

Hydrotest Water

The volume of hydrotest water to be disposed of is small and is not expected to result in any adverse impacts. Disposal will be at an approved site and will not impact on groundwater, sensitive water bodies or remnant vegetation. Typically test water is disposed of at either end of the test section by running the water through a diffuser and into a filter or evaporation pond.

A Hydrotest Management Plan will be developed which will detail the sourcing, management and disposal of test water.

8.13.4 Predicted Outcome

Waste that has the potential to contaminate soil, surface water and groundwater will be managed appropriately. No adverse impacts to soil, surface water or groundwater quality are expected.

Overburden and waste dumps will be safe, stable and non polluting. Material that is potentially acid generating will be managed to minimise the potential for acidic materials to leaching from waste rock into the groundwater or surface water bodies.

8.14 Aboriginal Heritage and Culture

8.14.1 Management Objective and Applicable Standards and Guidelines

The EPA's objective for Aboriginal heritage is to ensure that changes to the biophysical environment do not adversely affect historical and cultural associations and comply with relevant cultural association.

Applicable guidelines include EPA Guidance Statement No 41:*Assessment of Aboriginal Heritage* (EPA, 2004c).

MGM has project agreements with the Badimia People and the Widi Mob, whose claims cover the area of the mine site. MGM is in the process of negotiating pipeline-only Native Title agreements with the Mullewa Wadjari, Amangu and Naaguja Peoples whose registered Native Title claim areas cover parts of the pipeline corridor (that section relating to the crossing of the Greenough River).

8.14.2 Potential Impacts

The project has been structured so that areas of cultural significance to indigenous groups are avoided as far as is practicable. The Mt Gibson hills have a level of significance to the Widi Mob and a Section 18 application has been agreed to by them to allow the mining of Extension Hill. The Tailings Storage facility initially proposed was relocated to avoid the playa to the south east of the hills, which also was of significance to the Widi Mob.

MGM has received approval under Section 18 of the *Aboriginal Heritage Act* to mine Extension Hill.

One new site of significance was discovered by the Badimia People just outside the northern boundary of the waste dump. By agreement with the Badimia People, MGM has agreed to a 300m wide exclusion zone to protect this site.

Heritage surveys have been undertaken for much of the services corridor route and are proposed for the balance. The route of the services corridor has been deviated to avoid sites which appear on the DIA register of Aboriginal Sites and those located through heritage surveys. Further surveys will be undertaken where necessary on deviations and any sites will be avoided wherever possible. All relevant Native title groups will be consulted.

Some additional Section 18 approvals may be required where the pipeline route crosses river systems which have been registered as sites of significance. This will be addressed during the current heritage surveys, in discussion with the relevant Aboriginal groups to minimise the impact as far as is practicable.

8.14.3 Management Strategies

MGM will ensure it complies with all statutory requirements relating to areas of Aboriginal heritage during the construction and operation of the Mt Gibson Iron Ore Project.

MGM will comply with the conditions of all approvals obtained under Section 18 of the *Aboriginal Heritage Act*. If any additional aboriginal site is required to be disturbed, an application will be made to disturb the site under Section 18 of the *Aboriginal Heritage Act*. The Department of Indigenous Affairs will be notified of any sites identified during the construction or operation of the project.

A 300m wide exclusion zone will be established to protect an archaeological site which is just outside the northern boundary of the waste dump, which is of significance to the Badimia People.

Workforce inductions will include Aboriginal Heritage issues. Management procedures will be detailed in the Project EMP.
Representatives of the relevant Aboriginal Groups will be employed to carry out heritage monitoring during the construction of the services corridor.

8.14.4 Predicted Outcome

Some Aboriginal heritage sites will be disturbed in accordance with Section 18 of the *Aboriginal Heritage Act* 1972 and following consultation with the appropriate groups. All requirements of the *Aboriginal Heritage Act* 1972 will be complied with.

8.15 European Heritage

8.15.1 Management Objective and Applicable Standards and Guidelines

The EPA's objective for European Heritage is to ensure that the proposal complies with statutory requirements in relation to areas of cultural or historical significance.

8.15.2 Potential Impacts

The project area is not included on the Register of the National Estate, the Commonwealth Heritage List, National Heritage list and World Heritage List.

Mt Singleton approximately 20km to the north is listed on the Register of the National Estate as an Indicative Place for its geological values. Lake Moore 30km to the east has several entries on the Register of the National Estate relating to indigenous values. An area to the south of White Wells Station is also listed on the Register of the National Estate. The project will not affect or impact on the values of these places in any way. The project will not be easily visible from Mt Singleton (see Section 8.18).

The services corridor will have no impact on sites with European heritage. Gould's Cottage, which has been identified as a significant heritage building, is located approximately 2km west of the Walkaway Road near Narnagulu within the Geraldton Southern Transport Corridor. Preservation of the cottage is incorporated in the plans for the Southern Transport corridor. The slurry pipeline route is within the Geraldton Southern Transport corridor but is located south of the cottage in accordance with corridor planning. No impacts to the precinct are expected. Workforce and construction activities will not be permitted to access the site. There are no other European heritage sites near the corridor.

8.15.3 Management Strategies

MGM will ensure it complies with all statutory requirements relating to areas of European heritage and historical significance during the construction and operation of the Mt Gibson Iron Ore Mine and Infrastructure Project.

8.15.4 Predicted Outcome

There will be no impact on European heritage.

8.16 Public Health & Safety

8.16.1 Management Objective and Applicable Standards and Guidelines

The EPA's objective for Public Health and Safety is to ensure that roads are maintained or improved and road traffic managed to meet an adequate standard of service and safety and MRWA requirements.

8.16.2 Potential Impacts

Minesite

The northern end of the proposed pit is located approximately 200m to the east of the existing Great Northern Highway. Mining operations (drilling, excavation, ore and waste removal) will be carried out on a 24 hour per day basis and have the potential to adversely affect the travelling public through the proximity to mining operations.

Services Corridor

In accordance with the requirements of the *Petroleum Pipelines Act* 1996 and Australian Standard 2885, the route of the services corridor has been selected to locate the pipeline in areas to achieve low risk. Setbacks in excess of the nominated distances from residences and sensitive structures have been adopted.

8.16.3 Management Strategies

Minesite

Blasting will only occur during daylight hours. It is a basic blast design objective to minimise the wasted energy and inefficiency that overpressure and flyrock represents. Typically, flyrock will be localised and will not travel further than 100m (RSG Global, pers com). Blast energy will not affect the stability of the road formation. Prior to its realignment, the Great Northern Highway will be closed to traffic for the duration of blasting (approximately 20 minutes once a day) when blasting is occurring at the northern end of the pit during the early years of excavation to ensure a safe clearance distance for the travelling public. Main Roads has agreed in principle to the closure of Great Northern Highway during periods of blasting.

Great Northern Highway will be permanently realigned (Figure 3), to increase the separation distance between the northern end of the pit and the Highway. The timing of the realignment of Great Northern Highway will be decided in consultation with MRWA, the Department of Industry and Resources and the Shire of Yalgoo and will depend on the mine schedule and mine plan.

MRWA requirements will be adhered with to ensure public safety. Traffic will be controlled at the Great Northern Highway by intersection modifications to increase line of sight for oncoming traffic and will be MRWA approved. Hematite will be conveyed under Great Northern Highway to remove the requirement for road trains crossing the highway. Signage will be placed on the Great Northern Highway in accordance with Main Roads WA requirements to alert general traffic to the potential traffic conditions at the highway crossing. Public access to the mine will be controlled. Large rock bunds will be built around the pit perimeter to prevent any type of vehicle access. Security fencing in the form of a stock fence will be erected inside the bunds to prevent pedestrian and animal access.

Service Corridor

The Australian pipeline industry has a record of low risk operations due to high construction, operation and maintenance standards within industry and statutory safety regulations.

In accordance with the requirements of the *Petroleum Pipelines Act* (1996) for gas pipelines, a detailed risk assessment will be undertaken in accordance with AS2885 to identify risk issues, assess risk and manage risk. The route of the services corridor has been selected to locate the pipelines in areas to achieve low risk. Setbacks in excess of the nominated distances from residences and sensitive structures have been adopted.

Slurry pipelines have no specific Australian standard but where appropriate slurry and return water pipelines will be designed, constructed and operated to AS2885 and other relevant Australian standards. The American standard for slurry pipelines ASME-B31.11-2002 will also be used where appropriate.

The pipelines will be designed, constructed operated and maintained to achieve a risk level that is As Low As Reasonably Practical (ALARP) as per AS2885. Design measures to achieve this include:

- depth of cover to suit land use;
- pipe wall thickness to match land use risks;
- security of above ground structures;
- pipeline warning marker signs;
- mainline valves for shutdowns;
- SCAD pipeline monitoring system;
- marker tape buried above the pipe to warn third party excavators;
- regular aerial or ground maintenance controls;
- dial Before You Dig access control;
- pipeline safety management system and induction training; and
- community and landholder awareness.

8.16.4 Predicted Outcome

The safety of the travelling public will not be adversely impacted by the project as traffic on Great Northern Highway will be managed in accordance with MRWA requirements. Mining (including blasting) operations will be managed in accordance with DOIR requirements.

The hazard and risk associated with the services corridor will be maintained at acceptably low levels through the adoption of recognised pipeline industry practices and compliance with legislative requirements.

8.17 Visual Amenity

8.17.1 Management Objective and Applicable Standards and Guidelines

The EPA objective for visual amenity is to ensure that aesthetic values are considered and measures adopted to reduce visual impacts on the landscape as low as reasonably practicable.

8.17.2 Potential Impacts

Minesite

The mine and associated infrastructure at Extension Hill will be visible from Great Northern Highway (Figure 19).

The mine and associated infrastructure will not be easily visible from Mt Singleton (Figure 20). The waste dump be will visible from Mt Singleton until rehabilitation as outlined in section 8.8 has been completed.

Mining operations will not be easily visible from White Wells homestead. Neither the processing plant nor the waste dump will be visible from White Wells homestead (Figure 21).

Geraldton Port

The magnetite storage shed on Berth 5 will be visible from various locations in Geraldton City (Figure 22a-d). The storage shed and associated ship loading facilities will complement the viewscape of existing infrastructure at the Port.

8.17.3 Management Strategies

Mines site

MGM will minimise the impacts on the landscape by ensuring post mining landform replicates the pre-mining landscape as closely as practicable. This will be achieved through progressive rehabilitation during both construction and mining activities.

Geraldton Port

The impacts of the construction and operation of the magnetite shed and associated ship loading facilities at Berth 5 will be minimised through the appropriate choice of colours, which will be approved by the City of Geraldton. The layout of storage shed and filter plant on Berth 5 has been designed to minimise the visual impacts.

There will be ongoing consultation with stakeholders throughout the life of the project regarding the management of visual impact.

8.17.4 Predicted Outcome

On completion of rehabilitation, the mining areas are not expected to create an unacceptable visual impact on the landscape at Mt Gibson.

The impact of the proposed magnetite storage shed and associated ship loading facilities at Berth 5 are expected to complement the viewscape of existing infrastructure at the Port and therefore it is considered it will have an acceptable visual impact.

8.18 Light Overspill

8.18.1 Management Objectives and Applicable Standards and Guidelines

MGM's management objective for light spill is to avoid or manage potential impacts from light spill and manage in accordance with applicable standards.

8.18.2 Potential Impacts

CALM is considering the development of an Observatory at Mt Singleton approximately 20km to the north of Extension Hill. Discussions with Jamie Biggs indicated there is potential for the Mt Gibson Iron Ore Mine and Infrastructure Project to impact on the proposed observatory, primarily through dust and lighting from the Mt Gibson Iron Ore Mine and Infrastructure Project. However Extension Hill will provide a buffer between the plant site and the line of site to the proposed observatory.

8.18.3 Management Strategies

Lighting at the proposed mine site will be designed and managed in accordance with Australian Standard AS4282-1997 *Control of Obtrusive Effects of Outdoor Lighting*. Key points in the standard include directing light downwards rather than upwards whether possible, using specially designed lighting equipment to minimise the spread of near to or above the horizontal, prevention of over lighting and ensuring the angle of the main beam of the light and any observer is less than 70^0. Given the management of dust outlined in Section 8.9, dust from the proposed iron ore project is not expected to impact significantly on the proposed Observatory (Jamie Biggs, pers comm.).

MGM will establish a communication protocols with the Observatory to facilitate the exchange of information and the prompt resolution of any concerns.

8.18.4 Predicted Outcome

Light spill and dust from the Mt Gibson Iron Ore Mine and Infrastructure Project will not adversely affect the operations of the proposed Observatory at Mt Singleton.

9. ENVIRONMENTAL MANAGEMENT COMMITMENTS

The environmental management commitments made by MGM for the Mt Gibson Iron Ore Project are shown in Table 26.

TABLE 26
PROPONENT ENVIRONMENT MANAGEMENT COMMITMENTS

Topic	Objective	Commitments	Timing	Advice From
Environmental Management System	Manage environmental impacts of the project and promote environmental excellence.	1. Prepare and implement an Environmental Management System that is consistent with the ISO 14001 Standard	Prior to commissioning	DoE
Environmental Management Plan	Manage environmental impacts of the project	2. Prepare and implement separate EMPs for the construction and operation of the project that addresses relevant environmental issues for the project including: • Flora (including Declared Rare and Priority species), vegetation communities and land clearing • Weeds • Terrestrial fauna • Fire • Surface and groundwater • Water supply • Dust • Noise and vibration • Waste management including waste rock, overburden and tailings • Acid rock drainage • Hydrocarbon management • Hydrotest water • Aboriginal heritage • European heritage • Rehabilitation, revegetation, topsoil management and decommissioning • Stakeholder liaison • Reporting and auditing • Training .	Prior to construction and operation	DoE CALM DOIR

Topic	Objective	Commitments	Timing	Advice From
Regional Biodiversity	To maintain the abundance, diversity, geographic distribution and productivity of flora and fauna at a species and ecosystem levels through avoidance of or management of adverse impacts and improvement in knowledge.	3. Provide support of $50,000 per annum (based on a contribution per tonne) 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. 4. Establishment of and support for a Regional Conservation Association with the objectives of enhancing biodiversity and regional sustainability values. Funding of $100,000pa (based on a contribution per tonne) for projects in the northern Avon Wheatbelt and Southern Yalgoo IBRA bioregions generally focussing on an 2,600,000 ha area between Morawa and Beacon (200km west - east) and Wubin to Paynes Find (approximately 130km north - south).	Ongoing throughout the life of the project	DoE CALM
Declared Rare and Priority Flora	Manage Rare and Threatened flora species consistent with the requirements of the *Wildlife Conservation Act* and the *EPBC Act.*	5. Support a 3 year plus research program undertaken by BGPA leading to the preparation & implementation of a Recovery Plan for the DRF *Darwinia masonii* (already commenced) 6. Undertake surveys in the Midwest of areas of potential habitat of *Lepidosperma sp Mt* Gibson and depending on the results of the surveys, hold discussions with CALM and BGPA with a view to supporting a research program leading to the preparation and implementation of a Recovery Plan for the species. 7. Prepare and implement a Threatened Flora Conservation Plan to address the management of	 Prior to construction	CALM CALM CALM

Topic	Objective	Commitments	Timing	Advice From
		threatened flora impacted by the project		
Fire	Reduce the risk of unplanned fires and provide contingency measures to minimise any impacts in the event that a fire is started	8. Prepare and implement a Fire Management Plan that includes: • Installation of necessary firebreaks • Safe work procedures for all welding and grinding • Personal fire hazard procedures • Vehicle fire hazard procedures • Emergency fire responses • Bushfire contingency plans • A regional approach to fire management and suppression in the vicinity of the minesite	Prior to Construction	CALM FESA
Malleefowl	Manage Malleefowl (*Leipoa ocellata*) populations in accordance with the requirements of the *Wildlife Conservation Act* and the *EPBC Act.*	9. Prepare and implement a Malleefowl Conservation Plan 10. Contribute to a regional feral animal control program (in particular foxes)	Prior to Construction	DoE CALM CALM
Water Supply	Maintain aquifer characteristics including groundwater quality and quantity.	11. Prepare and implement a Borefield Management and Monitoring Plan	Prior to construction and ongoing during operating	DoE DOIR
Stygofauna	Maintain the abundance, diversity, and geographic distribution of subterranean fauna.	12. Prepare and Implement a Stygofauna Monitoring Plan for the mine dewatering waters 13. If it is necessary to develop a borefield in the paleochannel or to extract water from the fractured rock reserves, a Stygofauna Sampling & Management Plan will be developed	Prior to Construction Prior to commencement of operation of the paleochannel or fractured rock borefields	CALM CALM
Rehabilitation and Decommissioning	Ensure, as far as practical, that rehabilitation achieves stable and functioning landform consistent with the surrounding landscape.	14. Prepare a Closure Plan for the Project. The plan will address closure actions to be taken for mine voids, waste dumps, and associated infrastructure	Prior to the commencement of mining.	DOIR CALM DoE

Topic	Objective	Commitments	Timing	Advice From
		15. Review the Project Closure Plan regularly during the operational phase of the project 16. Submit a final Project Closure Plan	Every 2 years during the operational life of the project. Two years prior to the planned closure	DOIR CALM DoE DOIR CALM DoE

10. CONCLUSIONS

MGM has made a number of commitments with respect to the Mt Gibson Iron Ore Mine and Infrastructure Project to show its commitment to constructing and operating the project in an environmentally responsible manner. The commitments will be implemented to the satisfaction of the Environmental Protection Authority.

The key environmental issues associated with the development of the mine and related infrastructure, the services corridor from the minesite to Geraldton Port, the borefield at Tathra and the magnetite concentrate storage and ship loading facilities at Geraldton Port have been identified as impacts on Threatened and Priority flora and on selected floristic communities and on the Malleefowl population in the Mt Gibson hills.

The key environmental issues associated with the development of the mine and related infrastructure, the services corridor from the minesite to Geraldton Port, the borefield at Tathra and the magnetite concentrate storage and ship loading facilities at Geraldton Port have been identified as impacts on Threatened and Priority flora and on selected floristic communities and on the Malleefowl population in the Mt Gibson hills.

MGM is committed to avoiding environmental impacts where practicable and to minimising, mitigating and offsetting potential impacts. MGM will ensure all impacts are minimised and managed using the Construction and Operational Environmental Management Plans for the project. MGM has committed to developing an Environmental Management System (EMS) for the Mt Gibson Iron Ore Mine and Infrastructure Project, consistent with the objectives of ISO14001. The key elements of ISO14001 include assessing environmental risk and legal requirements, developing objectives and targets for improvement, training, operational control, communication, emergency response, corrective actions, audits and reviews.

The proposed Mt Gibson Iron Ore Mine and Infrastructure Project will impact on 14% of the known population of the DRF *Darwinia masonii*. The Botanic Gardens and Parks Authority (BGPA), in research supported by MGM, has already made significant advances in the knowledge of the DRF *Darwinia masonii*. The ongoing research by BGPA and the development and implementation of a Recovery Plan for the species will assist in the long term protection and sustainability of the species.

An undescribed species of *Lepidosperma*, *Lepidosperma sp Mt Gibson*, is known only from Mt Gibson where it prefers gullies that provide increased water availability. The conservation status of the species is as yet undetermined. The Mt Gibson Iron Ore Mine and Infrastructure Project will impact on 55% of the known population of 14,939 plants. MGM will undertake surveys of areas of potential habitat in areas of Banded Ironstone Formation throughout the Midwest. Depending on the results of the surveys, MGM will hold discussions with CALM and BPGA with a view to supporting a research program leading to the preparation and implementation of a Recovery Plan and the long term sustainability of the species.

The floristic communities on the Banded Ironstone Formation at Mt Gibson appear to be distinct from the floristic composition of vegetation on other areas of BIF. There is also geographic-related variation in the floristic communities within the Mt Gibson area. The

ridges of Extension Hill and Extension Hill South largely contain communities that are different to the other areas. There are some similarities with the communities on Iron Hill and Iron Hill East. Six of the twenty floristic communities (Group 40 group) mapped for the Mt Gibson area were assessed as occurring only within the proposed project area.

Malleefowl are known to occur at Mt Gibson. The preparation and implementation of a Malleefowl Conservation Plan, and support for a regional on-ground feral animal control program (especially for foxes which predate on malleefowl at Mt Gibson) will ensure the project has minimal long term impact on the species at a regional level and at the same time, will complement the work being undertaken as part of the Co-operative Research Centre for Invasive Animal Control on Mt Gibson Station.

MGM recognises that, while not part of the conservation estate, the properties adjoining the mine site are managed by private organisations for conservation purposes. MGM's Offset Package has been designed in accordance with the EPA's Position Paper No 9 to result in **a net benefit to environmental values in the area**. It recognises the significant contributions being made to the conservation values in the region by the private organisations Australian Wildlife Conservancy (AWC), Australian Bush Heritage Fund (ABHF) and the Pindiddy Aboriginal Corporation (Pindiddy), and has been developed in association with stakeholders and CALM.

The Offsets Package includes:

(j) Support for the ABHF, AWC and Pindiddy for suitable projects on White Wells, Mt Gibson and Ninghan Stations that are aimed at enhancing the protection and conservation of biodiversity and regional sustainability values. Each organisation will receive up to $50,000 pa (a total of $3 million over the life of the mine based on a contribution per tonne), with an emphasis placed on on-ground works.

(ii) Establishment of and funding for a Regional Conservation Association (RCA) aimed at enhancing regional sustainability, biodiversity, visitor and cultural values in the northern Avon Wheatbelt and Southern Yalgoo IBRA bioregions generally focussing on an 2,600,000 ha area between Morawa and Beacon (200km west - east) and Wubin to Paynes Find (approximately 130km north - south). Funding for the RCA would be $100,000pa or $2 million over the life of the mine (based on a contribution per tonne). Activities to be funded would have an emphasis an on-ground works aimed at enhancing the protection and conservation of biodiversity and regional sustainability values and may also include research, educational and cultural activities, the purchase of land or any other activities as seen fit by the RCA.

The Mt Gibson Iron Ore Mine and Infrastructure Project will also provide a number of significant benefits to the social and economic sustainability of the area including:

- significant regional infrastructure investment in the Midwest of Western Australia;
- significant direct employment opportunities in the Midwest region;

- significant indirect employment opportunities in the Midwest region and Western Australia; and

- major foreign investment into project development.

MGM believes the construction and operation of the Mt Gibson Iron Ore Mine and Infrastructure Project will result in net environmental, economic and social benefits to the Midwest region and to the State as a whole.

11. REFERENCES

Adams, M.A., Grierson, P.F., Bussau, A. & Dorling, K. (2001) *Biomass and carbon in vegetation of the Pilbara region, Western Australia.* Final report submitted to Hamersley Iron, BHP and Robe, July 2001. Ecosystems Research Group, The University of Western Australia, Crawley. 118 pp.

AEC/NHMRC (1986) *National Guidelines for the Control of Emissions of Air Pollutants from New Stationary Sources*. Australian Government Publishing Service, Canberra.

Alan Tingay & Associates (1996) *Vertebrate Fauna Koolanooka Mine Site Morowa*. Report No. 96/53 Prepared for Kingstream Resources N.L.

Air Emissions (2006) Mt *Gibson Iron Ore Mine and Infrastructure Project Power Station – Air Quality Assessment*. Unpublished report prepared for ATA Environmental. March 2006.

(AGO)Australian Greenhouse Office (2004) *AGO Factors and Methods Workbook*. August 2004.

ANZECC/ ARMCANZ (2000) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*.

ANZMEC/MCA (2000) *Strategic Framework for Mine Closure.* Australian and New Zealand Minerals and Energy Council and Minerals Council of Australia.

Aquaterra (2005) *Tathra Sub Area Groundwater Investigations*. Unpublished report for Mt Gibson Iron Ore Ltd. May 2005.

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 (2005b) *Fauna Assessment Mount Gibson*. Report No. 2004/51 Version 4. Unpublished report prepared for Mount Gibson Mining Ltd. December 2005.

ATA Environmental (2005c) *Malleefowl Assessment Mount Gibson*. Report No 2004/188 Version 2. Unpublished report prepared for Mount Gibson Mining Ltd June 2005.

ATA Environmental (2005d) *Fauna Assessment Proposed Mount Gibson to Geraldton Port Slurry Pipeline* Report No 2005/124. Version 2. Unpublished report prepared for Mount Gibson Mining Ltd. Version 2 March 2006.

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. Version 2 March 2006.

ATA Environmental (2005f) *Flora and Vegetation Assessment Proposed Slurry Pipeline Mount Gibson to Geraldton Port* Version 2. Unpublished report prepared for Mount Gibson Mining Ltd. Report No 2005/134.

ATA Environmental (2006) *A Targeted Survey at Mt Gibson for a Lepidosperma species: Lepidosperma sp. Mt Gibson.* Version 1 Report No 2006/090. Unpublished report prepared for Mount Gibson Mining. March 2006

Bamford Consulting Ecologists (2003) *Fauna Assessment for Tallering Peak*, Report to Mount Gibson Mining Ltd.

Bamford M.J. & Wilcox J.A (2004) *Blue Hills Fauna Assessment*. Unpublished report prepared for ATA Environmental, March 2004.

Benshemesh J (2000) *National Recovery Plan for Malleefowl, Environment Australia.* http:// www.deh.gov.au/biodiversity/threatened fauna/recovery/malleefowl

Beard, J. S. (1976) *Vegetation survey of Western Australia, 1:250,000 series. Vegetation of the Perenjori Area*. Vegmap Publications, Perth.

Beard, J. S. (1976) *Vegetation survey of Western Australia, 1:000,000 series. Vegetation of the Murchison area Explanatory Notes*. University of Western Australia Press, Nedlands.

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

Beard J.S and Burns, A.C (1976) *Vegetation Survey of Western Australia: The Vegetation of the Geraldton Area, Western Australia; Map and Explanatory Memoir* 1:250,000 series Vegmap Publications, Perth

Beeston, G.R., Hopkins, A.J.M. and Shepherd, D.P. (2002) *Land-Use and Vegetation in Western Australia.* National Land and Water Resources Audit Report, Resource Management Technical Report 250, Department of Agriculture, October 2002.

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

Botanic Gardens & Parks Authority (2005) *Research Benchmarks for conservation of Darwinia masonii at Mt Gibson: Stage 1 Report*. Report Prepared for Mount Gibson Iron Ltd. BGPA Genetics Laboratory Report No 29.

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

Bureau of Meteorology (2005) Western Australian Weather and Warnings website: http://www.bom.gov.au/weather/wa

Burbidge, A.A., Dixon, K.W., & Fuller, P.J. (1989). The Flora and Fauna of Vacant Crown Land at White Well, Shire of Dalwallinu, Western Australia. Department of Conservation & Land Management.

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

CECA (2003) Consumer Energy Council of America website: http://www.deforum.org/recips.htm

Connell Wagner (2000) *Geraldton Southern Transport Corridor Vegetation Impact Report.* Prepared for Main Roads of Western Australia. Perth

Dell, J. (1996a) *Results of the Spring 1996 Vertebrate Fauna Survey of Yandanooka Project Area.*

Dell, J. (1996b) *Vertebrate Faunal Assessment of Yandanooka Project Area*.

Department of Minerals and Energy (1996) *Guidelines for Mining in Arid Environments*.

Department of Industry & Resources (2003) *Western Australian Iron Ore Industry*. Government of Western Australia.

Ecologia (2002) *Koolyanobbing Iron Ore Expansion Project Public Environmental Review*. Prepared for Portman Limited. March 2002.

Economic Research Associates (2005) *Economic Benefits from the Development of a New Mine at Mt Gibson*. Unpublished report prepared for ATA Environmental by Economic Research Associates Pty Ltd.

English, V. (2002) *Identified and Possible Threatened Ecological Communities (TECs) in the Agricultural Region of South-west Western Australia.*

Environmental Protection Authority (1998) *Guidance for the Assessment of Environmental Factors No. 8*: *Environmental Noise. Draft.*

Environmental Protection Authority (2000a) *Guidance for the Assessment of Environmental Factors No. 15 – Guidance Statement for Emissions of Oxides of Nitrogen from Gas Turbines*, May 2000.

Environmental Protection Authority *(2000b) Guidance Statement No 18: Prevention of impacts from land development sites.*

Environmental Protection Authority (2000c) *Position Statement No 2: Environmental Protection of Native Vegetation in Western Australia.*

Environmental Protection Authority (2002a) *Guide to Preparing an Environmental Scoping Document.* June 2002.

Environmental Protection Authority (2002b) *Guidance for the Assessment of Environmental Factors No. 12 – Guidance Statement for Minimising Greenhouse Gas Emissions*, October 2002.

Environmental Protection Authority (2002c) *Position Statement No 3: Terrestrial Biological Surveys as an Element of Biodiversity Protection*

Environmental Protection Authority (2003a) *Guidance for the Assessment of Environmental Factors: Terrestrial flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia.* EPA, No. 51 Final June 2004.

Environmental Protection Authority (2003b) *Guidance for the Assessment of Environmental Factors No. 55 - Implementing Best Practice in Proposals Submitted to the Environmental Impact Assessment Process,* December 2003.

Environmental Protection Authority (2004a) *Guide to EIA Environmental Principles, Factors and Objectives.* Version 2 November 2004.

Environmental Protection Authority (2004b) *Guidance for the Assessment of Environmental Factors: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia.* EPA, No. 56 Final June 2004.

Environmental Protection Authority (2004c) *Assessment of Aboriginal Heritage* EPA, Guidance for the Assessment of Environmental Factors No. 41, April 2004.

Environmental Protection Authority (2004d) Position Statement No 7: Principles of Environmental Protection. August, 2004

Environmental Protection Authority (2004e) EPA Guidance Statement No 51 Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia

Environmental Protection Authority (2004f) *Position Statement No. 6 "Towards Sustainability"*

Environmental Protection Authority (2005) EPA Preliminary Position Statement No 9 Environmental Offsets Version 2

EPA see Environmental Protection Authority.

Fortescue Metals Group Limited (2005), *Pilbara Iron Infrastructure Project: E-W Railway and Mine Sites (Stage B), Public Environmental Review*, January 2005.

Government of Western Australia (2004) *Western Australian Greenhouse Strategy.* Perth, Western Australia. September 2004.

Graeme Campbell & Associates (2005a) *Extension Hill Iron Ore Project. Geochemical Characterisation of Soil, Regolith, Waste bedrock and low grade ore samples. Implications for Mine Waste Management.* Job No 0503/1. November 2005.

Graeme Campbell & Associates (2005b) *Extension Hill Iron Ore Project. Geochemical Characterisation of Process Tailings Samples. Implications for Process Tailings Management*. Job No 0503/2. November 2005.

Griffin, E.A. (2005) *PATN Analysis of Mt Gibson Sites*. Unpublished report.

Halpern Glick Maunsell (2002) Mt Gibson to Perenjori Haul Road Investigation. Report TH026843. Prepared for Mount Gibson Mining Ltd.

Hamersley Iron (2005) Brockman Syncline 4 Iron Ore Project Public Environmental Review

Hart Simpson & Associates Pty Ltd (2000) Mt Gibson Iron Pellet Project Fauna Survey. Unpublished report prepared for Mount Gibson Iron Ltd. October, 2000.

Harvey M. (2002) Short range endemism in the Australian fauna: some examples from the non-marine environments. *Invertebrate Systematics* 16:555-570

Harvey M. (2005) *The Short Range Endemic Invertebrate Fauna from the Mt Gibson region, Western Australia: the millipedes*. Unpublished report prepared for ATA Environmental. WA Museum

Herring Storer Acoustics (2006a) *Mt Gibson Iron Ore Project – Mining Operation Acoustical Assessment*. Unpublished report for ATA Environmental Ref 5845-1-02200-5. March 2006

Herring Storer Acoustics (2006b) *Proposed Mt Gibson Iron Ore Geraldton Port Facility. Environmental Acoustic Assessment*. Unpublished report for ATA Environmental. Ref 5844-1-02200-5. March 2006

Herring Storer Acoustics (2006c) Mt Gibson Iron Ore Project Management of Construction Noise. Unpublished report for ATA Environmental. Ref 5846-1-02200-5

Herring Storer Acoustics (2006d) Mt Gibson Iron Ore Project Management of Blasting. Unpublished report for ATA Environmental. Ref 5846-1-02200-5

Humphreys (2000) *Groundwater calcrete aquifers in the Australian arid zone: the context to an unfolding plethora of stygal biodiversity*. Records of the Western Australian Museum Supplement 64: 63-83

(IPCC) Intergovernmental Panel on Climate Change (2001) *Third Assessment Report – Summary for Policy Makers – a Report of Working Group 1 of the Intergovernmental Panel on Climate Change*. January 2001.

McLeod P. (2005) *Economic Benefits from the Development of a new Mine at Mt Gibson*. Unpublished report prepared for ATA Environmental. Economic Research Associates.

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.

Main B. (2005) *Report to ATA Environmental on Mt Gibson: Mygalomorph Spiders*. Unpublished report prepared for ATA Environmental.

Maslin B. R. (2001) *Acacia cerastes* Maslin. in *Flora of Australia*. Volume 11A. Mimosaceae, Acacia part 1 (eds. A.E. Orchard & A.J.G. Wilison). 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.

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.

National Environment Protection Council (NEPC) (1998) *National Environment Protection Measure for Ambient Air Quality*, National Environment Protection Council, 26 June 1998.

New South Wales (NSW) Government (2005) *The NSW Protection of the Environment Operations (Clean Air) Amendment Industrial and Commercial Activities and Plant Regulations.* Government of New South Wales

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

Rockwater (2005a) *Extension Hill Study of Pit Hydrogeology and Dewatering (draft)*. Unpublished report prepared for Mt Gibson Mining. July 2005.

Rockwater (2005b) *Revised Dewatering Assessment for 50 Metres/Year Pit Excavation Rate*. Unpublished report prepared for Mt Gibson Mining. September 2005.

Rockwater (2005c) *Mount Gibson Magnetite Project Report on Surface Water Runoff Management*. Unpublished report prepared for Mt Gibson Mining. September 2005.

Rockwater (2005d) *Extension Hill Magnetite Project Study of Groundwater Effects of Proposed Palaeochannel Borefield*. Unpublished report prepared for Mt Gibson Mining. July 2005.

Slack-Smith S. (2005) *The Invertebrate Fauna of the Mt Gibson Region, Western Australia: the Land Snails*. Unpublished report prepared for ATA Environmental. WA Museum.

Tasmanian Parks and Wildlife Service (2002) *Concepts and Principles of Geoconservation*. Published on the Tasmanian Parks and Wildlife Service's website.

Thackway R.and Cresswell I.D. (1995) *An Interim Biogeographic Regionalisation for Australia*. Australian Nature Conservation Agency, Canberra.

Thompson, G.G. and Thompson, S.A. (2003) Diversity and abundance of pit-trapped reptiles of arid and mesic habitats in Australia: Biodiversity for environmental impact assessments. *Pacific Conservation Biology* 9: 120-35

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

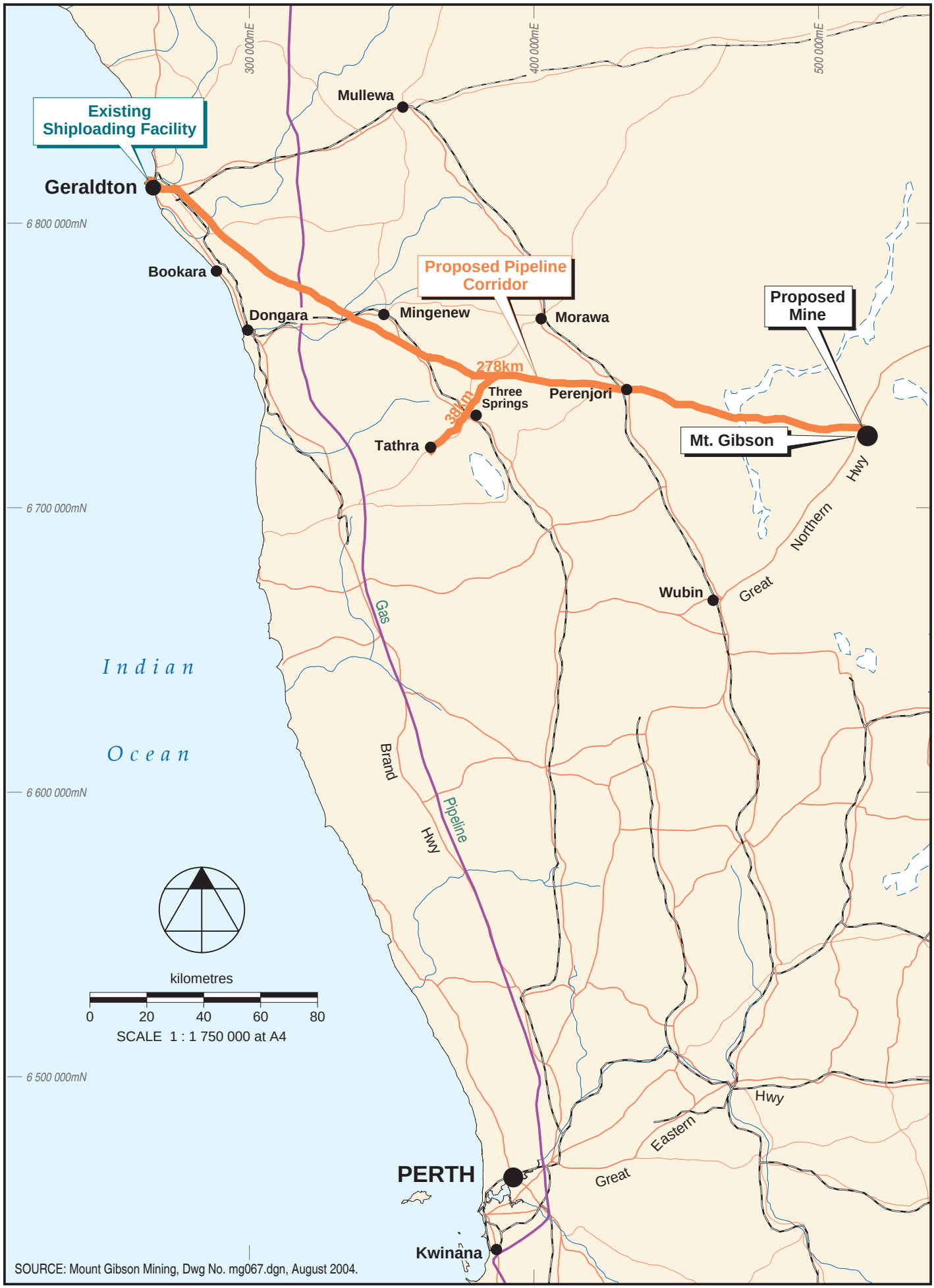
Water & Rivers Commission, (2003) Mine Void Water Resource Issues in Western Australia

World Health Organisation (WHO) 2000, *Air Quality Guidelines for Europe*, Second Edition, WHO Regional Publications, European Series, Number 91.

12. GLOSSARY

Abstraction/dewatering	Removal of groundwater from aquifer system
Aquifer	A permeable rock formation which stress and transmits groundwater
Banded Iron Formation	Tabular rock body usually consisting of alternating bands of quartz and iron rich minerals
Biodiversity	The variability among living organisms on the earth, including the variability within and between species and within and between ecosystems
Bioregion	A region constituting a natural ecological community with characteristic flora, fauna and environmental conditions and bounded by natural rather than artificial borders
Borefield	Series of holes that are drilled into an aquifer for the purpose of withdrawing water
Bund	An earth, rock or concrete wall constructed to prevent the inflow or outflow of liquids
Ephemeral	Watercourse that flows on only a few occasions in a year
Fines	That portion of iron ore product that is sized less than 6mm
Hydrogeology	The geology of groundwater
Impermeable	Material that does not allow a particular substance to pass through it
Invertebrates	Lacking a backbone or spinal column
Lump	That portion of iron ore product that is sized greater than 6mm
Overburden	Soil and rock overlying a mineral deposit that must be removed before the deposit can be mined
Permeability	The extent to which fluids can pass through rock
Potable water	Fresh and marginal water generally considered suitable for human consumption
Putrescible	Waste material that has the potential to rot, such as food matter
Recharge	The process where water penetrates soil to a temporary or permanently saturated zone
Stripping ratio	The ratio of overburden to mined
Stygofauna	Invertebrates that are adapted to inhabiting subterranean aquatic environments
Tailings	Material remaining after the processing of ground/crushed ore
Void	An open structure or pit that remains after ore has been removed by mining.

FIGURES



PRINTED: Thu 23 Mar 06 CHECKED BY: MS 23-03-06 DRAWN BY: EDS 23-03-06 DATUM: MGA MGM-2005-004/MGMT/24_246f01.dgn

SOURCE: Mount Gibson Mining, Dwg No. mg067.dgn, August 2004.

ATA Environmental
environmental scientists

MT GIBSON IRON ORE & INFRASTRUCTURE PROJECT - PUBLIC ENVIRONMENTAL REVIEW

REGIONAL LOCATION

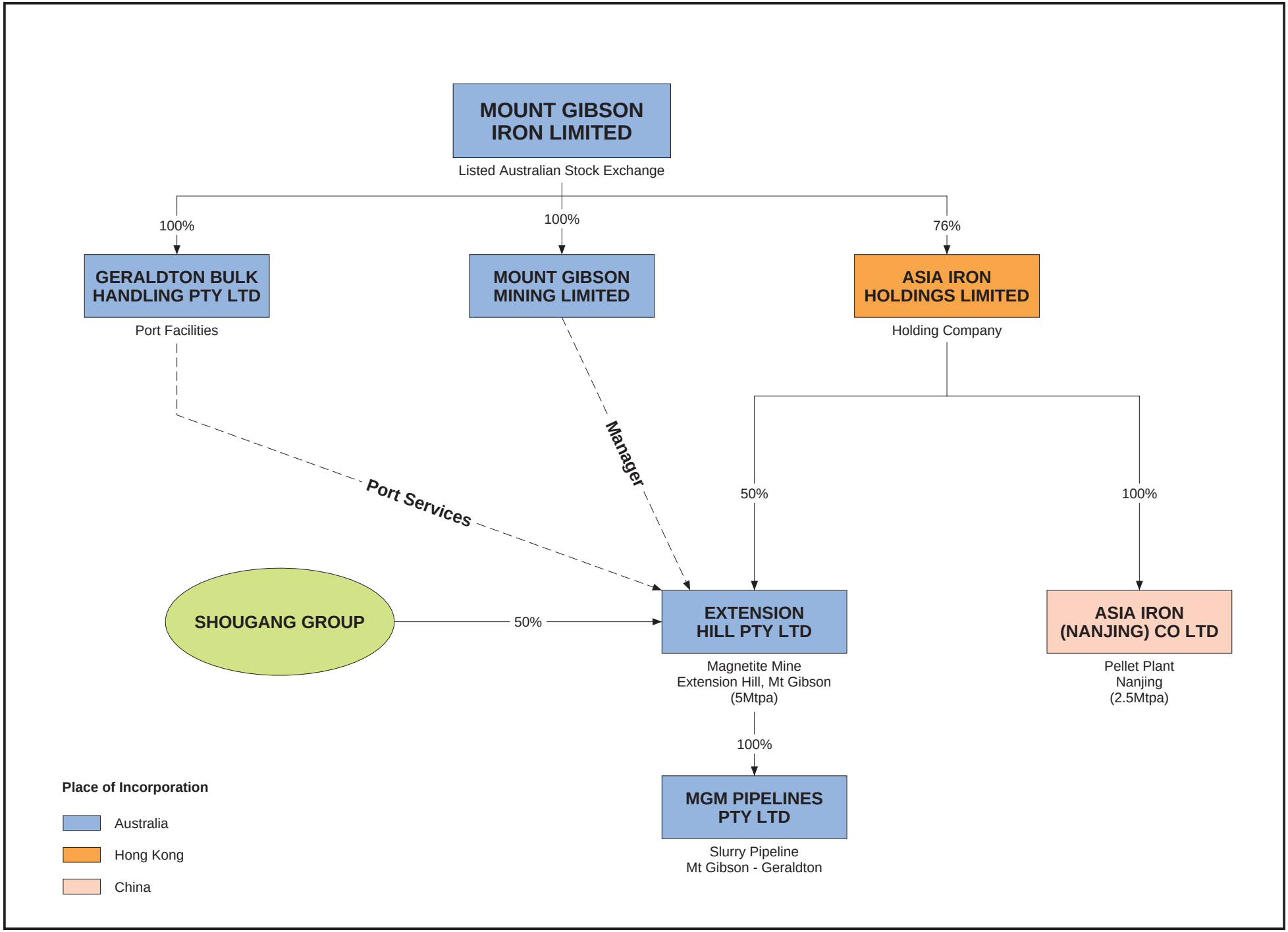
FIGURE 1

ATA Environmental
environmental scientists

MT GIBSON IRON ORE & INFRASTRUCTURE PROJECT - PUBLIC ENVIRONMENTAL REVIEW

CORPORATE STRUCTURE

FIGURE 2



PRINTED: Thu 23 Mar 06

CHECKED BY: MS 23-03-06

DRAWN BY: EDS 23-03-06

DATUM: MGA

MGM-2005-004/MGMT/24_246f03a.dgn

E59/1179

M59/339

G59/30

L 3114/ 602
NINGHL 04280

Proposed Deviation of
Great Northern Highway

6 730 000mN

Hematite
Stockpile

Hematite
Conveyor

Existing
Airstrip

L59/63

ROM
Pad

Co-located Waste Dump/
Dry Tailings Storage Facility

Extension
Hill North

Reserve 36657
NINGHL 04219

L 398/ 616
NINGHL 03572

Wanarra

Road

L 398/ 616
NINGHL 04282

VCL

Extension Hill
Pit

6 728 000mN

G59/32

Extension
Hill

Proposed
Airstrip

L59/67

Extension
Hill South

L 398/ 616
NINGHL 03543

L 398/ 616
NINGHL 03544

Concentrator Plant Site
and Ancillary Services

Highway

6 726 000mN

G59/34

Camp Services
Corridor

Iron Hill
North

Iron Hill
East

Mt Gibson

LGE 1288242
NINGHL 04397
Reserve 17367

L59/68

M59/550

Northern

Iron Hill

M59/609

Camp
Area

Iron Hill
South

Mt Gibson
South

G59/33

L59/69

G59/35

G59/31

Great

512 000mE

514 000mE

516 000mE

518 000mE

metres

0 250 500 750 1000

SCALE 1 : 30 000 at A3

LEGEND

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

SOURCE: Mount Gibson Iron Pty Ltd, 2005.

ATA Environmental
environmental scientists

MT GIBSON IRON ORE
& INFRASTRUCTURE PROJECT
PUBLIC ENVIRONMENTAL REVIEW

MINE SITE LAYOUT

FIGURE 3a

MGM-2005-004/MGMT/24_246f03b.dgn DATUM: MGA DRAWN BY: EDS 23-03-06 CHECKED BY: MS 23-03-06 PRINTED: Fri 24 Mar 06

kilometres
0 0.5 1 1.5 2 2.5
SCALE 1 : 75 000

LEGEND
- Proposed Mine Layout
- Tenement Boundary - Extension Hill Pty Ltd
- Tenement Boundary - Mount Gibson Mining Pty Ltd

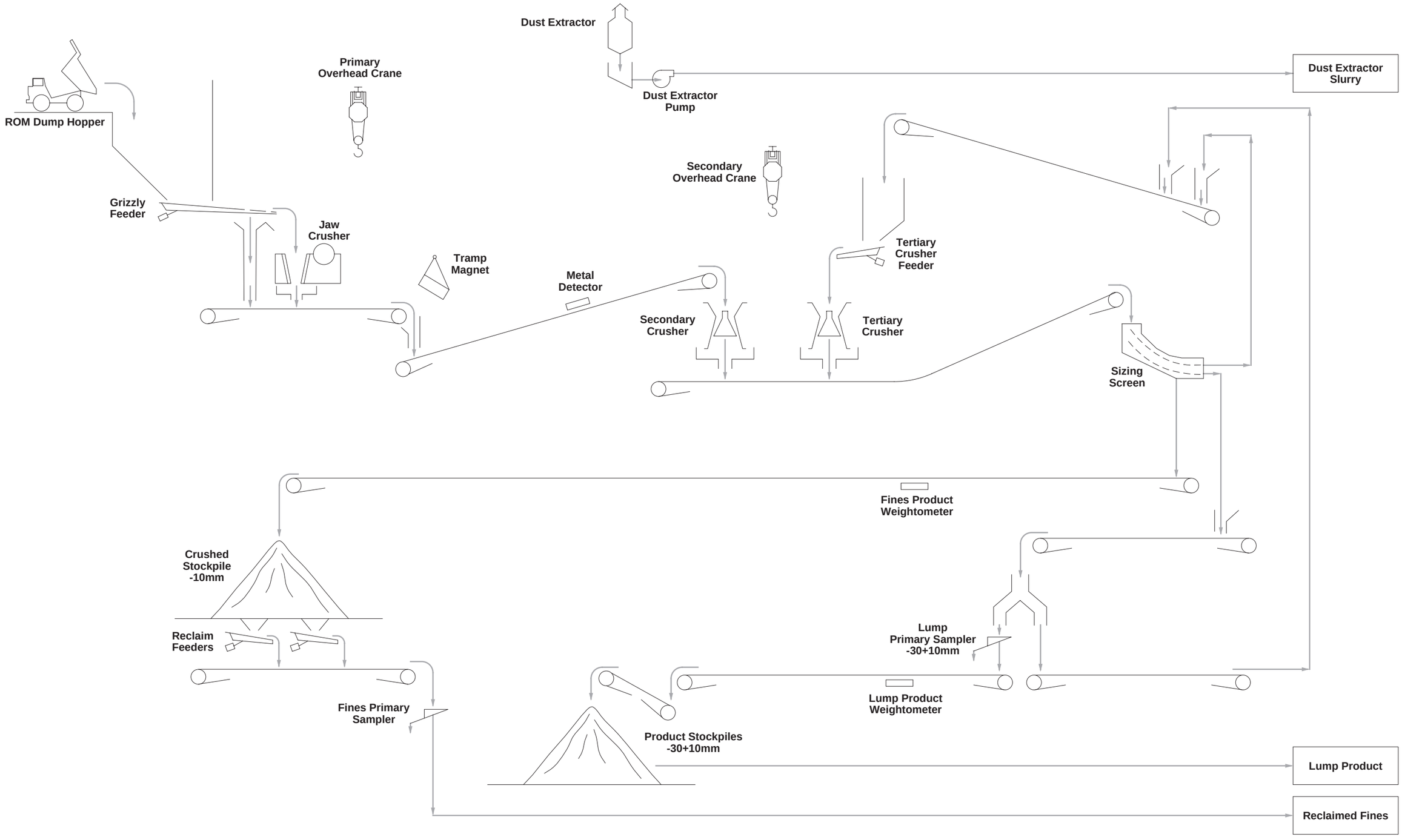
6 745 000mN
6 740 000mN
6 735 000mN
6 730 000mN
6 725 000mN
6 720 000mN
510 000mE
515 000mE
520 000mE
525 000mE

Dam
Warro Well
NINGHA
HOMESTEA
NORTHERN
GREAT
Kiaby Well
Yd
L/G
Roys Well (Niu)
RETALLIATION
Taylor Well
L59-66
Dam
Fence NIU
Christmas Bore
Turkey Well
Yd
Yandhanoo Well
VERMIN
M/A
BONNIE VENTURE MINE
YANDHANOO HILL
HILL
Puppy Well (
Well (Ruin)
Judis Dam
Bungeye
Dam
E59-1179
G59-30
Co-located Waste Dump/Dry Tailings Storage Facility
L/G
Cossie Lou Well (Ruin)
L59-63
Pit
Ruin
G59-32
Airstrip
L59-67
M59-339
M59-338
Beanthiny Rocks
BEANTHINY HILL
Beanthiny Spri
Plant and Ancillary Services
G59-34
M59-455
GIBSON
Deep Well (Ruin)
M59-526
M59-454
L59-68
Camp
M59-609
M59-550
G59-33
G59-35
G59-31
L59-69
Pipeline
Harp Well (Abd)
HARP MINE

MT GIBSON IRON ORE
& INFRASTRUCTURE PROJECT
PUBLIC ENVIRONMENTAL REVIEW
TENEMENT LOCATIONS
FIGURE 3b

ATA Environmental
environmental scientists

PRINTED: Thu 23 Mar 06
CHECKED BY: MS 23-03-06
DRAWN BY: EDS 23-03-06
DATUM: N/A
MGM-2005-004/MGMT/24_246f04.dgn



SOURCE: Signet Engineering Pty Ltd, 1995.

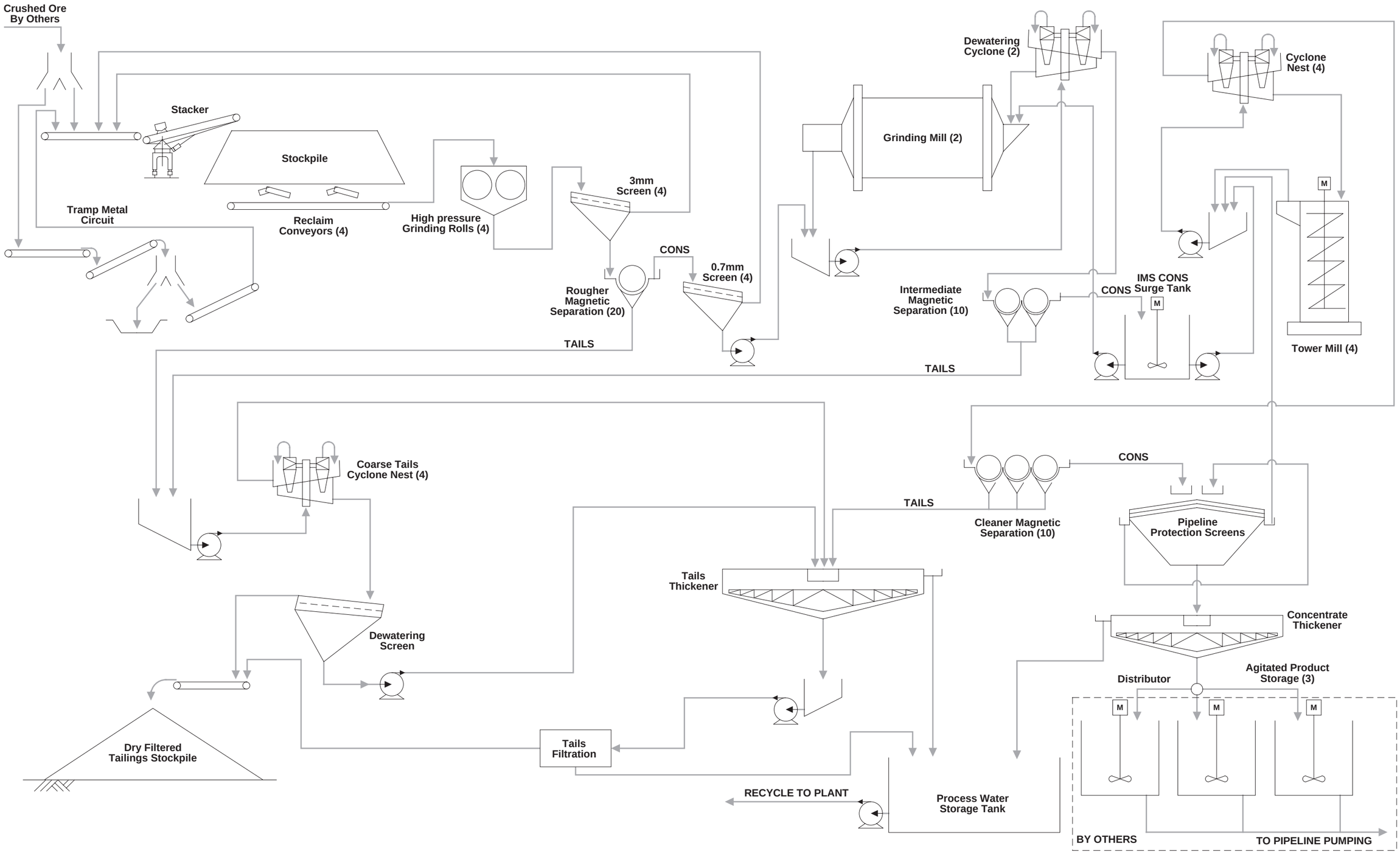
ATA Environmental
environmental scientists

MT GIBSON IRON ORE & INFRASTRUCTURE PROJECT
PUBLIC ENVIRONMENTAL REVIEW

PROCESS FLOW DIAGRAM - HEMATITE

FIGURE 4

PRINTED: Thu 23 Mar 06
CHECKED BY: MS 23-03-06
DRAWN BY: EDS 23-03-06
DATUM: N/A
MGM-2005-004/MGMT/24_246f04.dgn



SOURCE: ProMet Engineers, Dwg No. C5176-overall, 19-01-05.

ATA Environmental
environmental scientists

MT GIBSON IRON ORE & INFRASTRUCTURE PROJECT
PUBLIC ENVIRONMENTAL REVIEW

PROCESS FLOW DIAGRAM - MAGNETITE

FIGURE 5

PRINTED: Fri 24 Mar 06

CHECKED BY: MS 23-03-06

DRAWN BY: EDS 23-03-06

DATUM: MGA

MGM-2005-004/MGMT/24_246f06.dgn

kilometres

0 10 20 30 40

SCALE 1 : 700 000 at A3

LEGEND

- Gas, Return Water with Bore Water and Slurry Pipeline
- Gas, Slurry and Return Water Pipelines
- Bore Water Pipeline
- Slurry and Return Water Pipelines
- Dampier to Bunbury Natural Gas Pipeline
- Reserve Boundary
- Pump Station

Pump Station 7
279.99km
GERALDTON
Mullewa
Pump Station 6
232.618km
Pump Station 5
209.265km
Gas Pipeline Site 8
Mingenew
Morawa
Pump Station 4
175.291km
Pump Station 3
130.848km
Slurry Pump Station
38.297km
Perenjori
Pump Station 2
77.224km
Pump Station 1
45.965km
Pump Station 0
0km
MT GIBSON
Three Springs
Pump Station 9
0km
TATHRA BOREFIELD
OCEAN

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

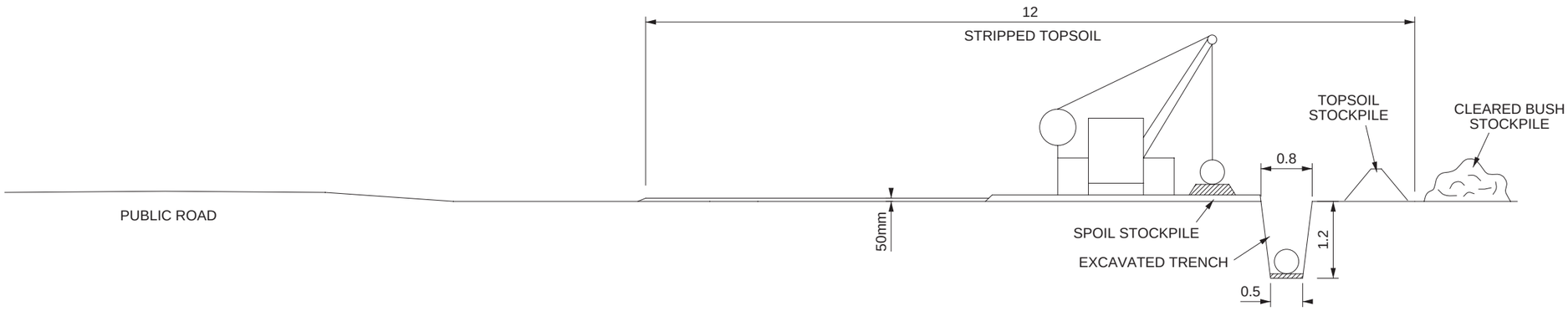
ATA Environmental
environmental scientists

MT GIBSON IRON ORE & INFRASTRUCTURE PROJECT
PUBLIC ENVIRONMENTAL REVIEW

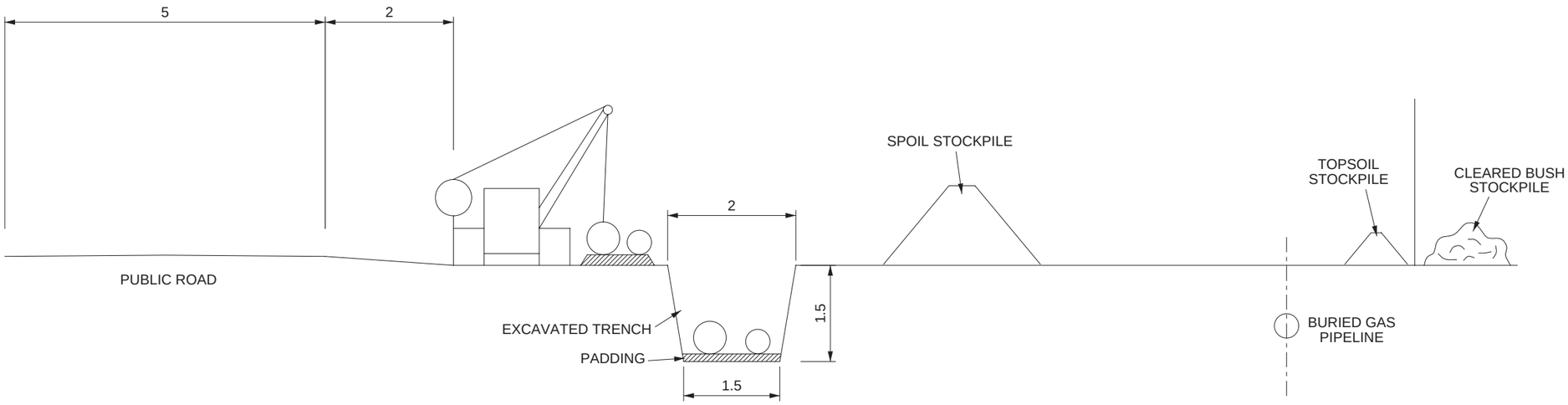
LOCATION OF SERVICES CORRIDOR

FIGURE 6

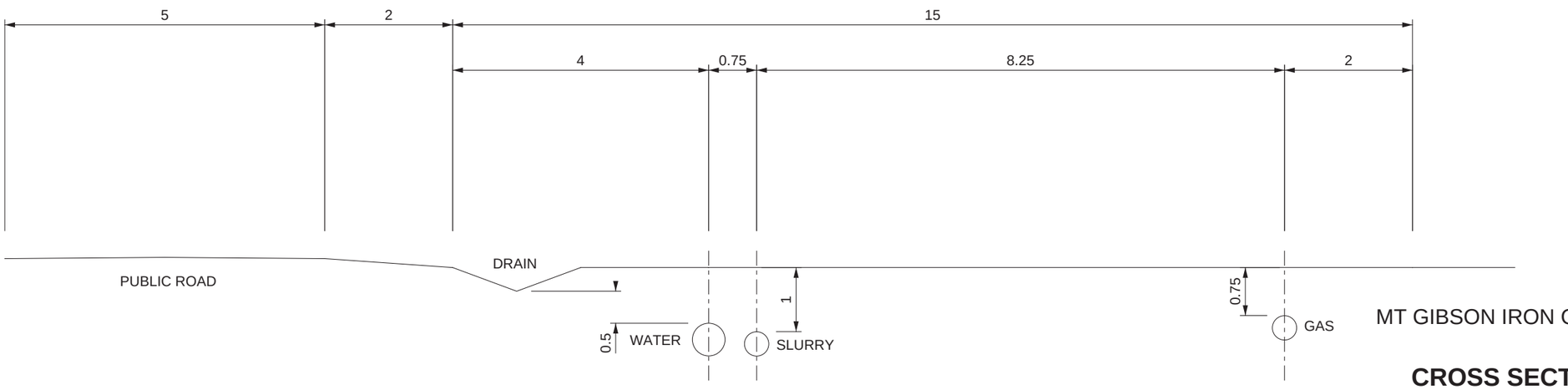
PRINTED: Thu 23 Mar 06
CHECKED BY: MS 23-03-06
DRAWN BY: EDS 23-03-06
DATUM: N/A
MGM-2005-004/MGMT/24_246f07a.dgn



GAS PIPELINE CONSTRUCTION



RETURN WATER AND SLURRY PIPELINE CONSTRUCTION



5Mtpa FINISHED CONSTRUCTION

SOURCE: OSD Energy Sources, 2005.

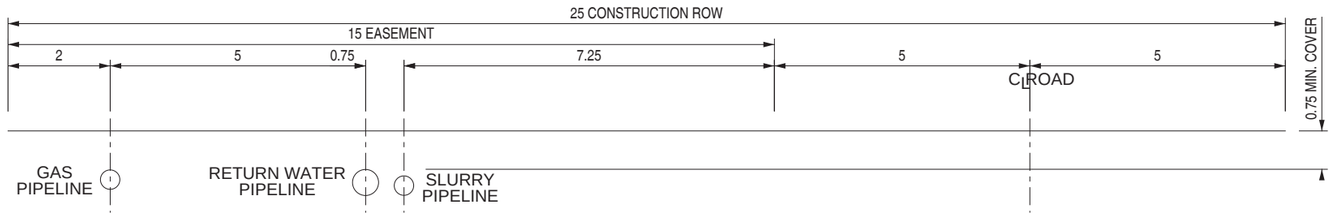
ATA Environmental
environmental scientists

MT GIBSON IRON ORE & INFRASTRUCTURE PROJECT
PUBLIC ENVIRONMENTAL REVIEW

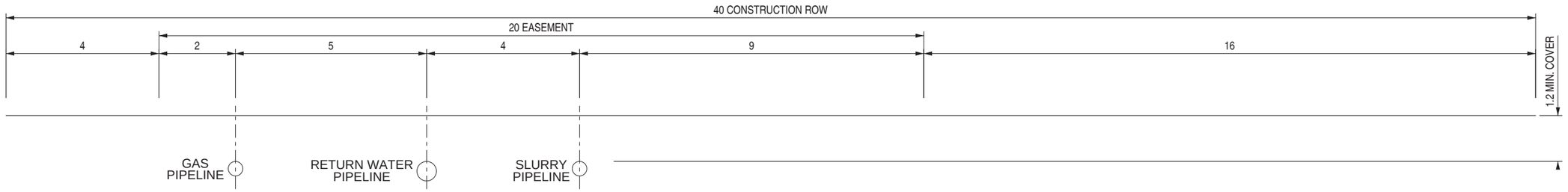
CROSS SECTION OF SERVICES CORRIDOR PASTORAL SECTION

FIGURE 7a

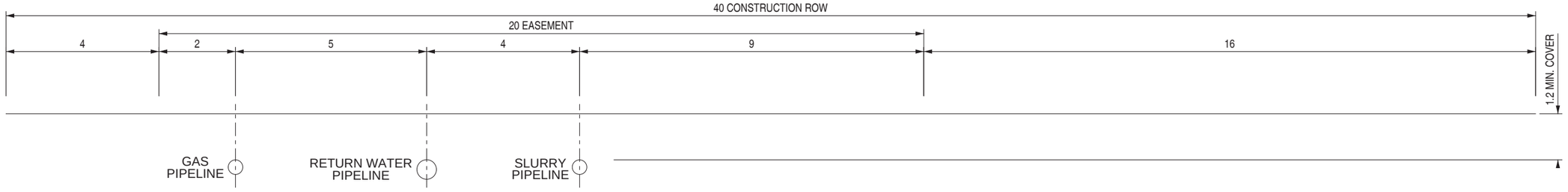
A
0km - 44km
(Pastoral Lease)



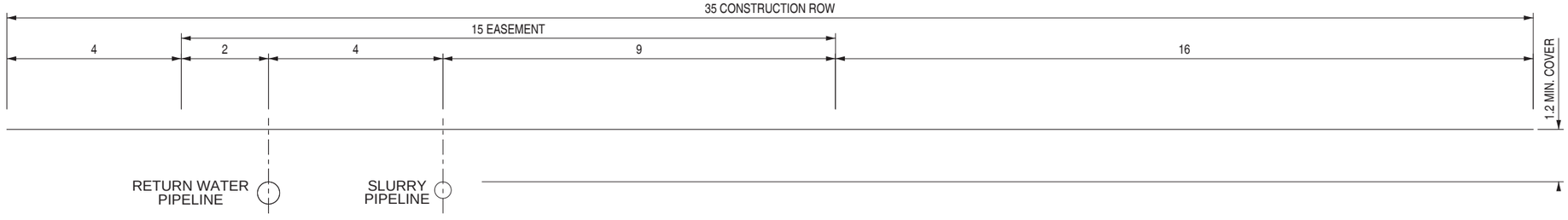
B
44km - 131km
(Agrcultural)



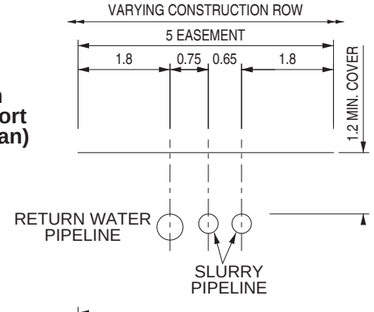
C
131km - 208km
(Agricultural)



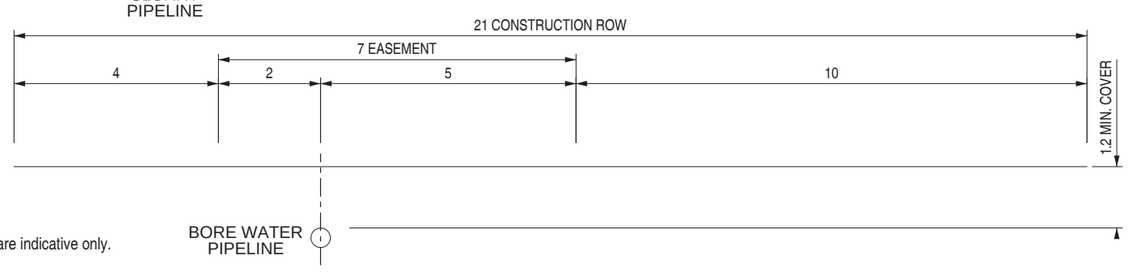
D
208km - 266km
(Agricultural)



E
266km - 278km
Southern Transport
Corridor (Suburban)



F
0km - 37km
Tathra Water Supply
(Agricultural)



NOTE: Configurations and Dimensions are indicative only.

SOURCE: OSD Energy Sources, 2005.

ATA Environmental
environmental scientists

MT GIBSON IRON ORE & INFRASTRUCTURE PROJECT
PUBLIC ENVIRONMENTAL REVIEW

CROSS SECTION OF SERVICES CORRIDOR AGRICULTURAL SECTION

FIGURE 7b

STAGES OF GAS PIPELINE CONSTRUCTION

PRELIMINARY/CENTERLINE SURVEY

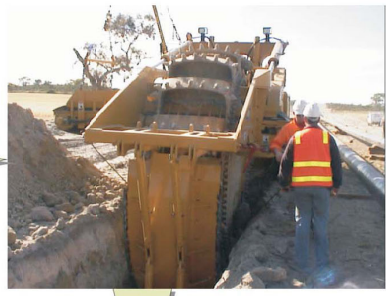
Non-destructive surveys are undertaker to valuate the pipeline route taking into consideration cultural land environmental, existing infrastcructure and engineering apsects.

CLEAR & GRADE

Graders, bulldozers and rakes are generally used to clear the Right of Way (ROW) ready for construction to commence. Top-soil and vegetction are removed and sored seperately for re-establishment after the pipeline is completed. Different techniques are implemented in consultation with the affected landhoder. During this process, severed fences are replaced with construction gates.

TRENCHING

After the route is cleared, trenches for the pipeline are dug.



WELDING & JOINT COATING

Pipe sections are welded together. The areas cround the weld are then sand blasted and coated with the same protective coating as over the rest of the pipe to reduce corrosion.

BENDING

If required, pipe sections can be bent to match changes in elevation and direction of the route.

STRINGING

Steel pipe is trucked in and the sections, each approximatey 12-18 metres long, are laid end to abng the ROW.

X-RAYING

The welds are carefully inspected using xray equipment.

LOWERING-IN

Side booms (bulldozers with cranes) are used to lower the pipe into the trench and workers ccrefully inspect it cgain for quality at this stage.

DETAILED AND AS BUILT SURVEYING

Engineering, environmental, archaeological and arthropologica surveys are used to determine any special construction techniques or mitigation measures required for construction. Once the pipeline alignment has been established with input from affected parties, tehn the 'trench-line' is estblished and engineering aspects are finalised. A final as-built survey is conducted on the pipeline in the trench.

BACKFILLING

The trench is re-filled, with pacding added over the pipe where required.

HYDROSTATIC TESTING

Using water at high pressures, the pipeline is thoroughly tested before being placed in service.

RESTORATION & REHABILITATION

Environmental experts oversee restoration procedures, which may include contouring, installation of erosion controls and re-vegetation.

SOURCE: Warren King & Company, December 2005.

PRINTED: Thu 23 Mar 06 CHECKED BY: MS 23-03-06 DRAWN BY: EDS 23-03-06 DATUM: N/A MGM-2005-004/MGMT/24_246f08.dgn

ATA Environmental
environmental scientists

MT GIBSON IRON ORE & INFRASTRUCTURE PROJECT - PUBLIC ENVIRONMENTAL REVIEW

PIPELINE CONSTRUCTION

FIGURE 8

PRINTED: Fri 24 Mar 06
CHECKED BY: MS 24-03-06
DRAWN BY: EDS 24-03-06
DATUM: N/A
MGM-2005-004/MGMT/24_246f09.dgn

metres
0 50 100 150 200
SCALE 1 : 4 000 at A3

Reclamation Area
Connell Road
Live Cray Factories
Heavy Loadout
Magnetite Storage Building
Conveying System to Storage Building
Road
Graham
Berth No. 6
Fuel Discharge Facility
Fishing Boat Harbour
Main Harbour
Proposed Tug Pens Shed
Storage Tanks
Clarifier
Lemmon Road
RD.
Clarke
Boat Lift Facility (55t, 80t)
Return Water Tank & Pumps
Filter Plant
Reg
Berth No. 5
BERTH 5
G.P.A. Slipway 150t
Work Boat House
Bulk Grain Unloading Facility
Berth No. 1
Berth No. 2
Berth No. 3
Road
SHED
Conveying System to Shiploader
Berth No. 4
Mineral Sands Storage Area
TAMI Lift Yard
CBH Truck Unloading Facilities
G.P.A.
IAN
Midwest Corporation Shed
Murchison Metal Shed
LEAD LIGHT
Talc Storage Area
Gillam
Bulk Minerals and Talc Unloading Facilities
Mineral Sands
Mt Gibson Iron Iron Ore Shed
Zinc and Copper Conc.
CBH Storage Silos
Road
Garnet
Marine
Terrace

ATA Environmental
environmental scientists

MT GIBSON IRON ORE
& INFRASTRUCTURE PROJECT
PUBLIC ENVIRONMENTAL REVIEW

SHIPLOADING FACILITIES AT GERALDTON PORT

FIGURE 9

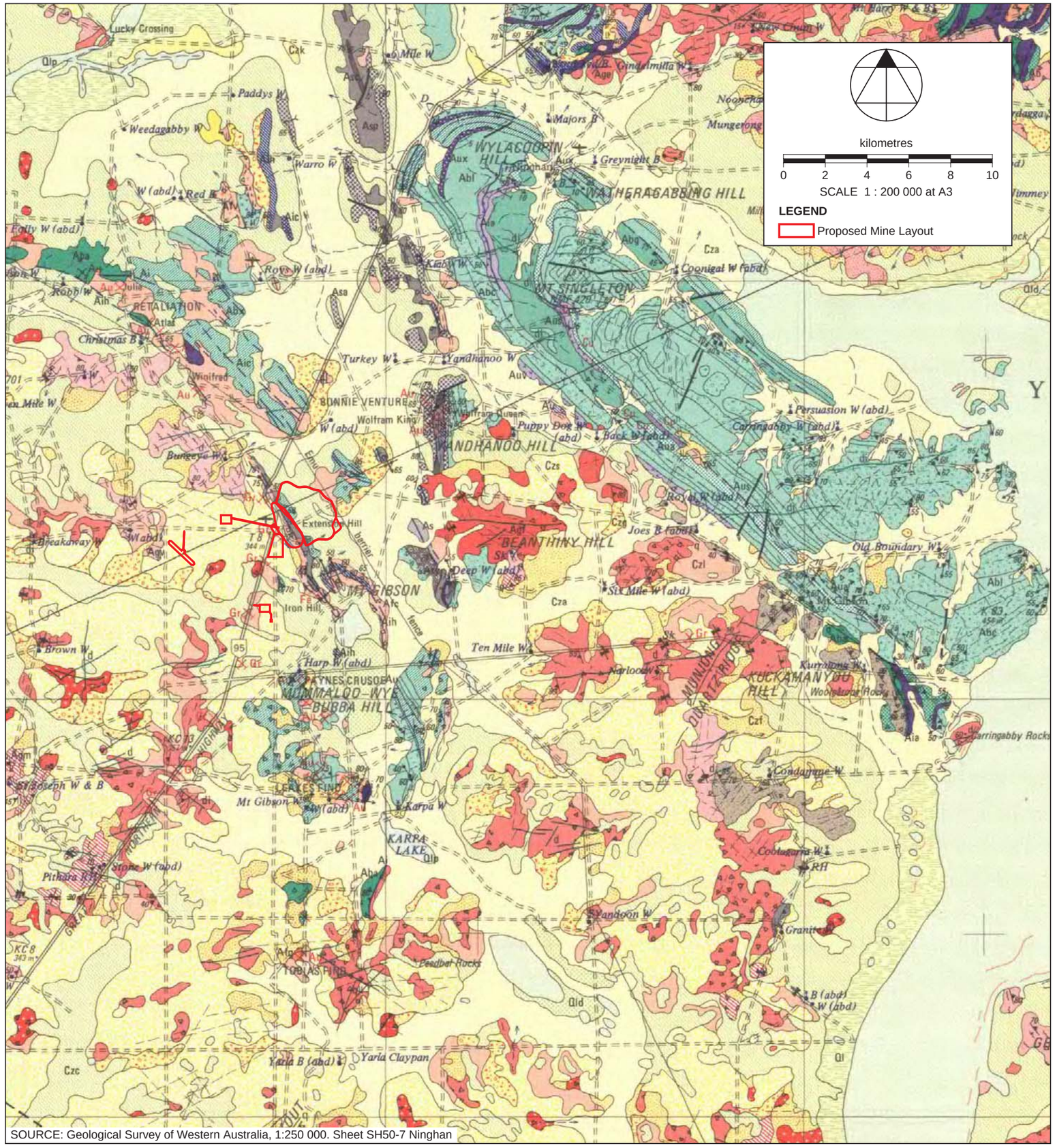
PRINTED: Fri 24 Mar 06

CHECKED BY: MS 23-03-06

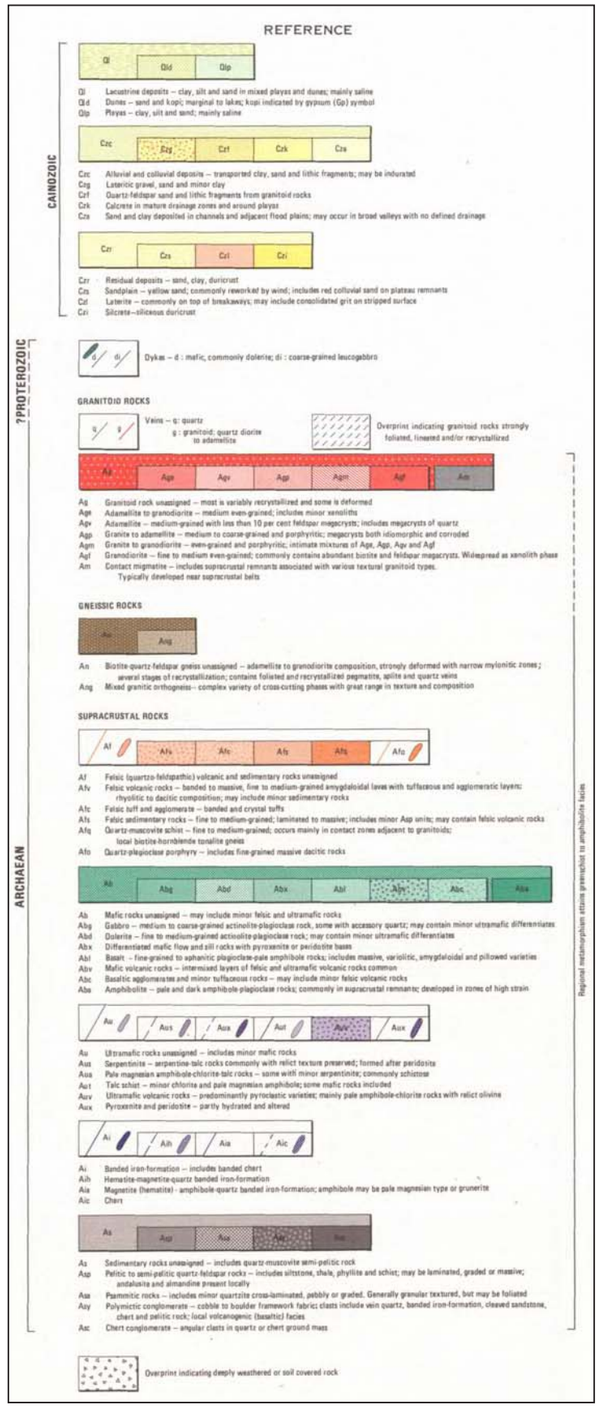
DRAWN BY: EDS 23-03-06

DATUM: MGA

MGM-2005-004/MGMT/24_246f10.dgn



SOURCE: Geological Survey of Western Australia, 1:250 000. Sheet SH50-7 Ninghan



ATA Environmental
environmental scientists

MT GIBSON IRON ORE & INFRASTRUCTURE PROJECT
PUBLIC ENVIRONMENTAL REVIEW

REGIONAL GEOLOGY

FIGURE 10

PRINTED: Thu 23 Mar 06

CHECKED BY: MS 23-03-06

DRAWN BY: EDS 23-03-06

DATUM: MGA

MGM-2005-004/MGMT/24_246f11a.dgn

Catchment Pre Two

Catchment Pre One

Co-located Waste Dump/
Dry Tailings Storage Facility

HSP1

HSP2

Hematite Stockpile

ROM Pad

Concentrator Plant Site and Ancillary Services

1

2

2

3

3

metres

0 250 500 750 1000

SCALE 1 : 20 000 at A3

Legend

- Topographic Contour (m AHD, 1m interval)
- Drainage Line
- Flow Direction
- Catchment Boundary
- Sub-catchment Boundary
- Section Line

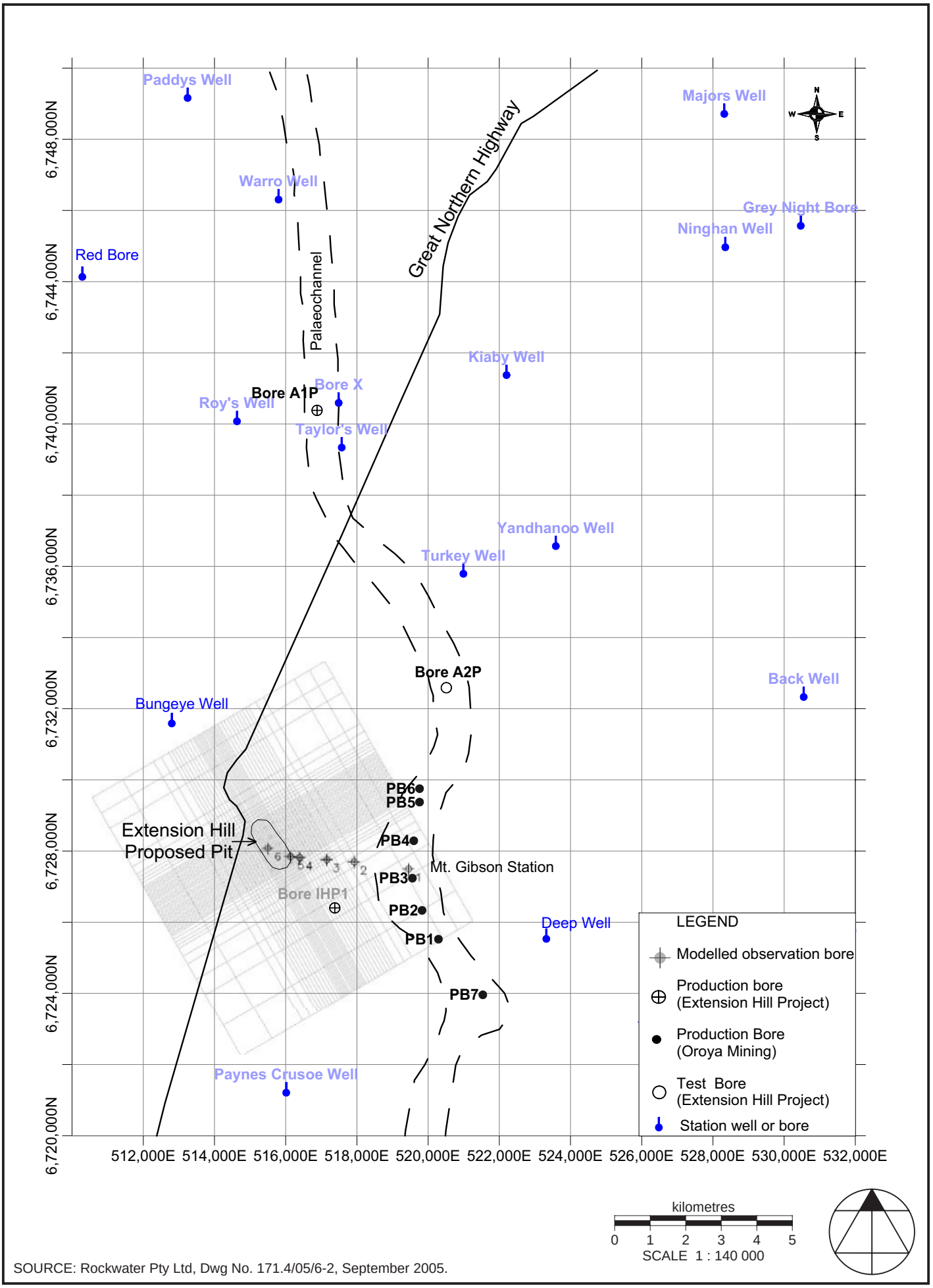
SOURCE: Rockwater, 2005.

ATA Environmental
environmental scientists

MT GIBSON IRON ORE & INFRASTRUCTURE PROJECT
PUBLIC ENVIRONMENTAL REVIEW

SURFACE HYDROLOGY AT MINE SITE

FIGURE 11a



SOURCE: Rockwater Pty Ltd, Dwg No. 171.4/05/6-2, September 2005.

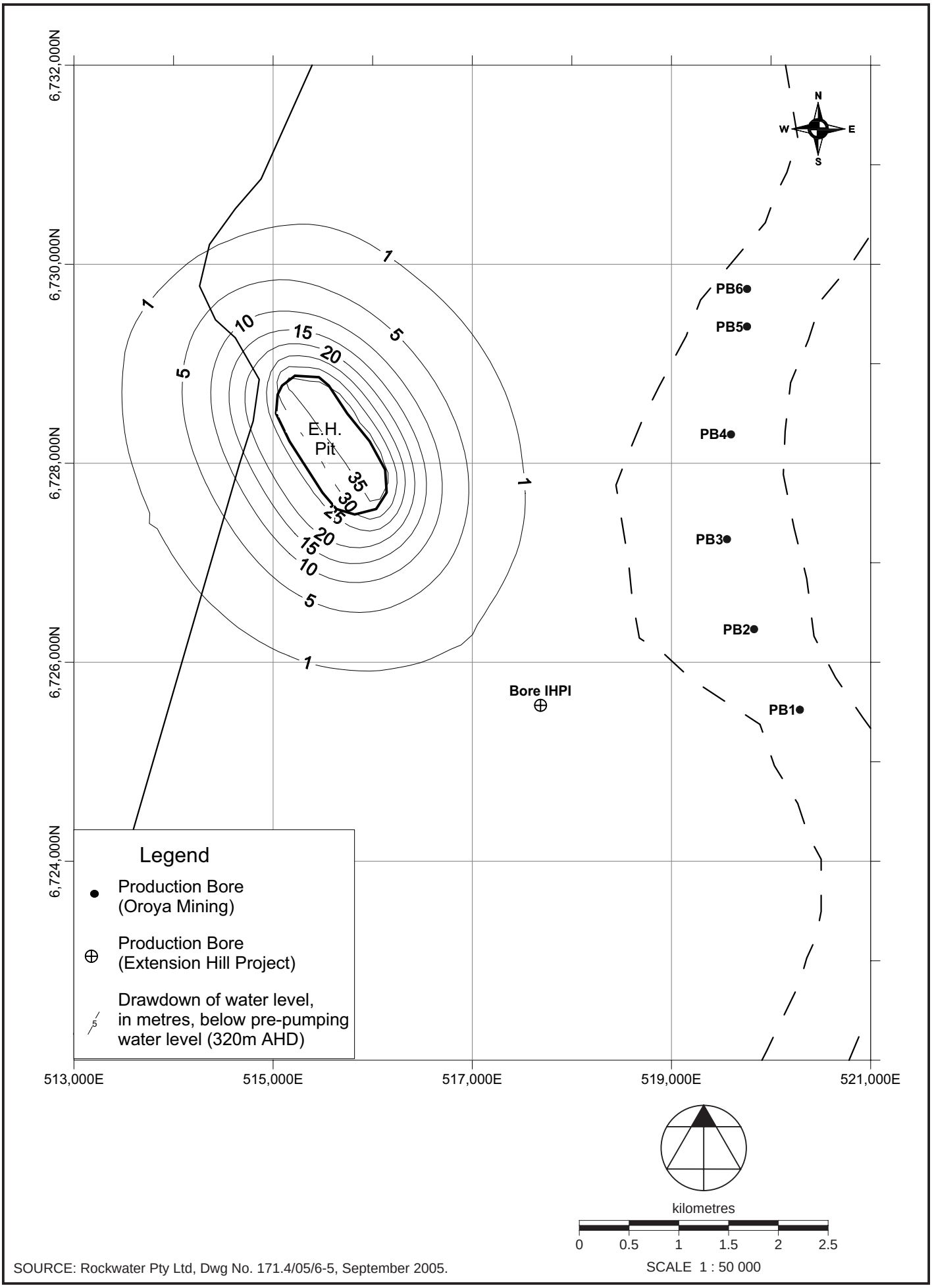
PRINTED: Thu 23 Mar 06 CHECKED BY: MS 23-03-06 DRAWN BY: EDS 23-03-06 DATUM: MGA MGM-2005-004/MGMT/24_246f11b.dgn

ATA Environmental
environmental scientists

MT GIBSON IRON ORE & INFRASTRUCTURE PROJECT - PUBLIC ENVIRONMENTAL REVIEW

GROUNDWATER BORES IN THE VICINITY OF MT GIBSON

FIGURE 11b



SOURCE: Rockwater Pty Ltd, Dwg No. 171.4/05/6-5, September 2005.

PRINTED: Thu 23 Mar 06 CHECKED BY: MS 23-03-06 DRAWN BY: EDS 23-03-06 DATUM: MGA MGM-2005-004/MGMT/24_246f11c.dgn

ATA Environmental
environmental scientists

MT GIBSON IRON ORE & INFRASTRUCTURE PROJECT - PUBLIC ENVIRONMENTAL REVIEW

CALCULATED DRAWDOWN OF GROUNDWATER IN UPPER BEDROCK FROM DEWATERING

FIGURE 11c

PRINTED: Thu 23 Mar 06

CHECKED BY: MS 23-03-06

DRAWN BY: EDS 23-03-06

DATUM: MGA

MGM-2005-004/MGMT/24_246f12.dgn

Northampton

Existing Shiploading Facilities (50,000 - 60,000DWT)

Geraldton

Narngulu

Mullewa

Yalgoo

Mount Magnet

Hwy

Murchison

Yalgoo

Geraldton Sandplains

Mingenew

Morawa

Dongara

Indian Ocean

Gas

287km

38km

Three Springs

Perenjori

Tathra

Brand

Proposed Pipeline Corridor

Extension Hill
Magnetite

Northern

Great

Eneabba

Wubin

Hwy

Jurien

Coolgardie

Avon Wheatbelt

Moora

Pipeline

Mukinbudin

Swan Coastal Plain

Jarrah Forest

Wyalkatchem

Southern C

WA Location

Indian Ocean

Derby

Broome

Port Hedland

Karratha

WESTERN AUSTRALIA

Geraldton

Figure Area

Kalgoorlie

PERTH

Bunbury

Albany

kilometres

0 10 20 30 40 50

SCALE 1 : 1 500 000 at A3

Legend

- Proposed Pipeline Corridor
- Rail Line
- Major Road

Bioregions Legend

- Murchison
- Geraldton Sandplains
- Yalgoo
- Avon Wheatbelt
- Swan Coastal Plain
- Jarrah Forest
- Coolgardie

BIOREGIONS SOURCE: Department of Environment & Heritage, IBRA, 1997.

ATA Environmental
environmental scientists

MT GIBSON IRON ORE
& INFRASTRUCTURE PROJECT
PUBLIC ENVIRONMENTAL REVIEW

BIOREGIONS

FIGURE 12

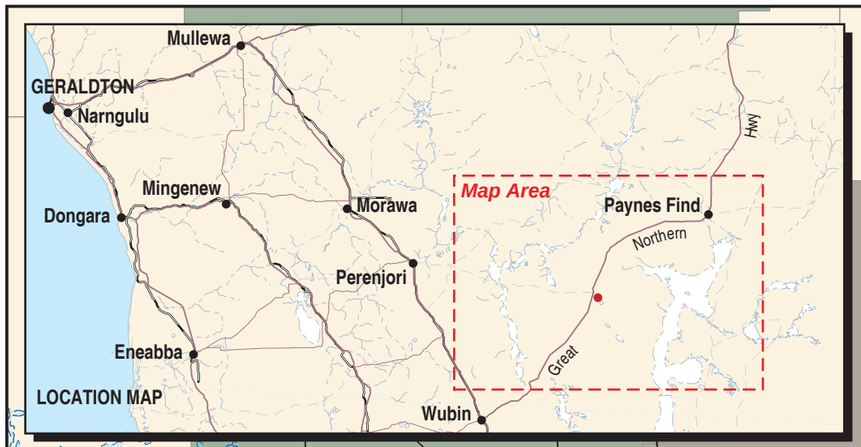
PRINTED: Thu 23 Mar 06

CHECKED BY: MS 23-03-06

DRAWN BY: EDS 23-03-06

DATUM: MGA

MGM-2005-004/MGMT/24_246f13.dgn



kilometres

0 5 10 15 20

SCALE 1 : 350 000 at A3

Legend

- White Wells Pastoral Lease Australian Bush Heritage Fund)
- Ninghan Indigenous Owned Lease
- Mt Gibson Pastoral Lease (Australian Wildlife Conservancy)
- Wanarra Pastoral Lease
- Karara Pastoral Lease (CALM)
- Crown Reserve
- Vacant Crown Land
- Salt Lake
- Tenement Boundary
- Indigenous Protection Area Category III
- Indigenous Protection Area Category VI
- Watercourse
- Road Reserve
- Route of Services Corridor
- Proposed Mine Layout

SOURCE: Mount Gibson Mining, Dwg No. MG-01-012.dgn, 11-06-04.

ATA Environmental
environmental scientists

MT GIBSON IRON ORE
& INFRASTRUCTURE PROJECT
PUBLIC ENVIRONMENTAL REVIEW

SURROUNDING LAND USE

FIGURE 13

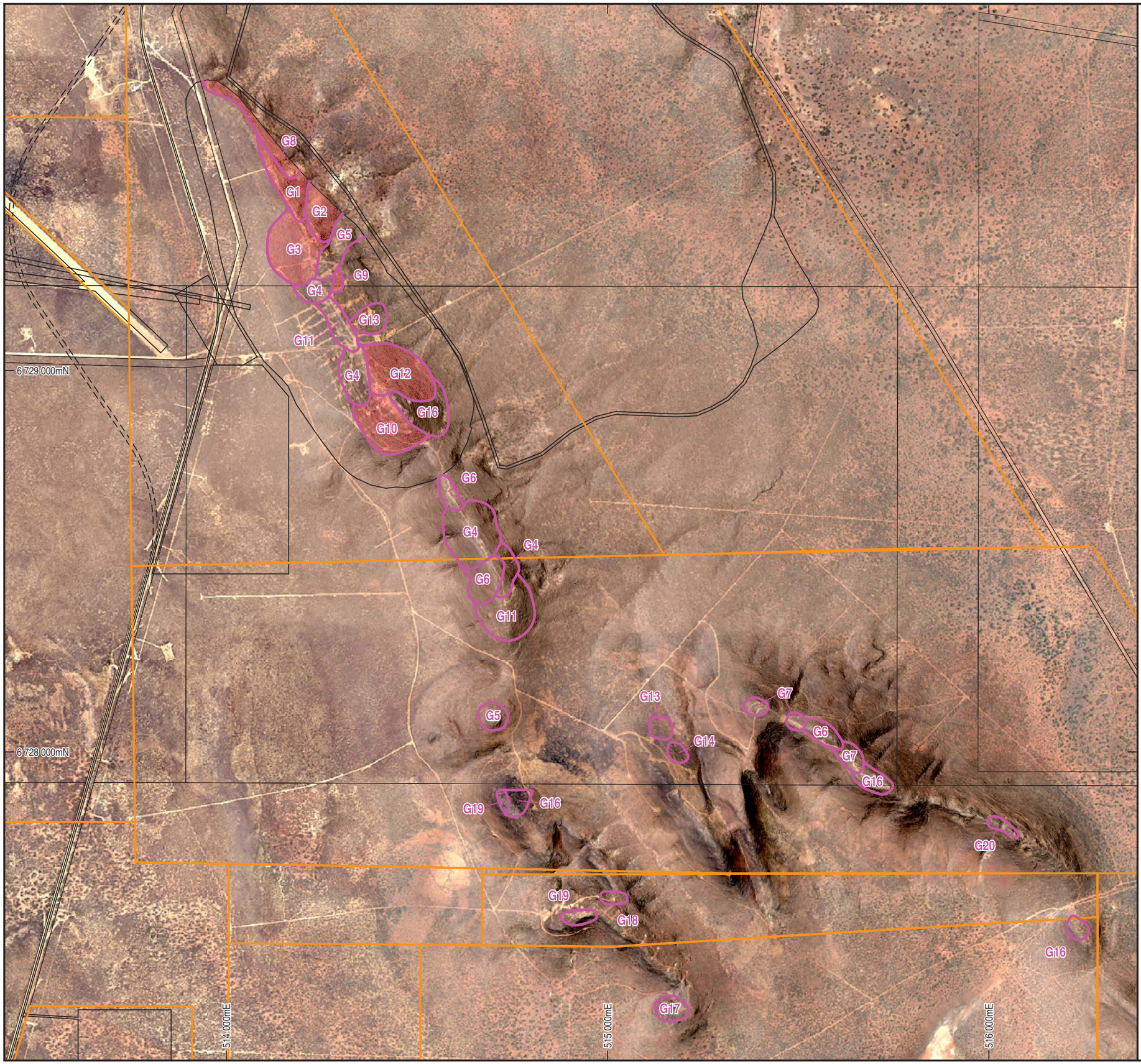
PRINTED: Thu 23 Mar 06

CHECKED BY: MS 23-03-06

DRAWN BY: EDS 23-03-06

DATUM: MGA

MGM-2005-004/MGMT/24_246f14a.dgn



metres

0 200 400 600 800 1000

SCALE 1 : 20 000

Legend

- Project Layout
- Cadastral Boundary
- Tenement Boundary
- Floristic Group Boundary
- Floristic Community Types Impacted by the Project Not Occuring Elswhere on Banded Iron Formation in the Mt Gibson Area

Floristic Group Mapping (Group 40 groups) on Banded Iron Formation Mt Gibson

G1 Closed Tall Scrub *Acacia aneura* var. *aneura, Allocasuarina acutivalvis* subsp. *prinsepiana, Grevillea paradoxa* with scattered *Eucalyptus oldfieldii* and *Calycopeplus paucifolius* over Herbland of *Waitzia nitida, Trachymene ornata, Stylidium confluens, Enekbatus stowardii, Drosera micrantha* and *Thysanotus patersonii.*

G2 Open Heath *Mirbelia macrophylla* and *Philotheca seriacea* with scattered *Acacia aneura* subsp. *aneura* and *Allocasuarina acutivalvis* subsp. *prinsepiana.*

G3 Closed Tall Scrub *Allocasuarina acutivalvis* subsp. *prinsepiana, Aluta aspera, Philotheca seriacea, Acacia aneura* var. *aneura, Acacia assimilis* subsp. *assimilis, Grevillea obliquistigma* subsp. *obliquistigma, Melaleuca conothamnoides* x *nematophylla, Calycopeplus paucifolius, Grevillea paradoxa, Micromyrtus racemosa* var. *prochytes* and *Acacia stereophylla* var. *stereophylla.*

G4 Closed Tall Scrub *Allocasuarina acutivalvis* subsp. *prinsepiana, Grevillea obliquistigma* subsp. *obliquistigma, Melaleuca conothamnoides* x *nematophylla, Philotheca seriacea, Acacia assimilis* subsp. *assimilis, Calycopeplus paucifolius, Hibbertia hypericoides* and *Aluta aspera.*

G5 Closed Tall Scrub *Allocasuarina acutivalvis* subsp. *prinsepiana, Calycopeplus paucifolius, Grevillea obliquistigma* subsp. *obliquistigma, Melaleuca conothamnoides* x *nematophylla* and *Philotheca seriacea.*

G6 Closed Tall Scrub *Allocasuarina acutivalvis* subsp. *prinsepiana, Calycopeplus paucifolius, Gastrolobium laytonii, Grevillea obliquistigma* subsp. *obliquistigma, Melaleuca conothamnoides* x *nematophylla* and *Xanthosia bungei.*

G7 Tall Open Scrub *Allocasuarina acutivalvis* subsp. *prinsepiana, Melaleuca conothamnoides* x *nematophylla, Calycopeplus paucifolius, Grevillea paradoxa, Hibbertia acerosa* and *Grevillea obliquistigma* subsp. *obliquistigma.*

G8 Tall Shrubland *Allocasuarina acutivalvis* subsp. *prinsepiana, Philotheca sericea* and *Acacia assimilis* subsp. *assimilis.*

G9 Tall Open Scrub *Allocasuarina acutivalvis* subsp. *prinsepiana,, Eucalyptus loxophleba* subsp. *supralaevis, Melaleuca leiocarpa, Acacia assimilis* subsp. *assimilis* and *Philotheca sericea.*

G10 Tall Open Scrub *Allocasuarina acutivalvis* subsp. *prinsepiana, Hibbertia hypericoides, Melaleuca conothamnoides* x *nematophylla, Acacia assimilis* subsp. *assimilis, Aluta aspersa* subsp. *hesperia* and *Grevillea paradoxa.*

G11 Closed Tall Scrub *Allocasuarina acutivalvis* subsp. *prinsepiana, Aluta aspera, Grevillea obliquistigma* subsp. *obliquistigma, Hibbertia hypericoides, Melaleuca conothamnoides* x *nematophylla, Acacia assimilis* subsp. *assimilis, Grevillea paradoxa* and *Xanthosia bungei.*

G12 Closed Tall Scrub *Acacia assimilis, Allocasuarina acutivalvis* subsp. *prinsepiana, Eremophila clarkei, Grevillea obliquistigma* subsp. *obliquistigma, Philotheca sericea, Aluta aspersa, Grevillea paradoxa* and *Melaleuca conothamnoides* x *nematophylla.*

G13 Closed Tall Scrub *Acacia aneura* var. *aneura, Allocasuarina acutivalvis* subsp. *prinsepiana, Aluta aspersa, Grevillea obliquistigma* subsp. *obliquistigma, Grevillea paradoxa* and *Melaleuca conothamnoides* x *nematophylla*.

G14 Tall Open Scrub *Aluta aspersa, Acacia aspersa, Grevillea obliquistigma* subsp. *obliquistigma* and *Allocasuarina acutivalvis* subsp. *prinsepiana.*

G16 Shrubland to Tall Open Scrub *Calycopeplus paucifolius, Melaleuca conothamnoides* x *nematophylla, Philotheca sericea, Allocasuarina acutivalvis* subsp. *prinsepiana, Darwinia masonii, Eremophila clarkei, Grevillea paradoxa, Hibbertia hypericoides, Grevillea obliquistigma* subsp. *obliquistigma, Velleia cycnopotamica* and *Melaleuca fulgens* subsp. *fulgens*.

G18 Open Heath to Tall Open Scrub *Acacia aneura, Grevillea obliquistigma* subsp. *obliquistigma, Allocasuarina acutivalvis* subsp. *prinsepiana* and *Sida excedentifolia* over Open Herbland of *Waitzia nitida.*

G19 Tall Open Scrub *Allocasuarina acutivalvis* subsp. *prinsepiana, Eremophila clarkei, Philotheca brucei* subsp. *brucei, Calycopeplus paucifolius, Melaleuca conothamnoides* x *nematophylla*, *Acacia tetragonophylla* and *Aluta aspersa*.

G20 Tall Shrubland of *Calycopeplus paucifolius, Dodonaea inaequifolia* over Herbland of *Ptilotus obovatus.*

ATA Environmental
environmental scientists

MT GIBSON IRON ORE
& INFRASTRUCTURE PROJECT
PUBLIC ENVIRONMENTAL REVIEW

FLORISTIC GROUP MAPPING (GROUP 40 GROUPS) ON BANDED IRON FORMATION AT MT GIBSON

FIGURE 14a

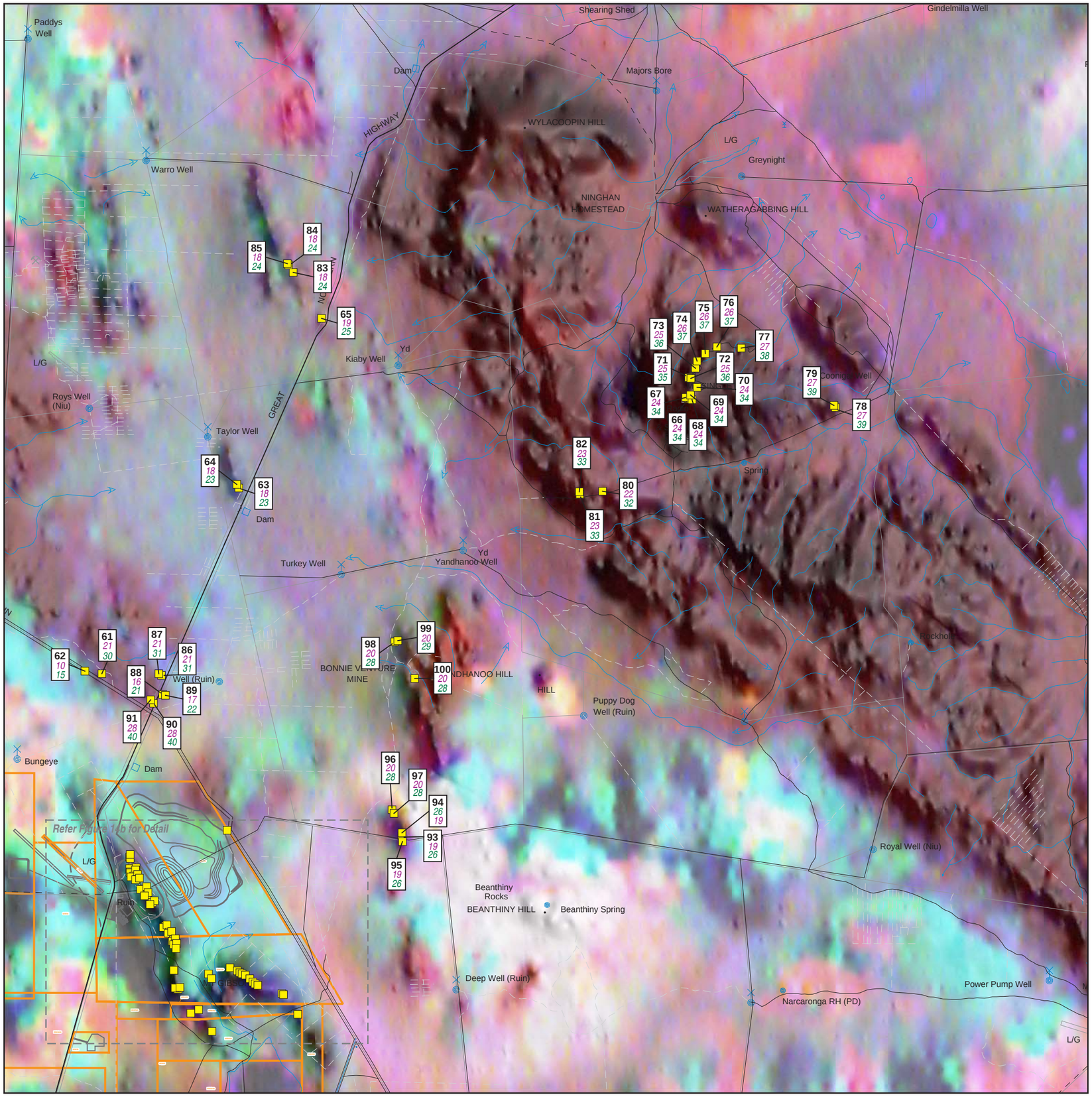
PRINTED: Thu 23 Mar 06

CHECKED BY: MS 23-03-06

DRAWN BY: EDS 23-03-06

DATUM: MGA

MGM-2005-004/MGMT/24_246f14b.dgn



SOURCE: Agriculture WA (2005) Digital Elevation Model overlain with ternary radiometrics & Griffin (2005).

kilometres

0 1 2 3 4 5

SCALE 1 : 100 000 at A3

LEGEND

- Tenement Boundary
- Proposed Mine Layout
- Quadrat Location
- Quadrat Number / Group 28 Number / Group 40 Number (e.g. 78 / 27 / 39)

NOTE:

Group 28: is based on identification of 28 groups of floristic communities

Group 40: is based on identification of 40 groups of floristic communities

(see Appendix 4)

ATA Environmental
environmental scientists

MT GIBSON IRON ORE & INFRASTRUCTURE PROJECT
PUBLIC ENVIRONMENTAL REVIEW

FLORISTIC COMMUNITY GROUPINGS ON REGIONAL BANDED IRONSTONE FORMATION (BIF)

FIGURE 14b

PRINTED: Thu 23 Mar 06

CHECKED BY: MS 23-03-06

DRAWN BY: EDS 23-03-06

DATUM: MGA

MGM-2005-004/MGMT/24_246f15a.dgn

Granite Outcrop

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

metres

0 250 500 750 1000

SCALE 1 : 30 000 at A3

LEGEND

- Cadastral Boundary
- Tenement Boundary
- Proposed Mine Layout
- Boundary of Vegetation Mapping ATA Environmental, 2005
- Boundary of Vegetation Mapping Bennett Environmental Consulting, 2000
- Vegetation Association Boundary
- 12 Vegetation Association

See Figure 15b for Vegetation Association Legend

ATA Environmental
environmental scientists

MT GIBSON IRON ORE
& INFRASTRUCTURE PROJECT
PUBLIC ENVIRONMENTAL REVIEW

VEGETATION AT MT GIBSON MINESITE

FIGURE 15a

PRINTED: Thu 23 Mar 06
MGM-2005-004/MGMT/24_246f15b.dgn DATUM: N/A DRAWN BY: EDS 23-03-06 CHECKED BY: MS 23-03-06

ATA ENVIRONMENTAL CONSULTING VEGETATION ASSOCIATIONS LEGEND

1 Closed Heath to Tall Open Shrubland dominated by *Acacia aneura* var. *aneura*, *Calycopeplus paucifolius, Melaleuca uncinata* and *Aluta aspera* with scattered *Melaleuca nematophylla* over an Open Heath dominated by *Acacia assimilis* subsp. *assimilis* over a Low Open Shrubland dominated by *Thryptomene cuspidata* on lateritic gravel
Condition: Very Good

2 Closed Heath to Tall Open Scrub dominated by *Acacia masliniana, Acacia aneura* var. *aneura,* and *Allocasuarina acutivalvis* subsp. *prinsepiana* with scattered *Eucalyptus leptopoda* subsp. *arctata* over a Shrubland dominated by *Melaleuca nematophylla, Grevillea paradoxa* and *Micromyrtus clavata* (ms).
Condition: Very Good

3 Low Open Woodland dominated by *Eucalyptus kochii* subsp. *plenissima*, *Eucalyptus leptopoda* subsp. *arctata* and *Eucalyptus ebbanoensis* subsp. *ebbanoensis* with occasional *Callitris glaucophylla* and *Allocasuarina acutivalvis* subsp. *prinsepiana* over a Tall Open Shrubland dominated by *Acacia anthochaera* and *Acacia tetragonophylla* over a Shrubland of *Acacia aneura* var. *aneura* and *Hibbertia ancistrophylla* (ms) on loamy clayey soils with scattered rocks.
Condition: Excellent to Good

4 Closed Tall Scrub to Shrubland dominated by *Acacia aneura* var. *aneura*, *Melaleuca nematophylla, Baeckea* sp. with occasional *Allocasuarina acutivalvis* subsp. *prinsepiana*, *Eucalyptus kochii* subsp. *horistes* (ms) and *Eucalyptus brachycorys* over a Low Open Shrubland dominated by *Micromyrtus clavata* (ms) over a Very Open Herbland dominated by *Hyalosperma glutinosum* subsp. *glutinosum*
Condition: Excellent to Good

5 Closed Tall Scrub to Tall Open Scrub dominated by *Acacia aneura* var. *aneura*, *Hakea minyma* and *Allocasuarina acutivalvis* subsp. *prinsepiana* with occasional *Santalum acuminatum* over an Open Shrubland dominated by *Philotheca brucei* subsp. *brucei, Philotheca tomentella, Thryptomene cuspidata* and *Micromytus clavata* (ms)
Condition: Excellent to Good

6 Closed Heath to Shrubland dominated by *Baeckea benthamii* (ms)*, Acacia ramulosa, Acacia assimilis* subsp. *assimilis* and *Melaleuca uncinata* over a Very Open Herbland dominated by *Borya sphaerocephala* and *Calandinia polyandra* associated with granite outcropping.
Condition: Very Good to Degraded

7 Woodland to Low Open Woodland of *Eucalyptus kochii* subsp. *plenissima*, *Eucalyptus oldfieldii* with scattered *Callitris glaucophylla* over a Tall Open Scrub dominated by *Acacia aneura* var. *aneura, Santalum acuminatum, Hakea minyma* and *Melaleuca leiocarpa* over an Open Shrubland dominated by *Alyxia buxifolia* and *Phebalium tuberculosum* over a Low Open Shrubland of *Olearia muelleri* and *Olearia dampieri* subsp. *eremicola*
Condition: Very Good to Good

8 Mixed Closed Heath to Tall Open Scrub dominated by *Acacia aneura* var. *aneura*, *Acacia stereophylla* var. *stereophylla*, *Acacia masliniana* and *Allocasuarina acutivalvis* subsp. *prinsepiana* with scattered *Eucalyptus leptopoda* subsp. *arctata* over a Low Open Shrubland dominated by *Micromyrtus clavata* (ms) and *Melaleuca fabri*
Condition: Excellent to Very Good

9 Open Woodland of *Eucalyptus loxophleba* subsp. *supralaevis* with occasional *Eucalyptus leptopoda* subsp. *arctata* and *Callitris glaucophylla* over a Shrubland dominated by *Acacia colletioides*, *Acacia tetragonophylla* and *Exocarpos aphyllus* over a Low Open Shrubland of *Olearia muelleri, Ptilotus obovatus* and *Atriplex bunburyana*
Condition: Very Good to Good

10 Low Open Woodland of *Eucalyptus leptopoda* subsp. *arctata* with occasional *Allocasuarina acutivalvis* subsp. *prinsepiana* over a Tall Open Scrub of *Melaleuca uncinata* and *Acacia aneura* var. *aneura* over a Tall Shrubland dominated by *Acacia masliniana* over a Low Shrubland dominated by *Micromyrtus clavata* (ms) and *Thryptomene cuspidata* over a Very Open Herbland of *Ecdeiocolea monostachya* and *Hyalosperma glutinosum* subsp. *glutinosum*
Condition: Excellent to Good

11 Tall Open Scrub *Acacia longispinea, Acacia ramulosa* subsp. *ramulosa, Acacia assimilis* subsp. *assimilis* and *Grevillea paradoxa* with scattered *Allocasuarina acutivalvis* subsp. *prinsepiana*, *Eucalyptus oldfieldii* and *Eucalyptus leptopoda* subsp. *arctata* over a Shrubland dominated by *Acacia stereophylla, Baeckea benthamii* (ms) and *Acacia aneura* var. *aneura* over a Low Open Shrubland of *Micromyrtus clavata* (ms) and *Cryptandra* sp.
Condition: Excellent to Very Good

12 Closed Tall Scrub of *Allocasuarina acutivalvis* subsp. *prinsepiana* with scattered *Eucalyptus leptopoda* subsp. *arctata* and *Grevillea paradoxa* over a Tall Open Scrub dominated by *Acacia aneura* var. *aneura*, *Acacia masliniana, Acacia ramulosa* and *Acacia anthochaera* over a Low Open Shrubland dominated by *Micromyrtus clavata* (ms) and *Acacia prainii* over a Very Open Herbland dominated by *Ecdeiocolea monostachya.*
Condition: Excellent to Good

13 Open Woodland to Low Woodland of *Eucalyptus brachycorys and Callitris glaucophylla* with scattered *Santalum acuminatum* and *Eucalyptus kochii* subsp. *horistes* (ms) over a Tall Open Scrub of *Acacia aneura* var. *aneura* and *Melaleuca nematophylla* over an Open Shrubland domianated by *Alyxia buxifolia* and *Scaevola spinescens* over a Low Open Shrubland of *Ptilotus obovatus*
Condition: Very Good to Good

14 Tall Open Scrub to Tall Open Shrubland dominated by *Melaleuca scalena* and *Baeckea benthamii* (ms) with occasional *Allocasuarina acutivalvis* subsp. *prinsepiana* over a Closed Low Heath dominated by *Acacia aneura* var. *aneura* over a Very Open Herbland dominated by *Ecdeiocolea monostachya*
Condition: Excellent to Good

15 Low Woodland of *Eucalyptus loxophleba* subsp. *supralaevis* and *Eucalyptus salicola* with scattered *Callitris glaucophylla* and *Hakea mynima* over a Tall Shrubland of *Acacia aneura* var. *aneura*, *Acacia anthochaera* and *Eremophila caperata* (ms) over an Open Shrubland dominated by *Gastrolobium laytonii*, *Eremophila oppositifolia* over a Low Open Shrubland of *Olearia muelleri* and *Olearia dampieri* subsp. *eremicola*
Condition: Very Good

16 Low Open Woodland of *Eucalyptus leptopoda* subsp. *arctata*, *Eucalyptus kochii* subsp. *plenissima* with occasional *Eucalyptus kochii* subsp. *horistes* (ms) and *Eucalyptus petraea* over a Closed Tall Scrub dominated *by Allocasuarina acutivalvis* subsp. *prinsepiana* over a Tall Shrubland dominated by *Melaleuca nematophylla, Acacia resinimarginea* and *Acacia acuminata* (npv) (ms) over an Open Shrubland dominated by *Acacia aneura* var. *aneura*.
Condition: Excellent to Good

17 Low Open Woodland of *Eucalyptus kochii* subsp. *plenissima*, *Eucalyptus kochii* subsp. *horistes* (ms) over a Tall Open Scrub dominated by *Allocasuarina acutivalvis* subsp. *prinsepiana*, *Acacia aneura* var. *aneura*, *Micromyrtus clavata* (ms) and *Acacia acuminata* (npv) (ms) over a Low Open Shrubland dominated by *Acacia andrewsii, Acacia ramulosa* var. *ramulosa*, *Acacia acuaria* and *Acacia anthochaera* on clayey loamy soils.
Condition: Excellent to Very Good

18 Tall Shrubland dominated by *Allocasuarina acutivalvis* subsp. *prinsepiana*, *Melaleuca leiocarpa* and *Calycopeplus paucifolius* with occasional *Eucalyptus petraea* and *Callitris glaucophylla* over a Tall Open Shrubland of *Acacia aneura* var. *aneura*, *Acacia acuminata* (npv) (ms) and *Acacia tetragonophylla* over an Open Shrubland dominated by *Hakea minyma* and *Philotheca tomentella* over a Very Open Herbland dominated by *Lepidosperma costale* and *Hyalosperma glutinosum* subsp. *glutinosum* on loamy clayey soils.
Condition: Excellent to Very Good

19 Closed to Open Heath dominated by *Acacia masliniana*, *Acacia stereophylla* var. *stereophylla, Micromyrtus clavata* (ms), *Melaleuca fabri* and *Grevillea juncifolia* (ms) over a Low Open Shrubland of *Melaleuca cordata* and *Thryptomene cuspidata* over a Very Open Herbland dominated by *Hyalosperma glutinosum* subsp. *glutinosum*.
Condition: Excellent to Very Good

20 Closed Tall Scrub dominated by *Allocasuarina acutivalvis* subsp. *prinsepiana*, *Melaleuca uncinata* and *Acacia acuminata* (npv) (ms) over an Open Shrubland dominated by *Dodonaea inaequifolia* over a Very Open Herbland dominated by *Lepidosperma costale*.
Condition: Excellent to Very Good

21 Tall Open Scrub of *Grevillea obliquistigma* subsp. *obliquistigma* and *Acacia masliniana* with scattered *Eucalyptus leptopoda* subsp. *arctata* over an Open Shrubland dominated by *Melaleuca brophyi* over a Very Open Sedgeland dominated by *Ecdeiocolea monostachya.*
Condition: Excellent to Very Good

22 Closed Shrubland dominated by *Acacia aneura* var. *aneura* with occasional *Melaleuca brophyi* and *Eucalyptus leptopoda* subsp. *arctata.*
Condition: Very Good

23 Open Heath dominated by *Melaleuca uncinata, Acacia prainii, Acacia aneura* var. *aneura* and *Acacia acuminata* (npv) (ms) over an Open Shrubland dominated by *Philotheca tomentella* and *Eremophila latrobei* subsp. *latrobei* (ms) over a Very Open Sedgelands dominated by *Ecdeiocolea monostachya* on yellow sandy loam.
Condition: Excellent to Very Good

24 Open Woodland of *Eucalyptus salicola* over Tall Open Scrub dominated by *Acacia aneura* var. *aneura*, *Acacia acuminata* (npv) (ms), *Acacia longispinea* and *Acacia ramulosa* var. *ramulosa* on yellow sandy loam.
Condition: Very Good

25 Closed Heath of *Acacia masliniana* over a Low Open Shrubland dominated by *Melaleuca cordata* and *Thryptomene cuspidate.*
Condition: Very Good

26 Tall Open Shrubland dominated by *Hakea subsulcata* over a an Open Low Heath dominated by *Micromyrtus clavata* (ms), *Hibbertia ancistrophylla* (ms) and *Philotheca brucei* subsp. *brucei.*
Condition: Very Good

27 Closed Heath dominated by *Melaleuca uncinata* with occasional *Eucalyptus petraea* and *Acacia assimilis* subsp. *assimilis* over a Low Open Shrubland dominated by *Acacia alata* and *Ptilotus obovatus* on hardpan.
Condition: Very Good

28 Open Woodland dominated by *Eucalyptus leptopoda* subsp. *arctata* over a Tall Shrubland dominated by *Callitris glaucophylla* and *Acacia acuminata* (npv) (ms) over a Tall Open Shrubland dominated by *Eremophila latrobei* subsp. *latrobei* (ms), *Eremophila clarkei, Acacia tetragonophylla, Dodonaea inaequifolia* and *Alyxia buxifolia* over a Very Open Sedgeland dominated by *Lepidosperma costale* on granite outcropping.
Condition: Very Good

29 Closed Tall Scrub dominated by *Acacia acuminata* (npv) (ms), *Melaleuca nematophylla, Grevillea scabrida* (P3) and *Baeckea benthamii* (ms) with occasional *Eucalyptus petraea* over a Very Open Herbland dominated by *Borya sphaerocephala.*
Condition: Excellent to Very Good

30 Mixed Tall Open Scrub dominated by *Acacia tetragonophylla* and *Acacia colletioides* with *Eremophila oldfieldii* subsp. *oldfieldii* and *Senna artemisioides* subsp. x *artemisioides* over a Very Open Herbland dominated by *Borya sphaerocephala* on granite outcropping
Condition: Very Good

31 Closed Tall Scrub of *Baeckea benthamii, Melaleuca filifolia* (P2) and *Acacia assimilis* subsp. *assimilis* over a Low Open Shrubland of *Thryptomene cuspidata*
Condition: Excellent to Very Good

32 Tall Open Scrub of *Acacia aneura* var. *aneura, Callitris glaucophylla, Grevillea obliquistigma* subsp. *obliquistigma* with scattered *Santalum acuminatum* over a Low Open Shrubland dominated by *Acacia colletioides* and *Acacia assimilis* subsp. *assimilis*
Condition: Very Good

33 Closed Heath dominated by *Acacia stereophylla* var. *stereophylla* over an Open Shrubland dominated by *Baeckea benthamii* (ms) and *Acacia aneura* var. *aneura* over a Low Open Shrubland dominated by *Philotheca brucei* subsp. *brucei* and *Enekbatus stowardii*
Condition: Excellent to Very Good

34 Tall Shrubland dominated by *Melaleuca nematophylla, Grevillea integrifolia* and *Acacia aneura* var. *aneura* with occasional *Eucalyptus loxophleba* subsp. *supralaevis* over a Low Shrubland dominated by *Ptilotus obovatus*
Condition: Good

35 Tall Shrubland dominated by *Acacia quadrimarginea, Acacia ramulosa* var. *ramulosa* and *Calycopeplus paucifolius* over an Open Herbland dominated by *Borya sphaerocephala* on clayey loams.
Condition: Very Good

Granite Outcrop

BENNETT ENVIRONMENTAL CONSULTING VEGETATION ASSOCIATIONS LEGEND

WOODLANDS

W1 Woodland of *Eucalyptus salmonophloia* (Salmon gum) over Thicket of *Acacia* species over Dense Low Heath dominated by *Atriplex bunburyana* on loam

W2 Dense to Open Woodland of *Eucalyptus loxophleba* subsp. *supralaevis* with occasional *Callitris glaucophylla* over a Thicket of *Acacia* species dominated by *A.assimilis* over Herbs dominated at the time of survey by *Velleia rosea* on silty sand.

W3 Woodland of *Eucalyptus loxophleba* subsp. *supralaevis* and *Callitris glaucophylla* over a Thicket of *Melaleuca stereophloia*, *Acacia nigripilosa* subsp. *nigripilosa, A. obtecta* over Low Shrubland of *Olearia dampiera* subsp. *erimcola* and *Bossiaea walkeri* and Herbs on silty sand.

W4 Very Open Woodland of *Callitris glaucophylla* and *Eucalyptus loxophleba* subsp. *supralaevis* over an Open Thicket of *Acacia acuminata* over a Herbland in sandy loam.

W5 Open Woodland of *Eucalyptus loxophleba* subsp. *supralaevis* with occasional *Callitris glaucophylla* over an Open Thicket of *Acacia acuminata* over a Low Shrubland of mixed species in silty clay.

W6 Very Open Woodland of *Eucalyptus salicola* over Open Low Shrubland of mixed shrubs over Herbs and Dense Low Grass.

MALLEE COMMUNITIES

M1 Open Tree Mallee of *Eucalyptus brachycorys*, *E. hypochlamydea* subsp. *hypochlamydea*, *E. loxophleba* subsp. *supralaevis* and *Callitris glaucophylla* over Thicket of *Acacia* species over Low Shrubland and Herbs on loam.

M2 Very Open Tree Mallee of *Eucalyptus brachycorys* and *E. oldfieldii* over a Thicket of *Acacia anthochaera* and *A. ramulosa* over a Herbland in loamy clay.

M3 Open Shrub Mallee of *Eucalyptus brachycorys* and *E. synandra* over Thicket of *Acacia anthochaera* and *A. ramulosa* over Low Shrubland of *Baeckea* affin. *cryptandroides* and *Ptilotus obovatus* over Herbs of *Amphipogon caricinus* subsp. *caricinus*, *Chamaexeros macrantha*, *Gilbertia tenuifolia*, *Waitzia acuminata* and *Velleia rosea*.

M4 Very Open Shrub Mallee of *Eucalyptus leptopoda* with emergent *Eucalyptus loxophleba* subsp. *supralaevis* over Thicket of *Acacia ramulosa* over Herbland of Asteraceae species in loam.

THICKET COMMUNITIES

T1 Dense Thicket of mixed species dominated by *Acacia* species, *Allocasuarina acutivalvis* subsp. *prinsepiana*, *Calcopeplus paucifolius*, and *Melaleuca nematophylla* over Low Shrubland in jaspilite rocks with pockets of loam.

T2 Dense Thicket dominated by *Acacia assimilis*, *A. stereophylla* var. *stereophylla*, *A. ramulosa* and *Allocasuarina acutivalvis* var. *prinsepiana* over Low Shrubland of *Acacia acuaria*, *Hemigenia* sp. Paynes Find and *Baeckea* affin. *cryptandroides* in loam with scattered rocks on the surface.

T3 Dense Thicket of *Acacia assimilis*, *Allocasuarina acutivalvis* subsp. *prinsepiana* and *Melaleuca nematophylla* over Low Shrubland of *Hemigenia* sp. Paynes Find and *Hibbertia crassifolia* in loam pockets in jaspilite rocks.

T4 Dense Thicket of *Allocasuarina acutivalvis* subsp. *prinsepiana* with occasional *Eucalyptus oldfieldii* over an Open Scrub of *Acacia* species over Open Shrubland of *Hemigenia* sp. Paynes Find or Open Herbs of *Xanthosia bungei*.

T5 Thicket of *Allocasuarina acutivalvis* subsp. *prinsepiana* and *Grevillea obliquistigma* with emergent *Callitris glaucophylla* over Low Shrubland dominated by *Darwinia masonii*, *Hibbertia crassifolia*, *Melaleuca radula* and *Philotheca brucei* subsp. *brucei* over Open Herbs of *Xanthosia bungei* in loam pockets in dense jaspilite rocks.

T6 Thicket of *Acacia aneura* and *Acacia stowardii* over Low Shrubland of mixed species with large numbers of *Darwinia masonii* in loam with abundant rocks on the surface.

T7 Open Thicket of *Acacia ramulosa* with emergent *Callitris glaucophylla* and *Eucalyptus loxophleba* subsp. *supralaevis* over Low Shrubland and Herbs in loamy sand surrounding the lake edge.

T8 Dense thicket of *Melaleuca* sp. Wongan Hills and *Acacia ramulosa* over low shrubland of mixed species in loamy clay soil.

T9 Dense Thicket of *Acacia* species, *Hakea* species, *Eucalyptus brachycorys* and *E. oldfieldii* with emergent *Callitris glaucophylla*, over Open Low Shrubland of mixed species on sand.

T10 Thicket of *Acacia acuminata*, *A. ramulosa*, *Allocasuarina acutivalvis* subsp. *prinsepiana*, *Eucalyptus hypoclamydea* subsp. *hypoclamydea* over an Open Shrubland of mixed species on sandy loam.

T11 Thicket of *Acacia* species and *Allocasuarina acutivalvis* subsp. *prinsepiana* with emergent Very Open Mallee of *Eucalyptus brachycorys* and *E. leptopoda* in loam.

T12 Thicket of *Acacia ramulosa* with emergent *Eucalyptus oldfieldii* and *E. loxophleba* subsp. *supralaevis* over a Low Shrubland over Herbs in loam with pebbles common on the surface.

HEATH COMMUNITIES

HS1 Low Heath of *Ptilotus obovatus* with emergent shrubs of *Acacia stowardii* and *Calcopeplus paucifolius* over Herbs in loamy clay amongst large boulders.

HS2 Dense Low Heath of *Halosarcia* species with other chenopods over Herbs in sandy clay soil in a salt lake.

ATA Environmental
environmental scientists

MT GIBSON IRON ORE & INFRASTRUCTURE PROJECT
PUBLIC ENVIRONMENTAL REVIEW

VEGETATION LEGEND
FIGURE 15b

PRINTED: Thu 23 Mar 06

CHECKED BY: MS 23-03-06

DRAWN BY: EDS 23-03-06

DATUM: MGA

MGM-2005-004/MGMT/24_246f16a.dgn

Legend

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

Flora Legend

- Areas of DRF - *Darwinia masonii*
- Areas of DRF - *Eucalyptus synandra*
- *Chamelaucium* sp. *Yalgoo* (P1)
- *Podotheca uniseta* (P3)
- *Acacia acanthoclada* subsp. *glaucescens* (P3)
- *Acacia cerastes* (P1)
- *Personia pentasticha* (P2)

E59/1179
M59/339
G59/30
G59/32
G59/34
G59/33
G59/35
G59/31
L59/63
L59/67
L59/68
L59/69
M59/609
M59/550

L 3114/ 602 NINGHL 04280
L 398/ 616 NINGHL 04282
L 398/ 616 NINGHL 03572
L 398/ 616 NINGHL 03543
L 398/ 616 NINGHL 03544
Reserve 36657 NINGHL 04219
LGE 1288242 NINGHL 04397 Reserve 17367

6 730 000mN
6 728 000mN
6 726 000mN
512 000mE
514 000mE
516 000mE
518 000mE

Hematite Stockpile
Hematite Conveyor
Existing Airstrip
ROM Pad
Co-located Waste Dump/ Dry Tailings Storage Facility
Extension Hill Pit
Extension Hill North
Extension Hill
Extension Hill South
Proposed Airstrip
Concentrator Plant Site and Ancillary Services
Camp Services Corridor
Camp Area
Iron Hill North
Iron Hill East
Iron Hill
Iron Hill South
Mt Gibson
Mt Gibson South
Northern Highway
Great

Mature = 545
Seedling = 12

Mature = 1924
Seedling = 12

Mature = 1874
Seedling = 26

Mature = 586
Seedling = 33

Mature = 7021
Seedling = 61

Mature = 370
Seedling = 597

Mature = 70
Seedling = 11

Mature = 1601
Seedling = 970

Mature = 324
Seedling = 1

VCL

metres
0 250 500 750 1000
SCALE 1 : 30 000 at A3

SOURCE: Mount Gibson Iron Pty Ltd, 2005.

ATA Environmental
environmental scientists

MT GIBSON IRON ORE
& INFRASTRUCTURE PROJECT
PUBLIC ENVIRONMENTAL REVIEW

LOCATION OF SIGNIFICANT FLORA

FIGURE 16a

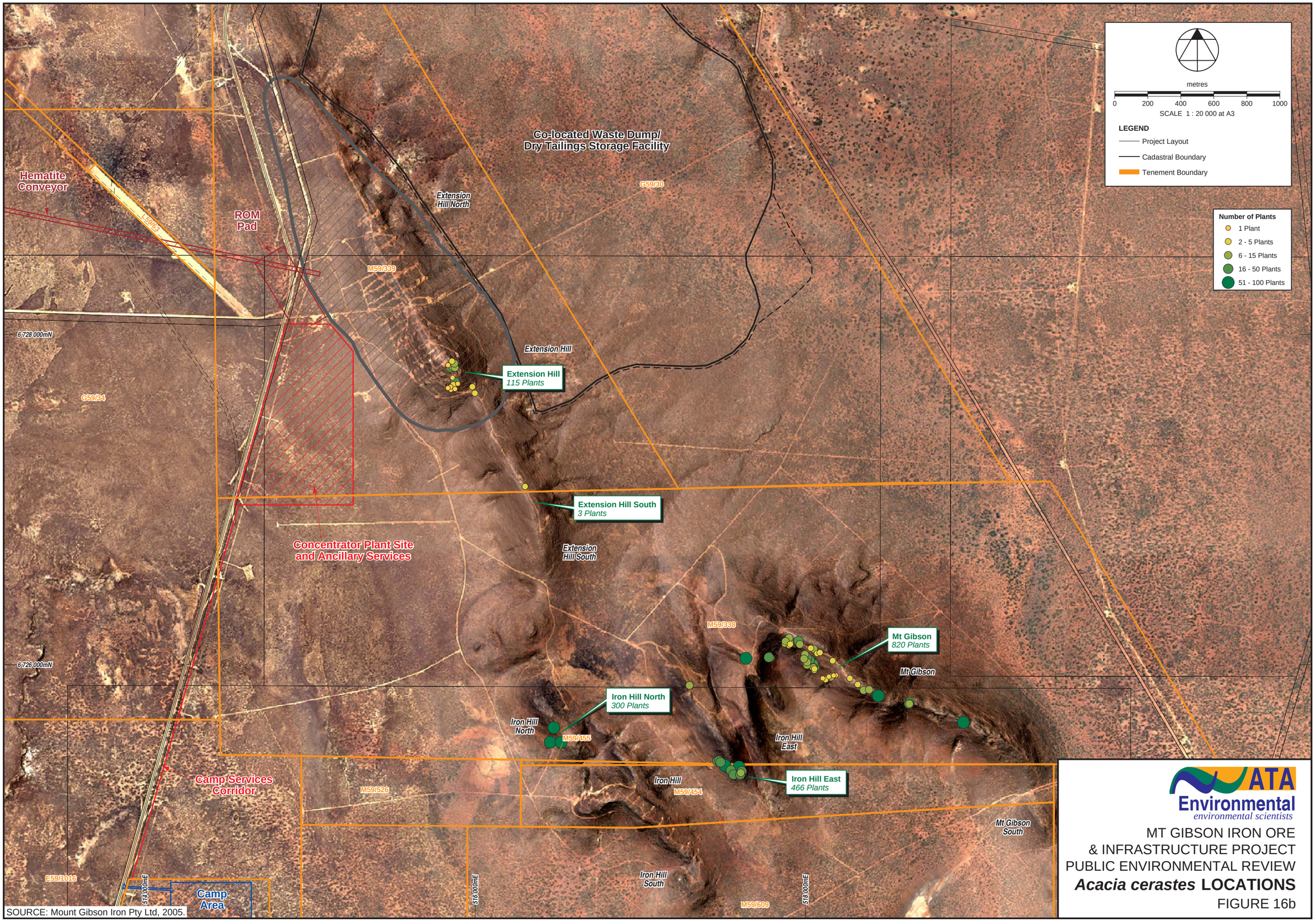
PRINTED: Fri 24 Mar 06

CHECKED BY: MS 24-03-06

DRAWN BY: EDS 24-03-06

DATUM: MGA

MGM-2005-004/MGMT/24_246f16b.dgn



SOURCE: Mount Gibson Iron Pty Ltd, 2005.

ATA Environmental
environmental scientists

MT GIBSON IRON ORE
& INFRASTRUCTURE PROJECT
PUBLIC ENVIRONMENTAL REVIEW

***Acacia cerastes* LOCATIONS**

FIGURE 16b

PRINTED: Mon 27 Mar 06

CHECKED BY: MS 24-03-06

DRAWN BY: EDS 24-03-06

DATUM: MGA

MGM-2005-004/MGMT/24_246f16c.dgn

Co-located Waste Dump/
Dry Tailings Storage Facility

Extension Hill North
777 Plants

Extension Hill
7424 Plants

Extension Hill South
4307 Plants

Mt Gibson
935 Plants

Mt Gibson South
435 Plants

Iron Hill North
265 Plants

Iron Hill East
675 Plants

Iron Hill South
118 Plants

Hematite Conveyor

ROM Pad

Concentrator Plant Site and Ancillary Services

Camp Services Corridor

Camp Area

Extension Hill North

Extension Hill

Extension Hill South

Mt Gibson

Mt Gibson South

Iron Hill North

Iron Hill East

Iron Hill

Iron Hill South

L59/63

G59/30

M59/339

G59/34

M59/338

M59/455

M59/526

M59/454

M59/609

E59/1016

6 728 000mN

6 726 000mN

514 000mE

516 000mE

518 000mE

metres

0 200 400 600 800 1000

SCALE 1 : 20 000 at A3

LEGEND

Project Layout

Cadastral Boundary

Tenement Boundary

Number of Plants

1 Plant

2 - 5 Plants

6 - 15 Plants

16 - 50 Plants

51 - 500 Plants

SOURCE: Mount Gibson Iron Pty Ltd, 2005.

ATA Environmental
environmental scientists

MT GIBSON IRON ORE
& INFRASTRUCTURE PROJECT
PUBLIC ENVIRONMENTAL REVIEW

***Lepidosperma* LOCATIONS**

FIGURE 16c

PRINTED: Thu 23 Mar 06

MGM-2005-004/MGMT/24_246f17.dgn DATUM: MGA DRAWN BY: EDS 23-03-06 CHECKED BY: MS 23-03-06

Legend

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

Fauna Legend

- Inactive Malleefowl Mound
- Active Malleefowl Mound
- Live Malleefowl Location
- Fresh Killed Malleefowl Location
- 100m Inactive Malleefowl Mound Buffer
- 250m Active Malleefowl Mound Buffer

E59/1179
M59/339
G59/30
G59/32
G59/34
G59/33
G59/35
G59/31
L59/63
L59/67
L59/68
L59/69
M59/550
M59/609
L 3114/ 602 NINGHL 04280
L 398/ 616 NINGHL 04282
L 398/ 616 NINGHL 03572
L 398/ 616 NINGHL 03543
L 398/ 616 NINGHL 03544
Reserve 36657 NINGHL 04219
LGE 1288242 NINGHL 04397 Reserve 17367
Hematite Stockpile
Hematite Conveyor
Existing Airstrip
ROM Pad
Co-located Waste Dump/ Dry Tailings Storage Facility
Extension Hill North
Extension Hill Pit
Extension Hill
Extension Hill South
Proposed Airstrip
Concentrator Plant Site and Ancillary Services
Camp Services Corridor
Camp Area
Iron Hill North
Iron Hill East
Iron Hill
Iron Hill South
Mt Gibson
Mt Gibson
VCL
VCL
VCL
Great Northern Highway
6 730 000mN
6 728 000mN
6 726 000mN
512 000mE
514 000mE
516 000mE
518 000mE

metres
0 250 500 750 1000
SCALE 1 : 30 000 at A3

SOURCE: Mount Gibson Iron Pty Ltd, 2005.

ATA Environmental
environmental scientists

MT GIBSON IRON ORE
& INFRASTRUCTURE PROJECT
PUBLIC ENVIRONMENTAL REVIEW

LOCATION OF MALLEEFOWL MOUNDS AT THE MT GIBSON MINESITE

FIGURE 17

PRINTED: Thu 23 Mar 06

MGM-2005-004/MGMT/24_246f18.dgn DATUM: MGA DRAWN BY: EDS 23-03-06 CHECKED BY: MS 23-03-06

Mount Magnet
Yalgoo
Northampton
Mullewa
Geraldton
Narngulu
Bookara
Geraldton Sandplains
Mingenew
Morawa
Dongara
Perenjori
Eneabba
Brand Hwy
Great Northern Hwy
Wubin
Jurien
Moora
Swan Coastal Plain
Jarrah Forest
Avon Wheatbelt
Mukinbudin
Wyalkatchem
Coolgardie
Murchison
Yalgoo
Extension Hill Magnetite Project
Indian Ocean

kilometres
0 10 20 30 40 50
SCALE 1 : 1 500 000 at A3

Legend

- Location of Malleefowl Observation (ATA Environmental)
- Location of Malleefowl Observation (Malleefowl Conservation Group)
- Location of Malleefowl Observation (Prof. Harry Recher)
- Location of Malleefowl Observation (Birds Australia)
- Location of Malleefowl Observation (Australian Wildlife Conservancy)
- Location of Malleefowl Observation (WA Museum)

- Specimen Collected Post 1995
- Specimen with No Date
- Observation Made Pre 1995
- Observation with No Date

Bioregions Legend

- Murchison
- Geraldton Sandplains
- Yalgoo
- Avon Wheatbelt
- Swan Coastal Plain
- Jarrah Forest
- Coolgardie

WA Location

BIOREGIONS SOURCE: Department of Environment & Heritage, IBRA, 2005.

ATA Environmental
environmental scientists

MT GIBSON IRON ORE
& INFRASTRUCTURE PROJECT
PUBLIC ENVIRONMENTAL REVIEW

OBSERVATIONS OF MALLEE FOWL AND/OR MALLEE FOWL MOUNDS IN THE REGION

FIGURE 18

View from Great Northern Highway Looking South

View from Great Northern Highway Looking North

ATA Environmental
environmental scientists

MT GIBSON IRON ORE
& INFRASTRUCTURE PROJECT
PUBLIC ENVIRONMENTAL REVIEW

VISUAL IMPACT ASSESSMENT
GREAT NORTHERN HIGHWAY

FIGURE 19

PRINTED: Fri 24 Mar 06
CHECKED BY: MS 23-03-06
DRAWN BY: EDS 23-03-06
DATUM: N/A
MGM-2005-004/MGMT/24_246f19.dgn

PRINTED: Thu 23 Mar 06
CHECKED BY: MS 23-03-06
DRAWN BY: EDS 23-03-06
DATUM: N/A
MGM-2005-004/MGMT/24_246f20.dgn

ATA Environmental
environmental scientists

MT GIBSON IRON ORE & INFRASTRUCTURE PROJECT - PUBLIC ENVIRONMENTAL REVIEW

VISUAL IMPACT ASSESSMENT - MT SINGLETON

FIGURE 20

PRINTED: Thu 23 Mar 06
CHECKED BY: MS 23-03-06
DRAWN BY: EDS 23-03-06
DATUM: N/A
MGM-2005-004/MGMT/24_246f21.dgn

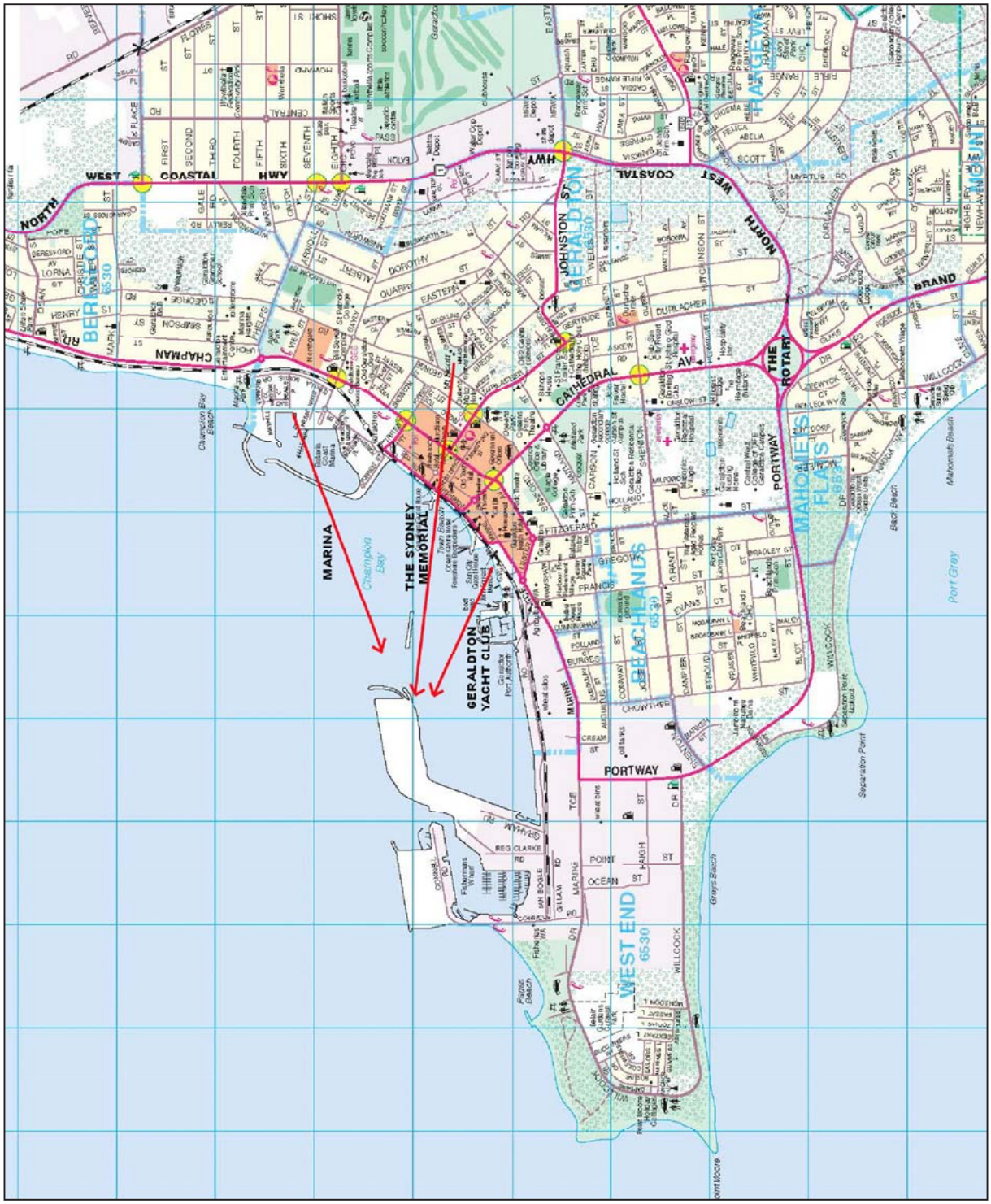
ATA Environmental
environmental scientists

MT GIBSON IRON ORE & INFRASTRUCTURE PROJECT - PUBLIC ENVIRONMENTAL REVIEW

VISUAL IMPACT ASSESSMENT - WHITE WELLS HOMESTEAD

FIGURE 21

PRINTED: Thu 23 Mar 06
MGM-2005-004/MGMT/24_246f22a.dgn DATUM: N/A DRAWN BY: EDS 23-03-06 CHECKED BY: MS 23-03-06



ATA Environmental
environmental scientists

MT GIBSON IRON ORE & INFRASTRUCTURE PROJECT - PUBLIC ENVIRONMENTAL REVIEW

LOCATION OF VIEWSCAPES

FIGURE 22a

ATA Environmental
environmental scientists

MT GIBSON IRON ORE & INFRASTRUCTURE PROJECT - PUBLIC ENVIRONMENTAL REVIEW

VIEW FROM GERALDTON YACHT CLUB

FIGURE 22b

ATA Environmental
environmental scientists

MT GIBSON IRON ORE & INFRASTRUCTURE PROJECT - PUBLIC ENVIRONMENTAL REVIEW

VIEW FROM MARINA

FIGURE 22c

No Development

Shed

Shed and Ship

ATA Environmental
environmental scientists

MT GIBSON IRON ORE & INFRASTRUCTURE PROJECT - PUBLIC ENVIRONMENTAL REVIEW

VIEW FROM SYDNEY MEMORIAL

FIGURE 22d

No Development

Shed

Shed and Ship