International Minerals
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Balmoral South Iron Ore Project
Environmental Scoping Document

International Minerals Pty Ltd

September 2008

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Prepared by

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1.0 PURPOSE OF DOCUMENT

International Minerals Pty. Ltd. (IM) proposes to develop a magnetite iron ore mine, processing facility and associated infrastructure in the Cape Preston region of Western Australia, 80km south of Karratha.

On 14 May 2007, the Environmental Protection Authority (EPA) released its recommendation to set the level of assessment for the Balmoral South Iron Ore Project at Public Environmental Review (PER).

This Environmental Scoping Document (ESD) has been prepared pursuant to section 6.1 of the *Environmental Assessment (Part IV Division 1) Administrative Procedures 2002*, which outline the requirements and approval procedures for an Environmental Scoping Document where the level of assessment has been set at PER. This document identifies potential environmental impacts on relevant environmental factors, summarises previous works undertaken relevant to the proposal and outlines relevant studies and activities to be undertaken by the proponent to complete the PER.

The Department of Environment, Water, Heritage and the Arts (DEWHA) has determined that the Balmoral South Iron Ore Project is a "controlled action" under the *Environment Protection and Biodiversity Act 1999* (EPBC Act). Balmoral South Iron Ore Project (EPBC ref 2008/4236) can be assessed under the "Agreement between the Commonwealth of Australia and WA under Section 45 of the EPBC Act relating to the Environmental Impact Assessment and in conformance with the Cooperative Arrangement to the Bilateral". This ESD has been prepared to also meet the requirements of the DEWHA.

This proposal will require environmental approval from both the State and Commonwealth environment ministers.

2.0 PROPONENT AND STUDY TEAM

IM, a wholly owned subsidiary of Australasian Resources Limited 'ARH' (ASX Code: ARH), is the Proponent for the development of the Balmoral South Iron Ore Project.

The Proponent has entered into a series of agreements with Mineralogy Pty Ltd, which provide for the rights and tenure to all of the Mineralogy tenements necessary to carry out the Balmoral South Iron Ore Project. These agreements have been approved by the Minister for Resources Development and are set out in the First Schedule of the *Iron Ore Processing (Mineralogy Pty Ltd) Agreement Act 2002* which was passed by the Parliament of Western Australia in 2002.

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IM has been supported by the following groups and individuals:

- URS Australia – preparation of the Environmental Scoping Study and Public Environmental Review, intertidal marine ecological assessment and hydrodynamic modelling;
- Maunsell Australia and Bassett Acoustics – completion of terrestrial ecological surveys, noise impact assessment, air quality assessment, interpretation of baseline studies, assessment of outcomes in a local and regional context, development of management procedures and peer review;
- SMEC Australia – assistance with the Environmental Scoping Document and peer review;
- Aquaterra – completion of groundwater and surface water investigations, impact assessment and development of management strategies;
- Benellongia – field investigations and reporting for subterranean fauna; and
- Professor Brenton Knott – advice on subterranean fauna.

3.0 THE PROPOSAL

3.1 Proposal Overview

The Balmoral South Iron Ore Project is adjacent to the Mineralogy Central Block Project (Central Block Project) which has received environmental approval for the development of a mine, processing plant, stockyards, villages, port, dredging and associated infrastructure (Ministerial Statement 635). The Central Block Project is currently being developed by CITIC Pacific Mining Management Pty. Ltd. (CPMM) under commercial agreements with Mineralogy.

Mineralogy is proposing to develop two further projects in the Cape Preston region. Mineralogy's current development plan for the Cape Preston region is further detailed in the information provided in Section 9.2, which highlights the context of these developments and relevance to the Balmoral South Iron Ore Project.

This proposal for the IM Balmoral South Iron Ore Project is seeking approval for the areas shown in "*Figure 1 Balmoral South Iron Ore Project Areas of Disturbance Sheet 1 of 2*" and *"Figure 2 Balmoral South Iron Ore Project Areas of Disturbance Sheet 2 of 2".*

The Central Block Project and its immediate surrounds were extensively assessed to support that project's approvals. IM has built on this previous work through the completion of a number of specialist studies to fill in the gaps in knowledge to complete an assessment of the cumulative impacts of the Balmoral South Iron Ore and the Central Block Projects, refer to "*Figure 3 Balmoral South Iron Ore Project and Mineralogy Central Block Project Approved Areas of Disturbance Sheet 1 of 2*" and *"Figure 4 Balmoral South Iron Ore Project and Mineralogy Central Block Project Approved Areas of Disturbance Sheet 2 of 2".*

A suite of Environmental Management Plans (EMPs) have been prepared to satisfy the Ministerial Conditions for the Central Block Project. IM recognises the important role that many Government Departments have played in working with the Central Block proponent to develop these EMPs. The EMPs set out the statutory requirements and industry best practice management strategies for an iron ore mining and processing project in the Cape Preston region. IM proposes to adopt and, where necessary, update the management strategies for the Central Block Project to ensure consistency in environmental management for the region.

The Balmoral South Iron Ore Project is seeking approval for the establishment of:

- Open pit mine;
- Waste Dump Facitilies(WDF1 and WDF2);
- Run of Mine (ROM) pad;
- Processing Plant, including power station and pelletising plant;
- Accommodation Village (Camp);
- Service corridors and roads;
- Conveyors, pipelines, power and gas distribution;
- Desalination plant, including intake and outfall;
- Buildings, workshops and associated infrastructure; and
- Other infrastructure as required to support the project.

3.1.1 Related Environmental Approvals

IM has access to additional infrastructure that is the subject of a separate approval application including port facilities. The final location of the desalination plant intake and outfall of the Balmoral South Iron Ore Project will be determined subject to the approvals granted to the port facilities of the Central Block Project. From the IM stockyard facilities, product will be conveyed to the port which will be established by the Central Block Project. From here product handling and loading will be managed in conjunction with the Central Block Project.

Figure 1 Balmoral South Iron Ore Project Areas of Disturbance Sheet 1 of 2

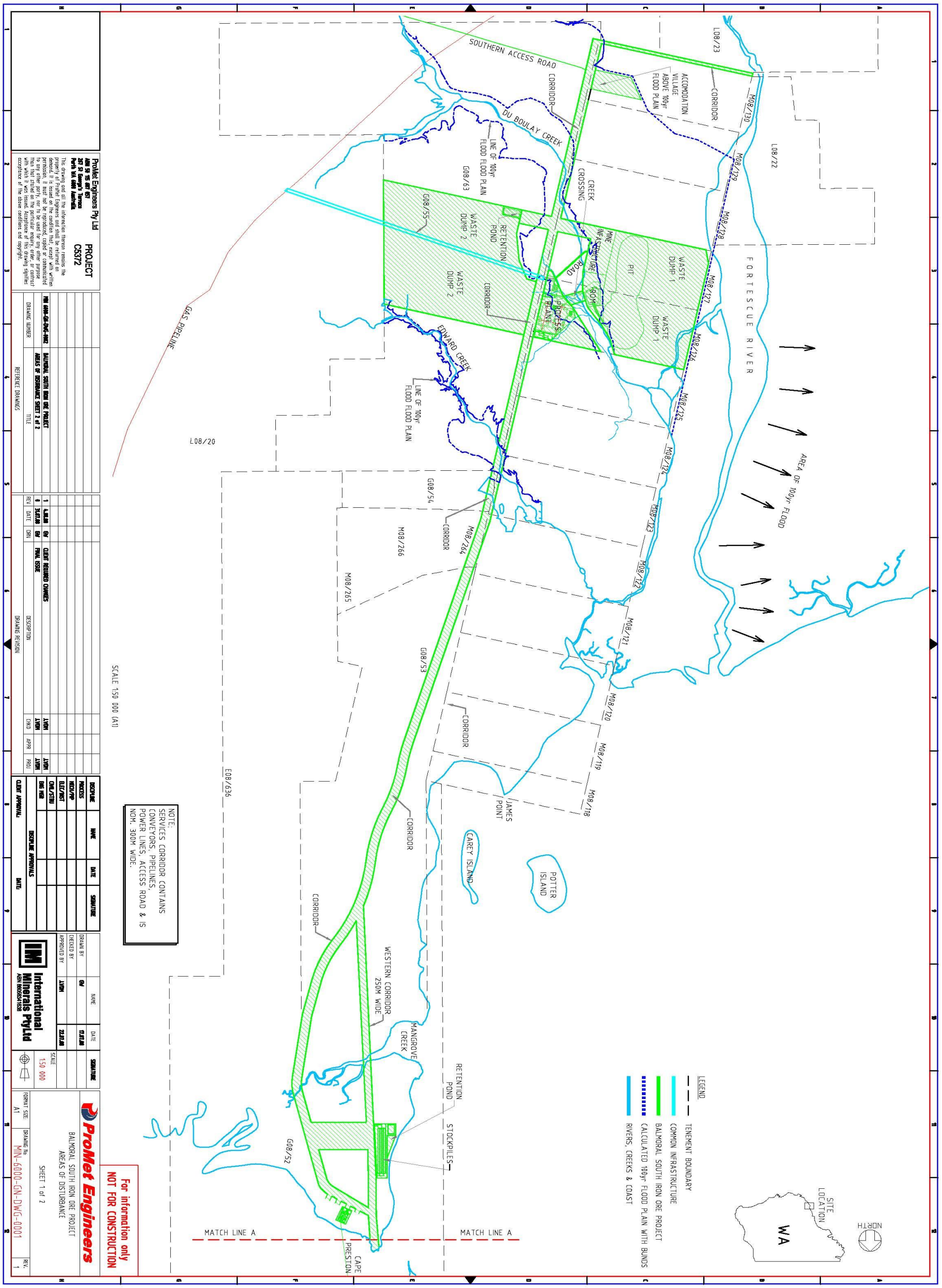


Figure 2 Balmoral South Iron Ore Project Areas of Disturbance Sheet 2 of 2

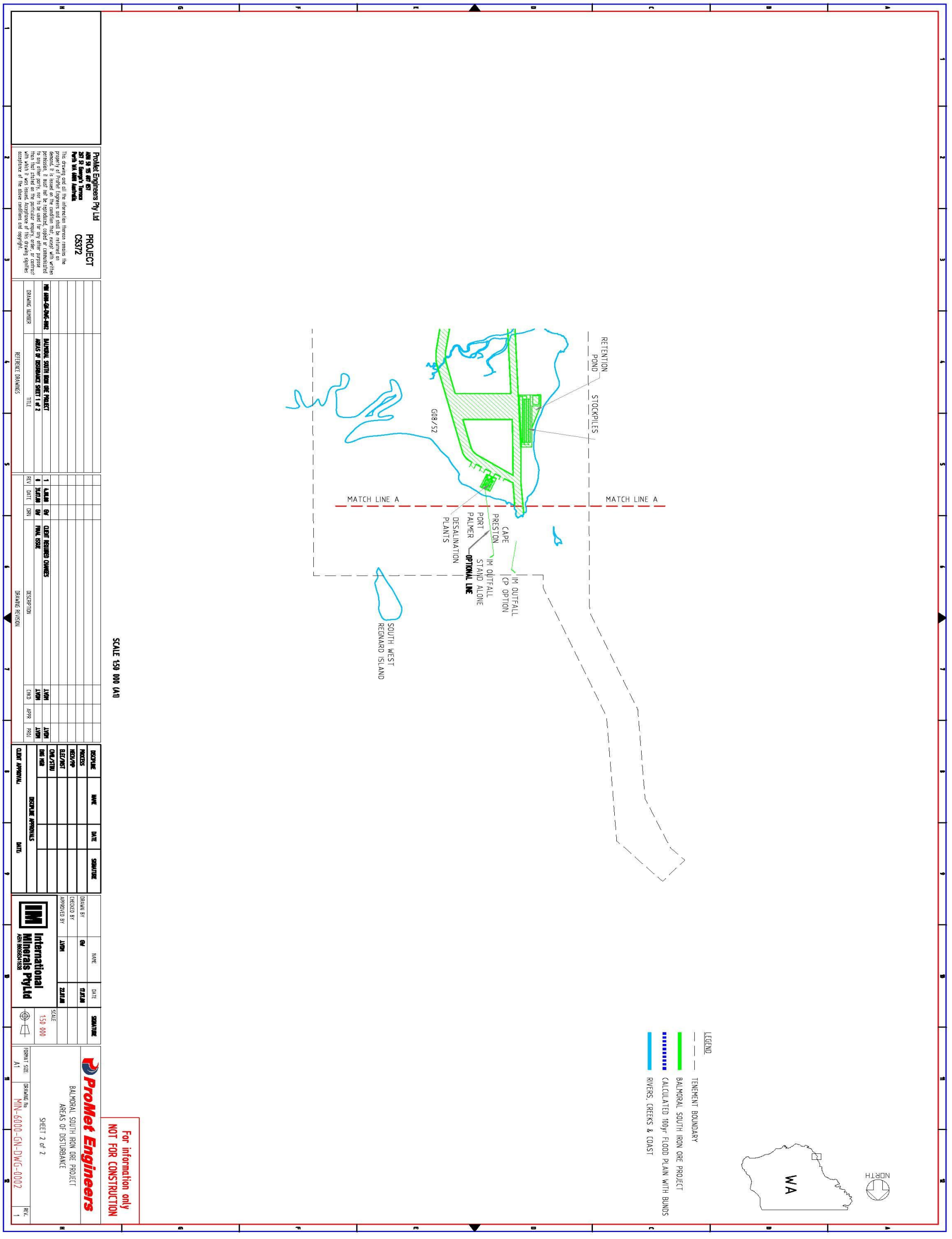


Figure 3 Balmoral South Iron Ore Project and Mineralogy Central Block Project Approved Areas of Disturbance Sheet 1 of 2

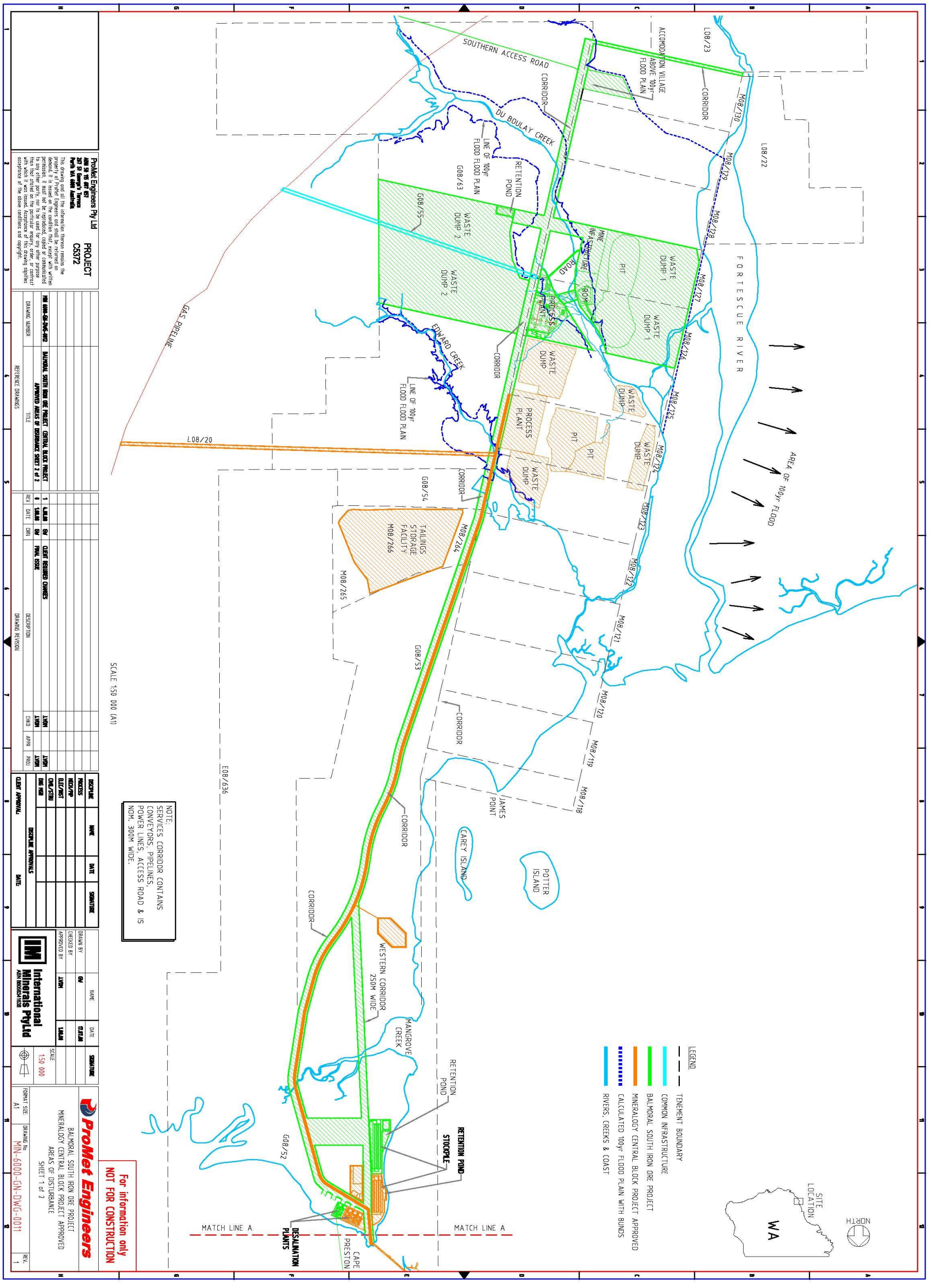
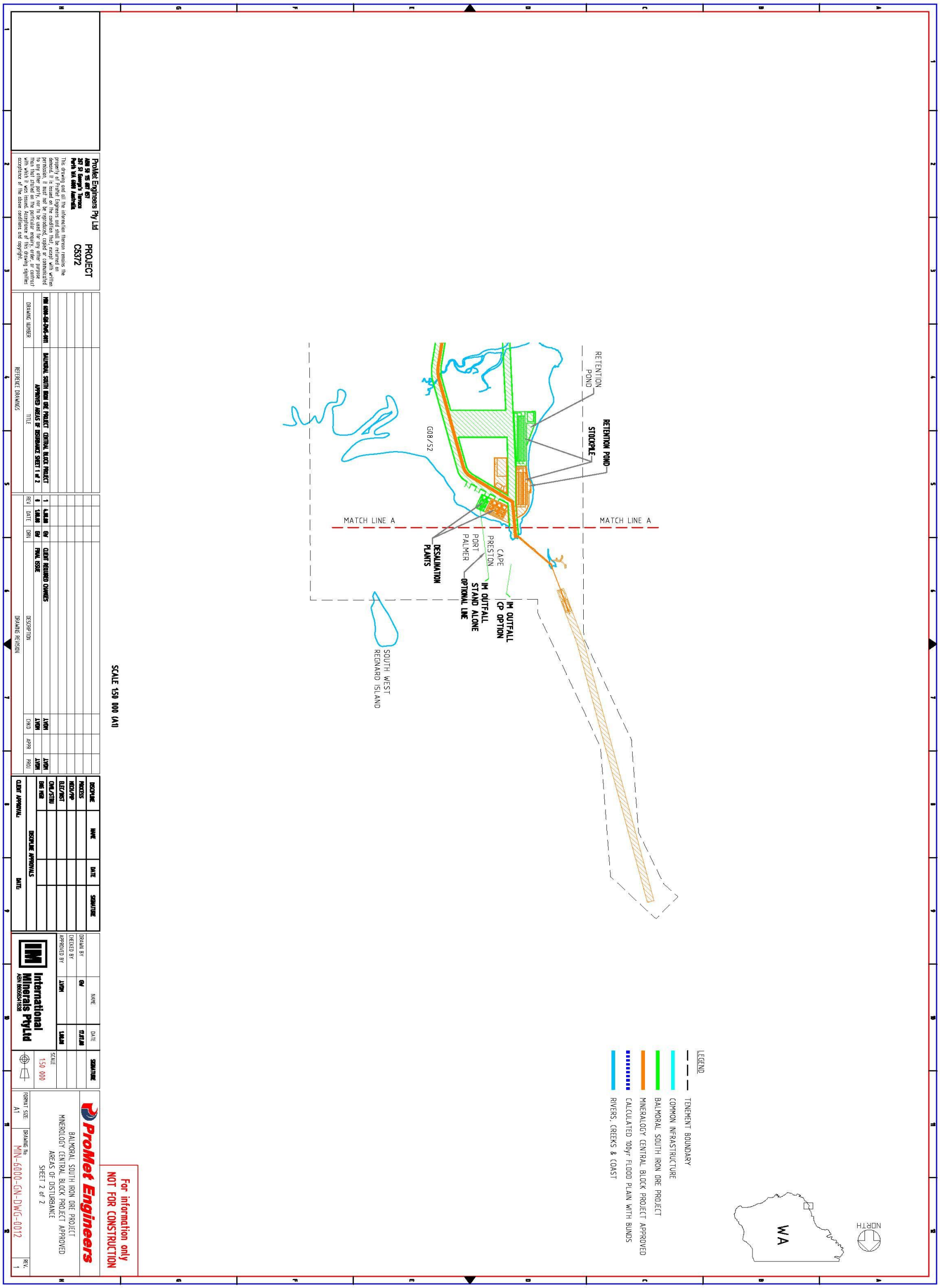


Figure 4 Balmoral South Iron Ore Project and Mineralogy Central Block Project Approved Areas of Disturbance Sheet 2 of 2



3.1.2 Construction Activities

The construction period for the Balmoral South Iron Ore Project is expected to be approximately six years. The following summarises the main construction activities:

- clearing of the mine and infrastructure sites;
- extraction of a bulk sample from the mine pit;
- pre-strip of the open pit to expose ore in advance of processing plant operation;
- construction of mining infrastructure;
- construction of monitoring equipment and commencement of monitoring activities;
- construction of temporary facilities (such as lay down areas, construction accommodation village (camps) and offices, workshops, concrete batching plant);
- construction of crushing, concentrating and pelletising facilities;
- construction of plant, roads, pipelines, conveyors, power station, communications and other services;
- construction of permanent accommodation, stream diversions, building pads, waste dump facility (WDF), and waste management facilities;
- construction of the desalination intake and wastewater outfall pipes; and
- other construction activities associated with the above.

3.1.3 Operation Activities

In relation to the operation activities, the Balmoral South Iron Ore Project will operate for at least 25 years and the following summarises the main operation activities:

- extraction of ore and waste for the mining operations;
- movement and placement of waste ore/rock into WDFs;
- operation of processing facilities (such as primary crusher, concentrator and pellet plant);
- disposal of waste processing material (dewatered tailings) to WDFs;
- operation of project infrastructure including power station and desalination plant;
- transportation of finished products from process plant site to stockyard facilities at Cape Preston;
- operation of desalination intake and wastewater outfall; and
- processive rehabilitation of waste dump facilities

3.1.4 Closure Activities

The closure of the mine site would include the following tasks:

- mine roads ripped and seeded;
- removal of infrastructure such as above ground structures, pipelines, electrical reticulation and magazines;
- creation of mine abandonment bunds as per DoIR guidelines;
- rehabilitation of mine office and workshop site; and
- removal of the fuel farm and clean up of any contaminated areas.

3.1.5 Key Project Characteristics and Technical Specifications

The following characteristics have been identified for the Balmoral South Iron Ore Project. Whilst best endeavours will be taken to develop plant designs that conform to these specifications, accurate quantities will not be known until detailed design is developed during later phases of the project.

Table 1 Key Project Characteristics

Element	Characteristics
General	
Construction period	6 years
Operation Period	Minimum 25 years
Mining	
Ore reserves	2 billion tonnes
Ore mining rate	Around 80 Mtpa
Pit depth	300 m
Overburden and waste	Around 80 Mtpa
Stripping ratio	1.0 / 1.0 waste ore
Materials handling	Conventional drill, blast, load and haul
Dewatering rate	Up to 4 GLpa
Dewatering disposal	To process water stream and dust suppression
Concentrator	
Production	Ore concentration: 24 Mtpa
Waste	56 Mtpa
Pelletising	
Production	Pellets: 14 Mtpa
Infrastructure	
Power	Up to 600 MW installed capacity gas fired combined cycle power station
Conveyor	~ 30km in length between the Process Plant Site and Cape Preston Stockyard
Gas supply	Up to 34,000 TJ pa
Water Supply	40 GLpa desalination plant and up to 4 GLpa pit dewatering
Port Stockyard	2Mt storage capacity
Roads	General traffic, haulage, mine, accommodation and access, infrastructure maintenance access
Buildings	Administration, maintenance workshops, storage, accommodation village and power station
Sewage	Package treatment plants
Approximate Disturbance Areas	
Total Area of disturbance	6000 ha
Workforce	
Construction	Up to 4000
Permanent	Up to 1500
Accommodation	Onsite for the entire workforce

3.2 Description of Key Activities

3.2.1 Mine and Waste Storage

The mining operations for the Balmoral South Iron Ore Project will involve large scale open-pit magnetic iron ore extraction, including:

- drilling;
- blasting;
- excavation;
- loading;
- truck haulage;
- run of mine stockpiles;
- ore delivery to processing facilities; and
- waste disposal to WDFs.

The material will be blasted before loading. The mining rate is expected to be 160 Mtpa, comprising 80 Mtpa of ore and 80 Mtpa of waste for a minimum of 25 years. The amount of ore and waste mined annually will vary according to the pit configuration at the time, ore quality and market requirements, which may lead to mining rates exceeding those identified above. The ore will be delivered to the crushers via trucks and / or conveyors. Crushing will occur before transport by conveyor to the concentration plant. In-pit crushing is being examined as an option once the mine has been established at depth.

Waste rock and dewatered tailings will be co-disposed in the designated waste dump facilities areas (WDF1 to the west of the pit and WDF2 to the east of the pit)

The ultimate height of the WDFs is 90m above ground level constructed in 30m lifts.

The tails stream produced from processing magnetite ore consists of inert materials comprising a fine and coarse fraction. The tails will be dewatered and conveyed to the WDF's for storage in overhead bins prior to truck haulage to dispose of the tails in conjunction with waste rock or alternatively distribution by stacker.

The construction of the WDF's will be such as to shed as much surface water as possible to help reduce the potential for acid mine drainage ("AMD").

A test work program has been commissioned to test the potential for acid formation from the waste material encountered within the pit of the Balmoral South Iron Ore project. The McCrae shale unit has been reported to have acid producing potential. It is not anticipated that significant quantities of McCrae shale will be mined, other than in isolated areas around faults. If any AMD waste is encountered it will be separately encapsulated in the WDF's, surrounded by low permeability material or blended with neutralising waste in accordance with DoIR and Environment Australia, 1997 guidelines.

The Pilbara region has the potential for asbestiform mineral occurrence. IM is working closely with the Central Block proponents to identify potential issues and has developed management plans for safe work procedures.

In the event that pyritic shales or asbestiform minerals are identified, the appropriate methods for managing the materials will be determined through consultation with the regulatory authorities.

3.2.2 Processing Facilities

Unlike high grade iron ores, magnetite ore requires beneficiation prior to export to steel mills. The processing facilities for the Balmoral South Iron Ore Project will include:

- materials stockpiles;
- primary and secondary crushing;
- high pressure grinding rolls;
- concentration via magnetic separation;
- waste disposal; and
- pelletising.

There will be various intermediate stockpiles within the plant.

The option chosen for the concentrator plant will use high pressure grinding rolls to reduce the ore size. This will help to reduce both power and water requirements. Should engineering studies prove that this is not viable, the Proponent will select conventional milling i.e. autogenous grinding. The crushed ore will be slurried and concentrated by magnetic separation. Water from the coarse and fine tailings produced in the concentrator will be recovered by filtering to minimise water usage. The preferred option for the disposal of tails is to dewater the tailings which will then be transported to the mine WDFs. Traditional tailings dams may be required if this process is not viable. However, this option is not a part of this approval assessment.

In the pellet plant, the concentrate will be balled with an organic binder or bentonite, and dolomite or limestone will be added to the pellets to meet physical specifications. The pellets will then be dried and cooled through a Travelling Grate or Grate-Kiln pelletising process. Fines, pellet chips and spillage will be captured and refed into the pellet plant.

3.2.3 Materials Handling Facilities

The material handling infrastructure required for the project includes:

- conveyors; and
- stockpiles including stackers and reclaimers.

Pellets and concentrate will be moved to the port stockyard by up to two conveyors. 14 Mtpa of pellets and 10.4 Mtpa of concentrate will be conveyed. From the stockyard, the pellets and concentrate will be conveyed to the port. Roads will be required to manage inbound and outbound logistics other than finished products.

3.2.4 Utilities

Given the remote location and lack of existing infrastructure, the project requires utilities to support the construction and operation including:

- desalination plant for process and potable water supply;
- sewage treatment plants; and
- combined cycle power plant.

Water will be required for ore processing and potable water will be required for the mine, plant and accommodation village (camp) areas. A 40 GLpa desalination plant is proposed and forms part of this assessment.

Package treatment plants will treat sewage effluent from on-site amenities. Treated water from this process will be used for irrigation where appropriate.

A combined cycle gas-fired power station will be constructed adjacent to the concentrator / pellet plant complex to supply up to 450 MW of power for the project. With standby capacity, the size of the installed power station will be up to 600 MW.

Gas for the power station will be transported via a spur line connecting to the Central Block Project gas lateral.

3.2.5 Project Infrastructure

Project infrastructure required includes:

- 4,000 person construction accommodation village;
- 1500 person permanent village;
- services corridors;
- on-site roads, power transmission lines and water piping;
- mobile equipment workshops (service and maintenance);
- specialist workshops (electrical, boilermaker, crusher);
- medical and emergency response facilities;
- wash bay / tyre bay / fuel bay for mining and support vehicle fleets;
- laboratory;
- explosives magazines and storage and distribution depot;
- offices (administration, mine planning, process plant, maintenance);
- crib room facilities (mine planning, production, maintenance);
- warehousing; and
- other ancillary requirements necessary for the project.

Roads will be required to manage inbound and outbound logistics other than finished products.

During the construction period, a workforce of up to 4,000 people will be housed in camp style units on-site. Once no longer required, the accommodation village will be downsized to accommodate an operations workforce of up to 1500 permanent employees. Other temporary facilities such as construction roads, offices and batch plant will also be removed and the affected areas either rehabilitated or maintained for future lay-down as appropriate.

A services corridor will be constructed between the accommodation village and the approved services corridor for the Central Block Project. This corridor will be 300 m wide and will be located within the eastern edge of the mining leases M08/123 to M08/130 and the western edge of G08/63 and 100m wide within the southern edge of M08/130. Conveyors, access roads, utilities / services and other infrastructure will be constructed within this corridor.

This application also seeks to widen the eastern port access corridor to 300m (90m currently approved for the Central Block Project) and construct an additional western corridor to 250m wide. These corridors will provide access for conveyors, access roads, railway lines, utilities/services and other infrastructure. The corridor will also cater for 3rd Party access as required by Clause 6(5) of the *Iron Ore Processing (Mineralogy Pty. Ltd.) Agreement Act 2002*.

A landfill will be located and maintained for inert and perishable waste. The location of this landfill is yet to be determined, but it will be situated and operated to meet all safety, health and environmental requirements.

3.3 Project Timeline

The Balmoral South Iron Ore Project is expected to operate for at least 25 years, although extensions beyond this will depend on continued contracts for ore supply and economic analysis.

It is proposed to develop the Balmoral South Iron Ore Project in two stages as described in Table 2.

Table 2 Two Stages of the development of Balmoral South Iron Ore Project

Stage	Timing	Product		
		Pellets	Concentrate	Export Product (Pellets and Concentrate)
1	Within three years of project commencement	7 Mtpa	5.2 Mtpa	12.2 Mtpa
2	Within six years of project commencement	7 Mtpa	5.2 Mtpa	12.2 Mtpa
Total	six years of project	14 Mtpa	10.4 Mtpa	24.4 Mtpa

During Stage 1 of operations, magnetite concentrate will be produced at the process plant at a rate of 12 Mtpa. Of this, 6.8Mtpa would be used in pellet production. With the addition of binders, a total of 7 Mtpa of pellets would be produced. Approximately 5.2Mtpa of concentrate remains available for export, along with the 7.0 Mtpa of pellets. Stage 1 is scheduled to be exporting concentrate and pellets within three years from commencement of project construction. The facilities will be expanded on completion of Stage 1 to suit the output of the mine and plant. Stage 2 is scheduled to commence three years after the start of project construction.

3.4 Project Justification

Balmoral South Iron Ore Project will use an ore resource which is undervalued by current operators in the Pilbara, and could eventually lead to significantly more development in terms of support industries, other port users and offshore gas fields.

3.4.1 The World Market for Steel

In 2005, the world production of steel was 1.1 Bt, an increase of 5.8% from the previous year. In 2006 the international steel market continued with strong growth driven by strong demand. The international steel price rose throughout 2006 and continues to rise in 2008. This continued rise in prices has been spurred by global economic growth. There has been high demand growth in the USA, EU, Japan and China, while at the same time, there was a reduction of crude steel production in many countries. Consequently, the world market experienced a shortage in supply, resulting in price rises.

3.4.2 State and National Benefits

Australia's balance of payments will improve through the production of value-added minerals that would otherwise not to be exported.

The benefits to Western Australia include:

- expenditure of up to AU$5 billion dollars for the project;
- increased royalties from the sale of additional iron ore products;
- increased employment and training opportunities;

- encouragement in the growth of ancillary industries in WA;
- increased use of natural gas derived from local gas fields and indirect value-adding to that natural resource tapped locally; and
- additional infrastructure development.

Benefits to the local region will include:

- provision of direct business, employment and training opportunities for the communities in the Pilbara during the construction and operation phases; and
- economic multiplier effects to other local businesses

The 'no project' option would result in the compounding of a number of undesirable issues which have been recognised in Australia's minerals extraction industry, namely:

- loss of employment and training opportunities to overseas suppliers and downstream processors;
- the inability to improve export earnings from the natural resources extracted;
- loss of a new industry together with the associated developments and ancillary industries that would flourish in support.

3.5 Alternatives Considered

3.5.1 Introduction

As part of the approvals process for the Central Block Project a number of alternatives were considered for the location of project components, including a port. These can be divided into three alternatives:

- construction of the concentrator at the mine site (a feature common to all three alternatives due to the need to dispose of a large quantity of tailings), slurry or rail transport of the concentrate to a site near the Burrup Peninsula (e.g. West Intercourse Island, South West Burrup, Hearson Cove, Maitland Estate) for pelletising, and export via a port constructed on the Burrup Peninsula (e.g. West Intercourse Island, King Bay, South-West Burrup);
- construction of the processing plant at the mine site with the rail of finished product to the Burrup Peninsula for stockpiling and export via a port constructed at one of the above locations; and
- construction of the processing plant at the mine site and construction of a port at Cape Preston. (Initial investigations also evaluated the option of locating the processing plant site at Cape Preston. However, the southern site was selected since it provides a significant area of flat ground)

The above alternatives were considered against a number of criteria including:

- environmental – shorter transport distance will result in less land clearing and less greenhouse gas emissions;
- plant economics – costs of building the facility at a location remote from a population centre (Karratha) compared with operational savings associated with having an integrated project with all of the downstream processing components located in close proximity to each other. There would also be additional costs associated with building a power station at one location and having to transmit power to a second location 100 km away, and the power loss such transmission would involve;
- economics of materials handling – 25-30 km of product transport to Cape Preston versus 100 km to the Burrup Peninsula; and
- capacity for expansion – sufficient area exists adjacent to the mine site for further downstream processing and at the port site for further materials stockpiles and construction of berths to allow the export of different products

The above considerations have been taken into account for the development of the Balmoral South Iron Ore Project.

3.5.2 Product Transport – Mine to Port

Four options were considered for the transport of finished products from the mine site to Cape Preston:

- rail haulage;
- road haulage
- slurry pipeline; and
- conveyor

A conveyor provides the most practical solution for pellets. Slurry pipeline and a dewatering plant at the port may be used for the transportation of concentrates.

From an environmental perspective a conveyor or slurry pipeline are preferred due to the smaller area that will need to be disturbed to allow construction and operation. They will also result in fewer greenhouse gas emissions per tonne of material moved compared to road and rail transport.

4.0 STAKEHOLDER CONSULTATION

A community and stakeholder consultation process has occurred over seven years (2000 – 2008) to document the issues associated with industrial development in the Cape Preston region. IM has undertaken specific stakeholder consultation on the environmental impacts associated with the Balmoral South Iron Ore Project. A project specific targeted consultation process has been developed to ensure that as many key stakeholders as possible are informed, with an opportunity to comment and provide technical guidance on the development plans.

The proponent conducted stakeholder consultation for the Balmoral South Iron Ore project during October 2006. Through DoIR, the Office of Development Approval Coordination provided the Proponent with a list of potential key stakeholders, to whom a project discussion paper was distributed. Written responses were requested and a meeting with all respondents was held in early November 2006. Additional meetings with key Decision Making Authority 's (DMA's), including DEC, EPA and DoW have been conducted to help refine the potential significant issues on site and ensure baseline studies address those issues.

In August 2007 IM undertook a supplementary consultation program posting consultation packages to 52 groups, including:

- key government Ministers, agencies and regional branches;
- the Shire of Roebourne (Local Government Authority);
- non-government organisations that represent indigenous interests, conservation and recreation groups and industry bodies;
- community groups; and
- local business groups

In March 2008, IM sent a further consultation package to keep stakeholders informed on the development of the project and a project amendment to increase the production of concentrate from 12 Mtpa to 24 Mtpa.

To assist with the input from stakeholders into the consultation process, IM provided a "Project Overview for Key Stakeholders" document within the packages to introduce the project concept to stakeholders and later consult with them on issues and potential impacts. The document provided:

- a description of the proposal;
- an overview of project benefits;
- a summary of environmental impacts; and
- Proponent's Environmental Commitments

IM also attached a pro-forma table to help guide stakeholder feedback based on specific environmental impacts identified. Currently feedback has been received from more than 30 representatives via letter, email, phone calls and meetings.

Key issues identified through the consultation process are summarised in **Table 3**.

Consultation with stakeholders will continue through the environmental approvals process and throughout the life of the project.

Table 3 Summary of key issues identified

Factor	Issues	Stakeholders
Terrestrial Flora and Vegetation		
	Declared Plants issues need to be considered in consultation with Department of Agriculture and Food (e.g. Mesquite)	DEC, DAF
	Need to consider conservation status of regionally significant native vegetation	DEC
	Need to consider local and regional significance of impacting groundwater dependent vegetation	DEC, DOW
	Project should address Conservation, Recreation and Natural Landscapes Reserve over Mangrove Creek and coastal zone adjacent to Stockpiles.	Shire of Roebourne
Subterranean Fauna		
	Need to provide supporting documents and consult experts on stygofauna and troglofauna.	DEC, DOW
Matters of National Significance		
	identify the project's potential impacts on turtle nesting from lighting, construction works, loss of foraging habitat, increased recreational movement including camping and potential boat strike from increased boating activity	DEWHA
	identify the project's potential impacts on the marine environment, particularly seagrasses, from the chemical and temperature characteristics of the discharge from outlets. (Scientific data suggests that increased salinity will adversely affect the health of seagrass beds). Potential impacts on the Dugong from potential loss of feeding habitat and from increased boating activity	DEWHA
Surface Water		
	Strategies to minimise impact, including increased erosion and sedimentation.	DOW, DOIR
	Modelling to include the cumulative impacts of the Balmoral South Iron Ore and Central Block Projects.	DOW
	Provide the methodology for hydraulic modelling	DOW
	Detail the impact of the changes to the groundwater and surface water interactions as a result of the project.	DOW
Groundwater		
	Consider the cumulative impacts across the total area of the proposed development.	DOW
	Details of monitoring programs, trigger levels, mitigation measures and contingency plans.	DOW, DEC
	Monitoring should cover saline intrusion from the ocean as a gradient is created towards the mine pit.	DOW
	Consider hydro-geological conditions such as connectivity between aquifers.	DEC
Water Quality		
	Describe management of surface water quality during construction and operation.	DOW
	Potential impacts of predicted rising sea levels and the risk of storm surge during cyclonic events.	DOW, DEC

Factor	Issues	Stakeholders
Flooding		
	Need to ensure diversion channels are designed to accommodate the peak flood event during the life of the project.	DoIR
	Describe the impact from the peak flood event with a map showing the increase in area.	DOW
	Assess sedimentation in the Fortescue River as a result of the waste dump and tailings facility impeding flood flows.	DEC, DoIR
	Demonstrate that the plant, power station and other infrastructure are protected from flooding during major flows.	DOW, DOH
Water Supply		
	Demonstrate the site water balance, water supplies and water use efficiency measures including improvement targets. The project needs to look at alternative water supplies and develop contingency planning.	DOW, DOH, Industry groups
Wastewater		
	Wastewater treatment and disposal systems.	DOH, DOW
Emission		
	Need to consider the cumulative impacts associated with air emissions	DEC,DOH, DPI
Noise		
	Address the impacts of noise and vibration on fauna.	DEC
	Address prediction of blasting noise levels.	DEC
Heritage		
	Resolve Aboriginal heritage issues including additional surveys, ongoing consultation and staff heritage awareness	DEC, DIA, Local Aboriginal groups
Social Impact		
	Workforce planning such as transport and transit requirements for construction and operation of this project.	MRWA, DOH, Shire of Roebourne
	Impacts on grazing lands and Pastoral Lease including: devaluation of Lease, jeopardising sale of Lease, direct loss of grazing land, loss of tourism potential, contamination affecting grazing land, loss of water supplies, road kills, dust impacts and loss of access.	Pastoral Lease Holder
Recreation		
	Management of impact on public usage of publicly accessible land in the area.	Shire of Roebourne, DPI
	Need to consider Conservation Estate (e.g. Great Sandy Island Nature Reserve, parts of Mardie and Karratha Stations to be relinquished, proposed Dampier Archipelago Marine Park and Cape Preston Marine Management Area).	DoE(CALM), Marine and Parks Reserves Selection Working Group

5.0 SUMMARY DESCRIPTION OF THE PHYSICAL, BIOLOGICAL AND SOCIAL ENVIRONMENT OF CAPE PRESTON

The Balmoral South Iron Ore Project is located on the north-west Pilbara coast near the mouth of the Fortescue River on weed infested cattle grazing country. The Cape Preston Region is affected by cyclones and associated flood events.

5.1 Climate

The Pilbara region is characterised by a hot arid climate, with daily maximum temperatures at Mardie ranging from 28°C to 38°C, daily minimum temperatures ranging from 12°C to 25°C and an annual rainfall of about 270 mm. Occasional heavy rainfall events occur as the result of cyclone activity.

5.2 Air Quality

Cape Preston is a remote site, relatively far from existing emission sources. As a result, existing levels of SO_2 and NO_2 are low. Ozone levels are moderate as indicated in the DEP monitoring at Dampier, where, over two years of monitoring, two events with 1-hour concentrations exceeding 0.06 ppm or 60% of the NEPM standard were recorded. These were due to bushfire smoke and, as such, similar levels could be expected at Cape Preston.

NO_X levels are also low with data indicating that the background annual average is around 3 µg/m^3 with a 70th percentile 1-hour concentration of 5 µg/m^3. Average annual background (concentrations at areas with no local sources) PM_{10} values in the Port Hedland region are around 20 µg/m^3.

5.3 Geology and Groundwater

The eastern part of the area is characterised by two series of north-northeasterly trending ridges of outcropping Lower Proterozoic aged rocks of the Mount Bruce Supergroup, which are part of the Hamersley Basin. The western series of ridges are made up of banded iron formation (BIF), cherts, shales and breccias of the Brockman Iron Formation. A schematic geological section through the project area is presented in Figure 5.

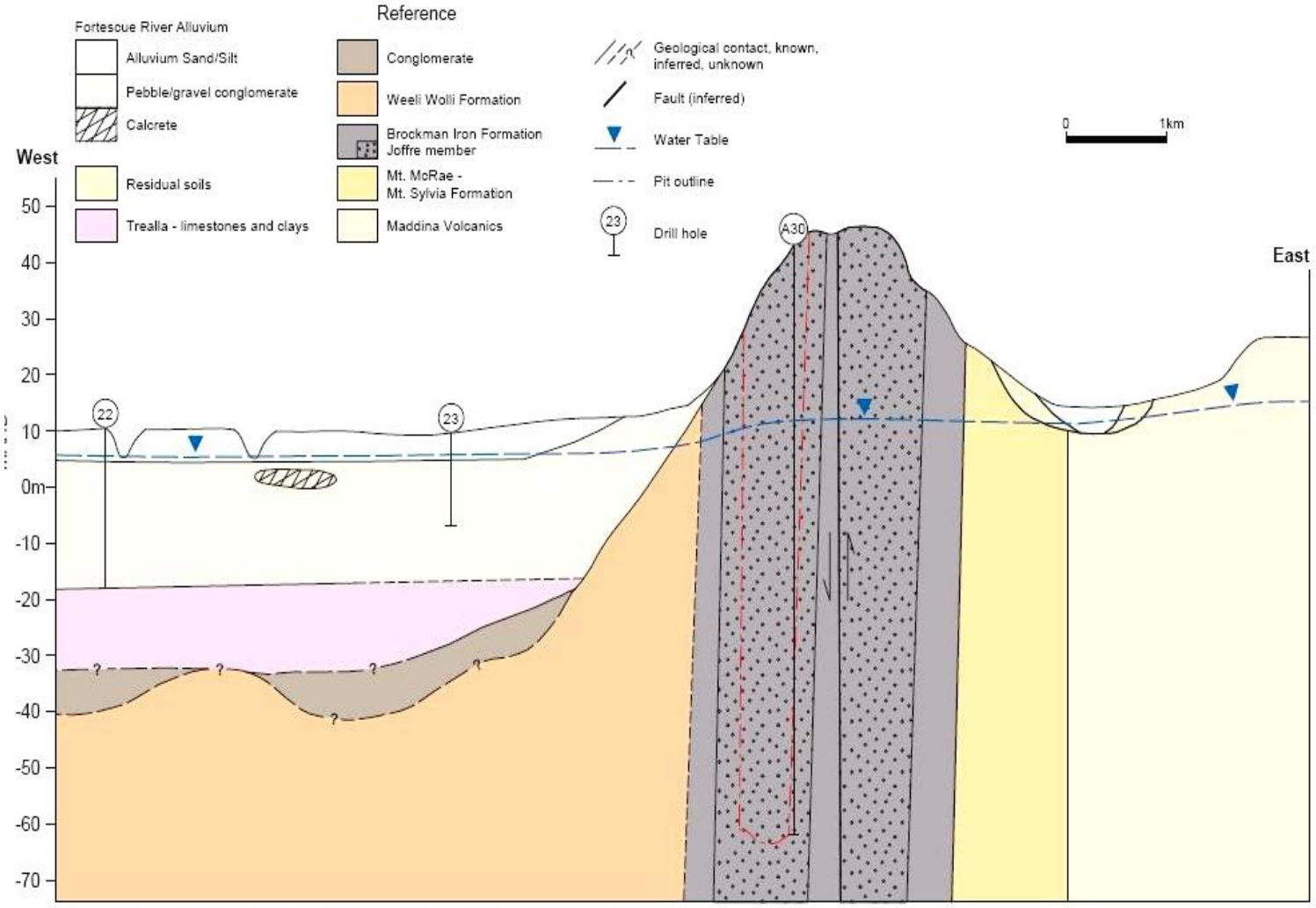


Figure 5 Schematic geological cross section

Three main orebodies have been identified; the George Palmer (Central Block) Orebody and the Northern and Southern Blocks. The orebodies are high-grade magnetites that have developed within the Joffre Member of the Brockman Iron Formation. A thin veneer of Quaternary aged alluvial, colluvial and residual soils overlies the basement rocks in low lying areas, with some creek bed alluvium along drainage courses.

The major aquifers in the area are the gravels of the Fortescue River alluvium and to a lesser extent the Yarraloola Conglomerate. The alluvium is potentially a major source of fresh water and could support substantial pumping. Hydraulic conductivity values in excess of 50 m/d and individual bore yields up to 900 kL/d have been demonstrated. Sustainable abstraction of around 10,000 ML per year has been estimated and the Department of Water has ear-marked the aquifer system as a potential area for future development. Numerous station wells and bores in the area also tap this aquifer.

Depth to the watertable over the full project area is generally 4 m to 12 m below ground level. The groundwater quality within the project area varies from fresh (<1,000 mg/L TDS) in the central part of the alluvium along the main channels of the river, to brackish (1,000 - 2,000 mg/L TDS) in basement rocks and on the edge of the floodplain, and brackish to saline (>5,000 mg/L TDS) near the coast.

5.4 Hydrology

The mine site is located adjacent to the lower reaches of the Fortescue River and about 15 km from the river mouth to the Indian Ocean. Above the project area, the Fortescue River has an effective catchment area of approximately 20,000 km^2 and an estimated 100 year ARI peak flow of 9,570 m^3/s. The Fortescue River has a well defined main flow channel, typically 4-6 m deep and around 100 m

wide adjacent to the project area. The main channel has a gravelly bed and typically gum trees along both banks. Vegetation over the floodplains varies from wide open grass areas to dense scrub.

Du Boulay Creek flows in a north-westerly direction through the general project area, and joins the Fortescue River approximately 6 km from the coast. The creek has a catchment area of about 200 km^2, with an estimated 100 year ARI peak flow of 1,400 m^3/s. Du Boulay Creek typically has main flow channels with 5-10 m width gravel beds and trees along the banks. Floodplains adjacent to the main channels typically comprise open grassed areas with scattered trees.

5.5 Flora and Vegetation

The Balmoral South Iron Ore Project Area is situated within the Fortescue Botanical District of the Pilbara region and broadly consists of various *Acacia* Shrublands over *Triodia* Hummock Grasslands on the more rugged, shallow soiled habitats and *Eragrostis xerophila* Tussock Grasslands dominating the heavy clay soils. Drainage lines are dominated by *Eucalyptus* species over *Melaleuca* and *Acacia* Shrublands.

83 vegetation communities have been identified in the project area. No Threatened Ecological Communities have been recorded. Of particular importance are the cracking clays of the Horseflats Land System and the phreatophytic vegetation of the River and Paraburdoo Land Systems.

Within the entire Cape Preston project area a total of 500 vascular flora species, from 64 families and 196 genera has been recorded. This total includes 482 (96.4%) native species and 18 (3.6%) introduced (weed) or non-endemic species. Families with the highest representation were Poaceae (Grass family – 73 native taxa; 4 introduced taxa); Papilionaceae (Pea family – 44 native taxa); and the Malvaceae (Mallow Family – 49 native taxa, 2 introduced taxa).

Ten Priority flora species have been identified through DEC Threatened and Priority Flora database searches to potentially occur within the project area. Of these, four were recorded within the mining lease during field surveys conducted between 2000 and 2007. Of those four species, *Eriachne tenuiculmis* and *Sida sp*. Wittenoom (WR Barker 1962) both formerly P3 have recently been removed from the DECs Threatened and Priority Flora List (2008). Two additional Priority Flora species, *Goodenia sp*. East Pilbara (A.A Mitchell PRP 727) and *Phyllanthus aridus* were not listed on the DEC database but have been found within the project area during field surveys.

No Declared Rare Flora (DRF) pursuant to the *Wildlife Conservation Act 1950*, or Threatened Flora pursuant to the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) have been recorded within the project area.

The project area contains the Declared Plants *Prosopis pallida* (Mesquite) and *Datura leichhardtii* (Native Thornapple). Drainage lines also tend to be heavily infested with *Cenchrus ciliaris* (Buffel Grass), a highly invasive weed introduced by pastoralists for its grazing value.

5.6 Phreatophytic Vegetation

Three phreatophytic species occur within the project area:

- *Eucalyptus camaldulensis*;
- *Eucalyptus victrix*; and
- *Melaleuca argentea*.

These species make up eight phreatophytic vegetation communities.

5.7 Mangroves

A well-developed mangrove system is associated with the major tidal creek and connective tidal flats that join Cape Preston with the mainland (Mangrove Creek). Other areas of mangrove occur in the wider locality, including a generally narrow zone of *Avicennia marina* which borders the western shoreline and embayments between the creek and the mouth of the Fortescue River.

Mangrove Creek

The local occurrence of mangrove species and assemblages within the creek system exhibits similar patterns to those observed elsewhere in the region in relation to species distribution, local geomorphology and substrate. The most abundant and widespread species are *Avicennia marina* (dominant or co-dominant in most assemblages in the study area) and *Rhizophora stylosa* (which formed dense monospecific assemblages). The occurrence of *Aegialitis annulata* and *Aegiceras corniculatum* was strongly related to newly formed islands, accretionary creek banks or other zones of recent deposition. In the most seaward sections of the creek system, the substrates were sandy and rocky and the mangroves occurred here as a relatively narrow fringe. Further into the creek system, mangal development becomes more structurally complex and species richness increased particularly on the connective tidal land that bridges Cape Preston and the mainland.

Landward of the mangrove zone, expansive areas of high tidal mudflats extend to the margin of the tidal flats with the hinterland terrestrial vegetation. While the majority of the high tidal flats are devoid of vegetation, areas of cyanobacterial (algal) mats occur on the mudflat surface.

5.8 Terrestrial Fauna

Three detailed fauna surveys have been conducted over the project impact area. An initial survey was undertaken in April 2000 in preparation of the Central Block Project PER (Halpern Glick Maunsell 2001) with additional surveys undertaken in 2006 by Maunsell Australia.

The fauna of the project area is dominated by avifauna (birds) and reptiles. Several species of mammal are also common, predominantly consisting of small species such as native mice.

Eight species of conservation significance are reported by database searches to occur in the area, including the Northern Quoll, Night Parrot, Pilbara Olive Python and the migratory Peregrine Falcon. None of these species were recorded within the project area during any of the surveys.

Two species listed as migratory under the *Environment Protection and Biodiversity Conservation Act 1999* were observed:

- *Merops ornatus* (Bee-eater) - recorded regularly throughout the survey area; and
- *Haliaeetus leucogaster* (White - bellied sea eagle) – one sighting recorded.

In general the fauna habitats within the project area are all well represented in the region and none are regarded as regionally significant or unique. Of the habitats sampled, creek lines and cracking clays dominated by *Triodia spp* yielded the highest number of species.

No mammal species of conservation significance were recorded during the field surveys. A targeted search of low stony rises failed to identify any signs of the priority species or *Pseudomys chapmani* (Western Pebble Mound Mouse) and targeted trapping of cracking clays failed to record *Leggadina lakedownensis* (Lakeland Downs Mouse).

5.9 Subterranean Fauna

Sampling to date has identified 13 stygofauna species from Balmoral South Iron Ore Project, all of which have been recorded elsewhere in the Cape Preston area beyond the zone of impact where at

least 54 species of stygofauna have been found. The community at Balmoral South Iron Ore Project appears to comprise a subset of the community found in the broader Cape Preston area. The Balmoral South Iron Ore Project community contained copepods (6 species), ostracods (2 species), amphipods (2 species), worms (1 species), mites (1 species) and nematods (1 species). The community of the broader Cape Preston area was dominated by copepods (12 species), ostracods (11 species), worms (11 species), amphipods (7 species) and single species of seven other groups.

Only five species of troglofauna have been collected at Balmoral South Iron Ore Project and four of them occurred at the Central Block Project where at least 19 species of troglofauna occur. The only species found at Balmoral South Iron Ore Project but yet to be found at the Central Block Project is the centipede *Cryptops sp*., which was represented by a single individual. A troglofauna *Cryptops sp*. has also been found in mesas of the Robe Valley about 90 km away (Biota 2006) although whether it is the Balmoral South Iron Ore Project species is unknown. The genus is cosmopolitan.

The sampling to date suggests that Balmoral South Iron Ore Project contains a subset of the troglofauna community occurring in the Cape Preston area. It appears likely, based on the distribution of the more frequently occurring troglofauna and the lack of major geological discontinuities between the mining areas, that the same troglofauna community extends through all orebodies at Cape Preston.

5.10 Marine Environment

Physical – Chemical

Regional waters are undisturbed by large-scale anthropogenic sources, consequently oceanographic, environmental and biological data available for the region provides a baseline for future monitoring.

At Cape Preston, nearshore water movements and mixing patterns are driven primarily by large tidal ranges (HAT of 4.75 m), local currents and winds, but are also influenced by seabed topography and the steering effect of islands and reefs. Annual water temperatures range between 18˚C and 31˚C and salinity between 35.1 and 37.1 ppt. The water column is relatively well mixed with stratification not apparent to any marked degree.

Turbidity in the region is generally high, due to the episodic high volume river flows, cyclones,dominant marine sediment types, strong local winds, large tides and common occurrences of cyanobacterial blooms.

Nutrient concentrations in water samples collected in 2002 were all found to be slightly above ANZECC & ARMCANZ guideline values for turbid macrotidal areas. Water samples collected in 2008 showed that, with the exception of lead and boron, all samples were below recommended ANZECC & ARMCANZ (2000) guideline values for 99% species protection (very high level of protection) or below laboratory detection limits.

Regional sediment studies revealed arsenic levels were found to be above ANZECC & ARMCANZ trigger values (also found in tissues of carnivorous fish from the area).

Biological

Within the Cape Preston area, macroalgae (seaweeds) dominate submerged limestone reefs and also grow on stable rubble and boulder surfaces. Seagrasses form interspersed seagrass/macroalgae beds (Figure 6).

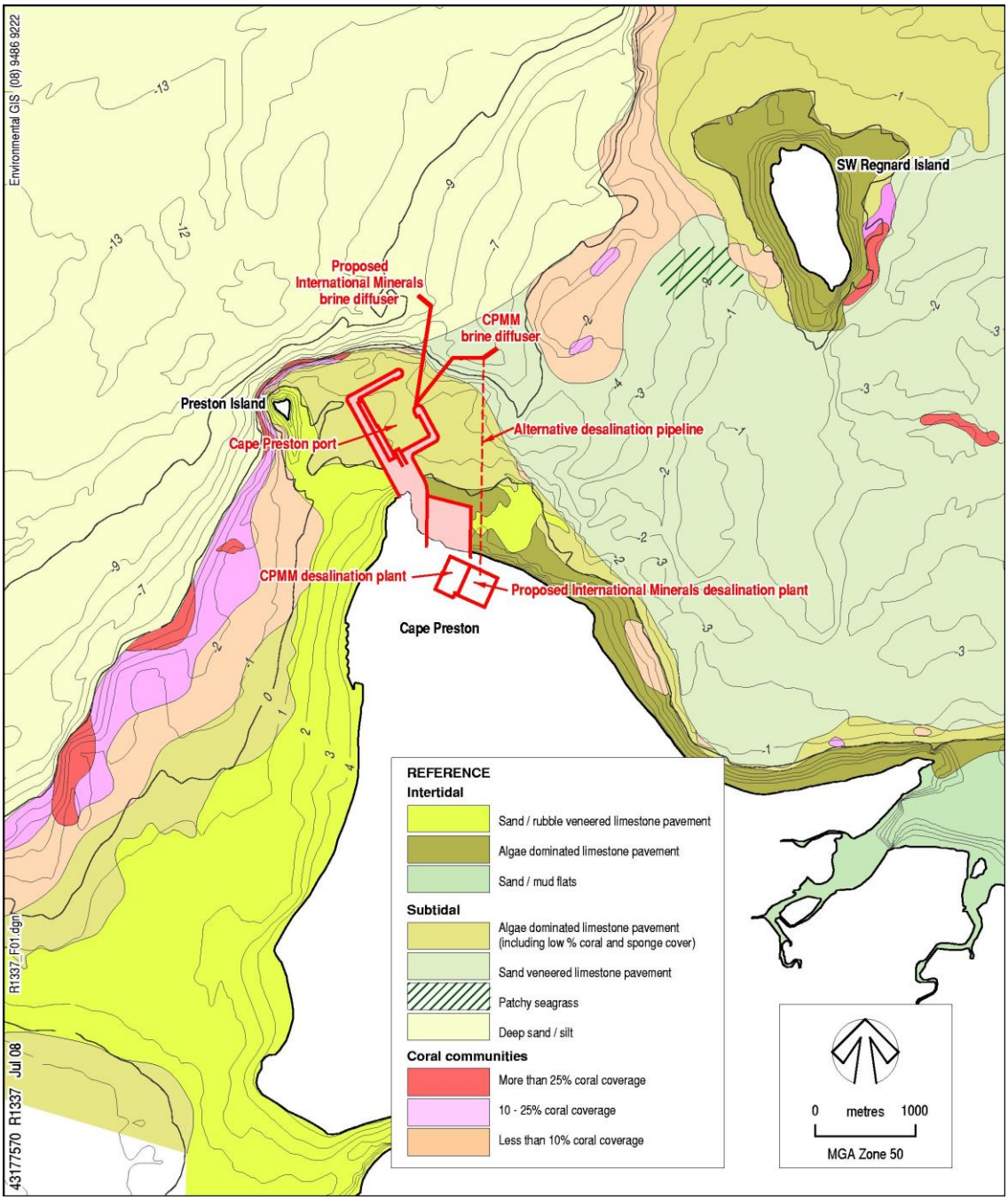


Figure 6 Cape Preston benthic habitats

Fauna of the shallow water limestone reefs and platforms include hard and soft corals, sponges, ascidians, fan worms, molluscs (octopus, gastropods [snails], and bivalves), crustaceans (crabs, rock lobsters), urchins and sea stars. Dense areas of high coral cover are sparsely distributed in the region, whilst areas of low coral cover tend to occur as a thin border along steep slopes that descend from shallow algae dominated pavements around islands to a deep sandy seafloor. The nearest major reefs to Cape Preston which support high live coral cover are over 3 km away.

Available survey information obtained during three separate seasons indicates that the beaches of Cape Preston are utilised for a very limited amount of turtle breeding activity. The results suggest the northern end of the western beach is a nesting area for hawksbill turtles (*Eretmochelys imbricate*), the eastern beaches are used by the green turtle (*Chelonia mydas*) and south western beaches by flatback turtles (*Natator depressus*).

In the Dampier Archipelago / Cape Preston region, small numbers of dugong (*Dugong dugon*) have been sighted in the shallow, warm waters in bays and between islands, including at East Lewis Island, Cape Preston, Regnard Bay, Nickol Bay and west of Keast Island. Current knowledge on the size of the population, distribution, migratory habits and regional and local importance of the Dampier Archipelago / Cape Preston area for dugongs is limited.

Migratory shorebirds utilise Pilbara coastal habitats such as beaches, tidal flats and other intertidal wetlands during the non-breeding season Migratory waders are protected under the *Environment Protection and Biodiversity Conservation Act 1999* in addition to several international agreements. Fauna surveys undertaken in the Cape Preston areas in April 2000 and October 2002 recorded 16 species listed under the CAMBA, JAMBA and ROKAMBA international agreements, of which two species, the Ruddy Turnstone and the Sanderling, were recorded in internationally significant numbers on the coastal habitat (inter-tidal mudflats, sandy beaches and dunes) stretching from the southern side of Mangrove Creek to the tip of Cape Preston.

5.11 Local Land Uses

In 2002, Cape Preston was recognised by the State of Western Australia as a major future industrial area through the signing of a State Agreement with Mineralogy. In 2008 the potential of the Cape Preston area as a major iron ore mining and down stream processing precinct has been realised through the commencement of construction for the Central Block Project. Amongst other benefits, the State Agreement provides for secure land tenure for the development of the mining operation, processing facilities, supporting infrastructure and a port access at Cape Preston.

The mainland immediately adjacent to Cape Preston, Regnard Bay and the Fortescue River has been zoned for industrial use and is covered by mining and exploration leases held by Mineralogy. The project area is covered by the Balmoral Pastoral Lease.

IM has entered into a series of agreements with Mineralogy which provides for the rights and tenure to all Mineralogy tenements necessary to carry out the project. These agreements have been agreed by the Minister Resources Development and set out in the First Schedule of the *Iron Ore Processing (Mineralogy Pty Ltd) Agreement Act 2002* which was passed by the Parliament of Western Australia in 2002.

Although remote, Cape Preston and the Fortescue River mouth are used by Pilbara residents and tourists for recreational pursuits, particularly fishing. The waters and shallow marine habitats of Regnard Bay are fished recreationally by low numbers of visitors from Dampier and by itinerant “grey nomads” that occupy the 40 mile beach camp site during winter months. Long term campers regularly stay at the river mouth for periods of up to several months.

In addition to the mainland visitor points mentioned above, there are several islands located off the Pilbara coast which form the Great Sandy Island Nature Reserve. To the east, the Dampier to Cape Preston Marine Management Area will incorporate a number of other islands. The project lies adjacent to the Coastal Margin Cape Preston to Cape Keraudren National Estate (identification number 17917) to the east and the Coastal Margin Exmouth Gulf to Cape Preston natural area (identification number 17918), located to the south-west of the mouth of the Fortescue River. Both National Estates are Indicative Places that have yet to receive official status. There will be no direct project impacts on these areas.

In 2004 the Minister for Planning and Infrastructure approved an area of approximately 2555 ha to be excluded from Mardie Station as part of the "2015 Exclusion Process". The area was identified by the DEC as particularly valuable for its conservation value because of the Horseflats Land System (cracking clay soils) and related vegetation associations that are poorly represented within the conservation estate and, also, because of its contiguous nature with the sanctuary Zone within the Regnard Marine Management Area.

5.12 Heritage

Archaeological and ethnographic studies have previously been conducted in the Cape Preston region, including the Balmoral South Iron Ore Project area. The studies identified the Aboriginal Heritage values of the area and the presence of a number of sites of heritage significance.

Local Aboriginal groups include the Wong-Goo_Tt_oo group, the Yaburara and Coastal Mardudhunera group, and the Kuruma Marthudunera group.

No sites of European heritage significance occur in the project area.

6.0 PRELIMINARY ENVIRONMENTAL IMPACT ASSESSMENT

This section outlines the potential impacts based on IM's current understanding of the receiving environment, identifies the key issues relating to project activities and identifies the key factors relating to the management of impacts.

6.1 Clearing Activities

Development of the project will require clearing to accommodate the pit, mine infrastructure, and WDF's stockpiles, processing plant, plant infrastructure, infrastructure corridors, port infrastructure and accommodation village.

The project could have the following impacts:

- habitat loss as a result of clearing;
- spread of Declared weed species; and
- disturbance of indigenous heritage sites

Four Priority Flora are known to occur within the project area.

No species listed as Declared Rare Flora (DRF) by the Department of Environment and Conservation(DEC), under the *Wildlife Conservation Act 1950*, or as Threatened under the *EPBC Act 1999* were recorded within the survey area during any of the field assessments, nor did any DRF result from database interrogations for the area.

Surveys indicate that most vegetation communities that could be affected by clearing are not regionally or locally significant, and are well represented throughout the region. The exceptions are the Cracking Clay Grasslands, phreatophytic vegetation communities and mangrove communities, which are recognised as regionally significant. Pastoral lease boundary rationalisation planned for 2015 will ensure that substantial areas of Cracking Clay Grasslands are preserved within the conservation estate. Project design requirements will also endeavor to minimise any clearing of these grasslands within project area.

Impacts on flora and vegetation communities will be managed through a process of avoidance, minimising disturbance, monitoring impacts and rehabilitation. Only areas specifically required for construction and operation will be cleared. Rigorous management controls will be implemented to ensure that personal and vehicles do not access any area not designated for clearing.

The Balmoral South Iron Ore Project area supports populations of the Declared Plant species *Prosopis pallida* (Mesquite) and *Datura leichhardtii* (Native Thornapple) as well as several other species of weeds.

Eight Priority Fauna under the *Wildlife Conservation Act*, ten species listed as Threatened under the EPBC Act and 25 species listed as migratory under the EPBC Act potentially occur in the project area. In general, it has been determined that the fauna habitats within the project area are all well represented in the region and none are regarded as regionally significant or unique. Of the habitats sampled, creek lines and cracking clays dominated by *Triodia spp* yielded the highest number of species. No mammal species of conservation significance were recorded during the field survey. A targeted search of low stony rises failed to identify any signs of the priority species *Pseudomys chapmani* (Western Pebble Mound Mouse) and targeted trapping of cracking clays failed to record *Leggadina lakedownensis* (Lakeland Downs Mouse).

An outfall pipeline is proposed to carry concentrated brine and filter backflush water to a discharge diffuser located approximately 800 m northeast of the proposed Cape Preston harbour, located in approximately 10m of water at Lowest Astronomical Tide. Benthic habitat mapping conducted for the project area has identified that the pipeline and diffuser is to be located in an area of low environmental sensitivity, mainly consisting of algal dominated limestone pavement and deep sand/silt. These habitats have a widespread distribution in the greater region of the project.

Archaeological and ethnographic studies were conducted for the greater Balmoral project area for the previously assessed Central Block Project. All activities undertaken for the Balmoral South project will be pursuant to the requirements of the *Aboriginal Heritage Act 1972*. Section 18 clearances to disturb known sites will be sought as required.

The management objectives of the Balmoral South Iron Ore Project relating to the clearing activitites are to:

- minimize the area to be cleared to accommodate the works;and
- protect adjacent vegetation from access by personnel or vehicles

6.2 Surface Water Management

The project will require construction of:

- a WDF1 in the western extent of Leases M08/126 and 127, which will encroach on the Fortescue River floodplain;
- a WDF2 in Lease G08/63, which will not encroach within the 100 year ARI floodplain of Du Boulay Creek floodplain;
- the process plant and power station adjacent to Du Boulay Creek;
- bunds within the 100 year ARI floodplain of Du Boulay Creek to protect stockpile areas, conveyors, ROM pad and primary crushing area;
- an open-cut mine that, at the completion of mining, will partially fill with water; and
- construction of service corridors across creeks including Mangrove Creek

The project could have the following potential impacts:

- increase flood levels in the Fortescue River;
- increase flood level and a change in the hydraulics of Du Boulay Creek;
- long term salinity build-up in the pit lake;
- an increase in erosion and sedimentation; and
- changes to the hydrodynamics of Mangrove Creek resulting in the indirect loss of mangroves

The Balmoral South Iron Ore Project WDFs will occupy the western extent of Leases M08/126 and 127. They will be located in the Fortescue River floodplain west of the pit with the north end of the WDF near Du Boulay Creek. A number of creeks and intertwining tributaries flow through the proposed dump area.

Hydraulic modelling for the Central Block Project waste dump predicted that the maximum local 100 year ARI flood level would increase by about 0.4 m adjacent to the dump, with no impact predicted 6 km upstream of the dump. The construction of the Balmoral South Iron Ore Project WDF1 will increase flood levels by around 0.37 m adjacent to the dump (0.3 m above those predicted for the Central Block Project dump only) with no impact predicted 3km upstream of the dump (an increase of 1.5 km in the upstream extent of flooding over levels predicted for the Central Block Project dump only).

The Fortescue River bridge on the north-west coastal highway is around 15 km upstream of the project area. Increased flood levels in proximity to the project area will not impact on this structure.

The process plant and power station site is set along side Du Boulay Creek. The proposed stockpile area, conveyor system, Run Of Mine stockpile pad and primary crushing area encroaches into the 100 year ARI floodplain but will be protected by bunding.

The bunds will restrict flow through the Du Boulay Creek in large flood events and cause water levels to rise. The 100 year ARI flood levels were predicted to increase by about 1.6 m after construction of the bunds around the plant site. Water velocities in this area should decrease due to the increased flow depths.

There will be some long term salinity build-up within the pit lake as a result of evaporative concentration. However, as the pit will remain a groundwater sink, this saline water will largely remain confined to the immediate pit area.

WDFs and stockpiles have the potential to discharge sediment laden water to the environment, and surface runoff in general will typically be sediment laden. Excavation activities undertaken in mangrove areas also have the potential to disturb acid sulfate soils resulting in the generation of acid and the mobilisation of heavy metals.

The construction of port infrastructure across tidal creeks and within the intertidal areas generally has the potential to modify tidal flows. Due to the lack of regular freshwater input into Pilbara zone mangroves from hinterland areas, tidal inundation is the dominant recharge mechanism responsible for maintaining the suitable groundwater / soil water conditions required for mangrove growth and survival. Modifications to tidal wetting and drying regimes through a reduction in tidal flushing or impoundment of water at higher levels can potentially impact mangroves.

The management objectives of the Balmoral South Iron Ore Project relating to surface water management are to:

- maintain the quantity and quality of water so that existing and potential environmental values, including ecosystem function, are protected;
- ensure that structures remaining in flood prone areas at the cessation of the project are stable in the long term; and
- minimise changes to the hydrodynamics of Mangrove Creek to avoid indirect impacts on mangrove communities

6.3 Dewatering Activities

Drawdown in groundwater levels due to dewatering activities will have the following impacts:

- groundwater users: bores and wells which tap the basement rock aquifers will experience interference drawdowns and some shallow wells close to the pit may dry up;
- phreatophytic vegetation: there is the potential for the loss of vegetation within the cone of depression of groundwater level drawdown, however seasoned recharge of the alluviums will provide some mitigation; and
- stygofauna: potential loss of species and communities due to drawdown

The pit will be excavated to around 300 m deep. Dewatering and depressurisation will be a critical component of mining. Average predicted inflows over the life of the mine are around 1,100 kL/day (12.5 L/s) with peak dewatering requirements in the order of 1,700 kL/d (19 L/s).

Dewatering of Balmoral South Iron Ore Project will induce a drawdown in groundwater levels around the pit. The lateral and vertical extent of the “cone of depression” in groundwater levels will be dependent on the nature of local and regional aquifers, the depth of the pit and the “interference” effects of dewatering at the nearby Central Block Project.

Modelling indicates that the cumulative impacts of both the Central Block and Balmoral South Iron Ore Projects dewatering operations will result in one large elongated cone of depression. Groundwater drawdown in close proximity to the mine will be at, or close to, the deepest section of the pit (around 300 mbgl). Predicted drawdown will extend 14 km northwards, 5 km southwards, 2 km to the west and 7 km to the east. Predicted drawdown within the adjacent Fortescue River alluvial aquifers is minimal.

Under cumulative abstraction conditions up to eight pastoral wells may be impacted by dewatering. IM will provide alternative water supplies to any groundwater users adversely affected by their operations.

Indirect impacts will occur to vegetation within the project area as a result of groundwater drawdown through mine dewatering. Groundwater drawdown is expected to cause extended drying of water pools, thereby impacting on riverine environments and Groundwater Dependent Ecosystems (GDEs) such as phreatophytic vegetation. Shallow-rooted species are not likely to be directly affected by

dewatering and consequently some vegetation cover may be retained. However, as a result of the permanent loss of phreatophytic vegetation, understory species may also be lost depending on the extent of drawdown, drawdown level and drawdown rate. Vegetation risk assessments have been based on the predicted drawdown in basement rock aquifers and take no account of seasonal creek flows and perched water tables within the main creeks which support much of the vegetation at risk.

It is unlikely that dewatering at Balmoral South Iron Ore Project will affect conservation of stygofauna species. With 13 species recorded, Balmoral South Iron Ore Project is not rich in stygofauna and all species present are known to be more widely distributed.

The trogofauna collected at Balmoral South Iron Ore Project appears to represent a subset of the Central Block Project trogofauna community. Although there is no evidence from sampling, it may reasonably be inferred that the troglofauna species present at Balmoral South Iron Ore Project will also occur in the surrounding Brockman Iron Formation, which will not be mined.

The management objectives of the Balmoral South Iron Ore Project relating to groundwater are to:

- Manage the quantity and quality of water so that existing and potential environmental values, including ecosystem maintenance, are protected; and
- ensure that discharges do not adversely affect water quality or the health, welfare and amenity of people and land uses by meeting statutory requirements and acceptable standards

6.4 Atmospheric Emissions

Particulates, oxides of nitrogen, carbon monoxide and sulphur dioxide will be emitted from:

- the power station consisting of closed-cycle gas turbines; and
- the main stack of the pellet plant

Under normal operations, air emissions will only occur through the main stack after passing through a dust control device to limit the particulate concentrations to 50 mg/m^3.

Highest 24-hour NO_X and 1-hour NO_2 concentrations occur within the first 500 to 1000 m of the proposed pellet plant. The contribution from the power station to the predicted ground level concentrations is low. Comparison to the NO_X vegetation criteria indicates that this would be exceeded within 800 m of the pellet plant but that the concentrations would decrease rapidly with distance. Concentrations of particulates, carbon monoxide and sulphur dioxide are all below criteria. Regional ozone concentrations are well below criteria at sensitive receptors.

The project will produce the following greenhouse gases:

- carbon dioxide;
- methane;
- sulphur dioxide; and
- oxides of nitrogen

The sources of these emissions include:

- pellet plant;
- gas turbines at the power station;
- combustion of diesel fuel in mobile plant and equipment used for construction and mining;
- decomposition of cleared vegetation;
- explosives used in blasting; and
- decomposition of domestic wastewater

Dust will be generated from a number of activities including:

- vegetation clearing, topsoil clearing and replacement;
- vehicle movements on the access roads and site roads during construction and operations;
- mining activities (blasting, earthmoving and dumping);

- materials handling and processing activities including crushing, screening, stacking and reclaiming of ore; and
- dust pick-up (wind erosion) from exposed areas including the pit, areas cleared for the process plant and offices, access roads, stockpiles, WDFs and the accommodation village

Given the remoteness of the nearest sensitive premise, no construction or operational dust impacts are expected.

The management objectives of the Balmoral South Iron Ore Project relating to atmospheric emissions are to:

- minimise atmospheric emissions to as low as reasonably practicable;
- use all reasonable and practicable measures to minimise airborne dust; and
- minimise emissions of greenhouse gasses to levels as low as practicable

The assessment will ensure that impacts from the project are understood and assessed in the context of impacts arising from other projects in the area.

6.5 Waste Management

The project will generate waste that can be broadly categorised into the eight types:

- dewatered tailings produced during ore concentration.
- industrial waste including oil filters, hydraulic hose, workshop waste, waste oil, tyres, etc;
- putrescibles (general domestic waste);
- inert waste including asphalt, concrete, etc;
- wastewater including sewage, grey water and washdown water;
- hazardous waste including pyritic black shales (acid mine drainage) and fibrous materials;
- recyclable waste including aluminium products, scrap metals, wire, etc; and
- brine discharge from the desalination plant

The waste will be managed in an appropriate manner. The potential impacts include the contamination of land, change in water quality of surface water and groundwater, and / or contamination of ecological habitats.

Both on-site and off-site facilities will be used to ensure appropriate disposal of all waste streams. Inert waste and putrescibles will be collected and disposed in a landfill sited and managed in compliance with the Draft Code of Practice for Rural Landfills. All industrial waste will be removed from the project site to a registered landfill or recycling facility, using appropriate certified contractors.

If accidental hydrocarbon spills do occur then an appropriately located on-site bioremediation land farm will be established. Sewage waste will be treated through a package treatment system and appropriately disposed to meet health regulations.

Water recovery from the tailings may be conducted via a tailings thickening process. Minimization of water in the WDF will also reduce the potential for surface water contamination.

The presence of any pyritic black shales, which can give rise to acid mine drainage, and fibrous forming minerals will be identified during drilling. Management of these materials, if present, will be determined through consultation with relevant authorities.

The seawater outfall will only be used for brine discharge from the desalination plant. All onshore wastewater, including power station cooling water blowdown and effluent from wastewater treatment plants will either be recycled or used onshore for dust suppression or irrigation.

The desalination plant's brine will contain concentrated dissolved solids (TDS) and concentrated suspended solids (TSS) as well as chemical additives used in the desalination process. The maximum TDS discharged will be 78.8 g/L at a temperature no greater than 2° C above the temperature of the intake seawater. TSS concentration will vary between 10 and 34 mg/L.

The discharge of brine has the potential to:

- change local marine water and TDS and TSS concentrates;
- adversely affect individual marine biota within the vicinity of the outfall; and
- reduce the abundance of sensitive benthic primary producer habit, including coral communities

The most appropriate way to avoid the above impacts is to select a disposal site that does not currently support a high abundance of corals, seagrass or algae, ensure that sufficient depth of water is available at low tide for initial dilution to occur rapidly, and ensure that the waters above the outfall are well flushed and mixed.

The PER will model the brine discharge and demonstrate its acceptability in relation to the size of the mixing zone, the presence of any residual chemicals and the impact of the discharge on the marine ecosystem. The PER will demonstrate that a specific ecotoxicology study is not required.

The management objectives of the Balmoral South Iron Ore Project relating to waste management are to:

- ensure that waste rock and tailings are emplaced in WDF that isolated long time
- integrate a waste hierarchy (i.e. avoid, reuse, reduce, recycle, treat, dispose) for waste minimisation and establish a 'closed loop' within as many waste streams as possible;
- ensure no release of hydrocarbons to the environment, either as a result of storage or handling incidents;
- ensure no discharge of waste to the sea;
- limit the area required for brine mixing surrounding the diffuser

6.6 Noise Emissions

The project will generate noise from a variety of sources including blasting, use of mining equipment, mineral processing, materials handling, conveyor use and the power station. The project area is within the boundaries of the Mardie pastoral lease and is remote from any substantial human development. The closest noise sensitive receivers are the two miner's camps (7 km south and 9 km north east of the pit) and the public camping ground at the mouth of the Fortescue River (11 km to the north west).

The management objective of the Balmoral South Iron Ore Project relating to noise emissions is to protect the amenity of nearby residents from noise impacts resulting from the project area. Noise assessment will need to ensure that impacts from the project are understood and assessed in the context of impacts arising from other projects in the area.

Modelling results show compliance with the relevant Environmental Protection (Noise) Regulations 1997 criteria at all potentially impacted noise-sensitive receivers surrounding the site.

6.7 Adjacent Land Users

Pastoral grazing is the only significant activity in the project area. The potential issues that may impact upon this land use include:

- disruption to cattle mustering operations;
- damage or removal of fencing;
- interruption to the water supply for cattle;and
- access to sites within the Pastoral Lease and possible interference with pastoral infrastructure

Water supply to eight wells is likely to be affected by groundwater drawdown from dewatering.

The management objective in relation to adjacent land users is to minimise any direct or indirect impact from the operations.

Cattle mustering occurs periodically throughout the year. Management strategies will be developed to accommodate these events and to schedule activities that may impact on the mustering operations.

Any fencing requiring removal will be replaced and relocated as agreed with the pastoralist.

Monitoring will be undertaken of all wells in the area and alternative water supply provided should the project impact on water availability.

6.8 Recreational Activities

The construction and operations workforces will operate on a fly-in / fly-out basis and consequently there will be limited time available for the workforce to significantly increase recreational pressures in the area. Nonetheless, the influx of a sizable construction and operations workforce has the potential to increase recreation activity in the area placing added pressures on

- areas protected in reserves;
- nesting birds and turtles using sandy beaches in the area;
- sensitive areas such as marine habitats and mangrove communities;
- fishing (open water, river and beach);
- boating;and
- pastoral and other commercial activities

The management objectives of the Balmoral South Iron Ore Project relating to recreational activities are to:

- manage the impact of mine employees and contractors on the “visitor locations” within the vicinity of the project site to minimise the degradation of these location;
- ensure that access to popular “visitor sites” is maintained for the use of the general public; and
- ensure that recreational activities do not significantly increase pressure on the natural resources of the area

7.0 MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

Under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), an action requires approval from the Commonwealth Minister for the Department of Environment, Water, Heritage and the Arts if the action has, will have, or is likely to have a significant impact on a Matter of National Environmental Significance (MNES). The MNES are:

- World Heritage Properties;
- National Heritage places;
- Ramsar wetlands of international significance;
- Nationally listed threatened species and ecological communities;
- Listed migratory species;
- Commonwealth marine areas; and
- Nuclear actions.

In May 2008, IM referred the Balmoral South Iron Ore Project to the Department (EPBC Ref 2008/4236). On 2nd July 2008 the project was determined to be a "controlled action", and will therefore require approval under the EPBC Act. The controlling provisions were that the project was likely to have a significant impact on listed threatened species and communities (Section 18 and 18A) and listed migratory species (Section 20 and 20A).

The PER to be prepared under the Western Australian *Environmental Protection Act 1986* will determine which species are likely to be impacted by the project and apply the MNES Significance Guidelines to determine the significance of the impact.

The environmental assessment of the Balmoral South Iron Ore Project will be conducted in accordance with the "Agreement between the Commonwealth of Australia and WA under Section 45 of the EPBC Act Relating to the Environmental Impact Assessment (the bilateral Agreement) and in conformance with the Cooperative Arrangements to the Bilateral". The potential for the project to impact on the MNES will be assessed in accordance with DEWHA's Administrative Guidelines (DEW, 2006), which state that:

> "In order to decide whether an action is likely to have a significant impact it is important to consider matter such as:
>
> - The sensitivity of the environmental which will be impacted;
> - The timing, duration and frequency of the action and its impacts;
> - All on-site and off-site impacts;
> - All direct and indirect impacts;
> - The total impact which can be attributed to the action over the entire geographic area affected, and over time;
> - Existing levels of impact from other sources; and
> - The degree of confidence with which the impacts of the action are known and understood".

8.0 ENVIRONMENTAL FACTORS, INVESTIGATIONS CONDUCTED TO DATE, POTENTIAL MANAGEMENT AND PROPOSED STUDIES

Table 4 identifies the key environmental factors that are relevant to the Balmoral South Iron Ore Project, the potential impact of the project on these factors, work required to support the PER and the likely actions that will be taken to mitigate or manage impacts.

Table 4 Environmental factors

Environmental factor	Environmental objective	Project component / Potential impacts	Work required	Potential management
BIOPHYSICAL				
Terrestrial vegetation and flora	Maintain the abundance, diversity, geographic distribution and productivity of flora at species and ecosystem levels through the avoidance or management of adverse impacts and improvement in knowledge. Protect species listed under the *Environment Protection and Biodiversity Conservation Act 1999* and Rare and Priority Flora consistent with the provisions of the *Wildlife Conservation Act 1950.*	**Vegetation clearing**	Field survey of the project area to document and map vegetation types and flora present. Survey to be undertaken consistent with EPA Position Statements No. 2 and No. 3, and Guidance Statement No. 51. Overlay project components onto habitat mapping to quantify impacts. Identification of any Threatened or Priority Flora, unusual or poorly known taxa, or restricted vegetation types (including Threatened Ecological Communities [TECs]). Evaluation of the local and regional conservation significance of the species and vegetation types present, including species at their geographical limits. Analysis of clearing areas to quantify loss of vegetation and identify impacts on Threatened or Priority Flora or TECs.	Minimise the extent of clearing required for construction and operation activities. Clearing control procedures to be implemented during construction. Progressive rehabilitation of disturbed areas where possible.
		Threatened flora Priority flora has been identified from the Cape Preston region.		Detailed design will consider the locations of Priority Flora and disturbance will be avoided where possible.
		Cracking Clay Grasslands Cracking clay grasslands are recognised as regionally significant vegetation communities.		Detailed design will consider the presence of Cracking Clay Grasslands and disturbance will be avoided where possible. Pastoral lease boundary rationalisation in 2015 will ensure that substantial areas of these grasslands are preserved within the conservation estate.
		Phreatophytic vegetation (GDEs) Phreatophytic vegetation will be impacted by groundwater drawdown.	Mapping of phreatophytic communities at risk from dewatering, modelling of groundwater drawdown and quantification of potential community loss.	There will be some unavoidable loss of phreatophytic vegetation but it will be minimised by reducing water level drawdown rates where possible, monitoring vegetation and vegetation stress and implementing management measures at identified trigger levels.

Environmental factor	Environmental objective	Project component / Potential impacts	Work required	Potential management
		Weeds The Declared species have been identified from the project area. Potential to spread weeds to uninfected areas.	Field survey to document the extent and occurrence of introduced flora in the project area.	Development of weed management and hygiene plan. Ongoing weed control programme to be implemented during operations.
Mangroves	Maintain the abundance, diversity, geographic distribution and productivity of mangroves and mangrove associations through the minimisation of direct and indirect impacts.	**Mangrove communities** There will be direct mangrove habitat lose through clearing to allow the infrastructure corridor to be built across Mangrove Creek. Potential indirect impacts through potential changes in hydrodynamics.	Document the condition and local and regional representation of mangrove species / assemblages. Evaluate the local and regional significance of affected mangrove areas. Quantify the extent of mangrove clearing and identify aspects of the project with the potential to restrict or alter tidal flushing. Assess impacts against EPA Guidance Statement No. 1 and No. 29.	Adoption of construction techniques to minimise mangrove clearing and changes to hydrodynamics. Implementation of a Mangrove Monitoring Program.
Terrestrial fauna	Maintain the abundance, diversity, geographic distribution and productivity of fauna at species and ecosystem levels through the avoidance or management of adverse impacts and improvement in knowledge. Protect species listed under the *Environment Protection and Biodiversity Conservation Act 1999* and Schedule and Priority Fauna consistent with the provisions of the *Wildlife Conservation Act 1950*.	**Fauna habitat** Clearing vegetation. **Threatened fauna** Priority fauna may occur within the project area. Some threatened and migratory species under the EPBC Act potentially occur.	Field survey of project area to document fauna communities, threatened taxa and potential short-range endemics. Survey to be undertaken consistent with EPA Position Statement No. 3 and Guidance Statement No. 56. Evaluation of the local and regional significance of the fauna and communities present. Quantify reduction in extent of habitat attributable to the project, with evaluation of impacts on fauna occurring on the affected habitat types and on patterns of fauna movement (corridors).	Detailed design will be undertaken to minimise as much as practical the extent of clearing for construction and operational activities. Impacts on fauna will be managed through a process of minimising the area to be disturbed, workforce education, avoidance, monitoring impacts, implementation of remedial strategies where practical and progressive rehabilitation of disturbed areas where possible.

Environmental factor	Environmental objective	Project component / Potential impacts	Work required	Potential management
Subterranean fauna and other Short Range Endemics	To maintain the abundance, diversity, geographic distribution and productivity of subterranean fauna and other short range endemics at the species and ecosystem levels through the avoidance or management of adverse impacts and improvement in knowledge.	**Subterranean fauna** Groundwater extraction has the potential to affect stygofauna. Stygofauna and troglofauna will be impacted through habitat loss.	Review all information on subterranean fauna in the locality and its conservation value. Document the potential impacts of the Central Block and Balmoral South Iron Ore Projects on groundwater drawdown and the amount of orebody likely to remain after development of the projects over next 25 years. Assess the risk of the projects to the biodiversity values of subterranean fauna in the region. Undertake surveys on the areas of impact for the IM Project in accordance with EPA Guidance Statements 54 and 54a (draft). Undertake a risk assessment and if appropriate, surveys for short-range endemic fauna over the disturbance and wider impact footprint in order to assess impacts and recommend appropriate management/mitigation strategies. Investigations into whether claypans are found in the adjacent flats and floodplains that may be impacted by the proposal.	Minimise impacts to subterranean fauna and other short range endemic species. In the event that the subterranean fauna sampling indicates that species may be at risk as a result of the dewatering activities, scopes of work for the development of contingency measures (which may include further investigation outside the footprint or the development of stringent monitoring and management measures) will be included in the PER.
Marine biota	Maintain the ecological function, abundance, species diversity and geographical distribution of marine biota and habitat.	Construction of the seawater intake, brine outfall and diffuser could impact on Benthic Primary Producers (BPP) and Benthic Primary Producer Habitat (BPPH). Habitat disturbance to turtle nesting areas and shorebird roosting and feeding areas. Seawater intake is potentially hazardous to marine fauna.	Field surveys to document the presence of BPPH and the presence of any species of conservation significance. Evaluation of the local and regional conservation significance of species present. Assessment of impacts consistent with EPA Guidance Statement No. 29.	Design of the seawater intake to minimise the potential ingress of marine fauna. Selection of the pipeline corridors to avoid, where possible, BPPH. Filling of the pipeline trench's with rock to construct artificial reef.

Environmental factor	Environmental objective	Project component / Potential impacts	Work required	Potential management
Surface water	Maintain the quantity of water so that existing and potential environmental values, including ecosystem function, are protected. Maintain the integrity, ecological functions and environmental values of wetlands.	**Flood levels** WDF1 will encroach into the floodplain of the Fortescue River with the potential to impact on flood level and extent. Mine site, infrastructure and WDFs will impact surface waters and there is the potential for impacts should their flood protection works fail.	Undertake hydraulic modelling of surface water flows in the Fortescue River and Du Boulay Creek to quantify potential changes as a result of the project. Demonstrate that infrastructure and facilities that encroach on floodplains will withstand flood events with minimal likelihood of catastrophic failure.	Detailed design to minimise impacts including: • bunding to redirect surface water around mine structures; • riprap / armouring to slow and redistribute runoff; • culverts to maintain major flow paths intercepted by infrastructure; • location of mine site infrastructure to minimise encroachment into the 100yr ARI floodplain; • drainage works around the waste • dump; • bunding to contain contaminated runoff.
		Sedimentation Modification of sediment transport, erosion and deposition patterns.	Prevent erosion of WDFs	
Groundwater	Maintain the quantity and quality of water so that existing and potential environmental values, including ecosystem function, are protected.	**Dewatering** Dewatering will cause a cone of depression in the local water table. Potential to impact on phreatophytic vegetation, stygofauna and groundwater users.	Modelling of the cumulative cone of depression from the Central and Balmoral South Iron Ore Projects to determine impact on groundwater levels.	Monitoring of water level drawdown. Establish trigger levels for the provision of alternative water supply to phreatophytic vegetation and groundwater users.
Matters of National Environmental Significance	Ensure that the project does not significantly impact of Matters of National Significance or Other Matters Protected by the EPBC Act.	Listed threaten species and communities (sections 18 and 18A) Listed migratory species (section 20 and 20A)	Determine which species are likely to be impacted by the project and apply the MNES Significance Guidelines to determine the significance of the impact.	If required, develop and implement management measures to reduce or eliminate the potential impact.

Environmental factor	Environmental objective	Project component / Potential impacts	Work required	Potential management
POLLUTION MANAGEMENT				
Air Quality	Ensure that emissions do not adversely affect environment values or the health, welfare and amenity of people and land uses.	**Dust emissions** Earthworks, mining, ore processing and ore handling will produce dust.	Identify potential sources of dust and quantify likely impacts on the receiving environment. Impact assessment and management will recognise the requirements of the Draft DEC Dust Guidance Statement.	Project design will ensure that dust is captured at source wherever practical. Dust will be managed using standard dust suppression techniques such as water sprays, chemical suppressants and revegetation. Dust monitoring will comply with the current ambient air quality NEPM and monitor PM_{10}. Monitoring of $PM_{2.5}$ will also be undertaken.
		Process emissions The pellet plant and power station will emit particulates, carbon monoxide and oxides of nitrogen and sulphur dioxide which have the potential to adversely impact on human and animal health, and vegetation.	Modelling of emissions to determine compliance with appropriate standards and guidelines. The assessment will consider cumulative emissions from the approved Central Block Project. Undertake modelling in accordance with the DoE's Air Quality Modelling Guidance Notes.	Project design will ensure that levels of atmospheric pollutants are minimised at source wherever practical. Demonstrate that best practicable technology has been adopted for the design and construction of the power station, particularly with regards to NO_X emissions, in line with the EPA Guidance Statement No.15.
		Photochemical smog The power station and pellet plants will emit oxides of nitrogen which could lead to an increase in photochemical smog in the region.	Undertake a photochemical smog study which accounts for other emissions in the region. Undertake modelling in accordance with the DoE's Air Quality Modelling Guidance Notes.	
Greenhouse gases	Minimise emissions to levels as low as practicable on an on-going basis and consider offsets to further reduce cumulative emissions.	The project will generate greenhouse with the highest emissions will occur from the power station.	Quantification of greenhouse gas emissions and demonstration that emissions are as low as reasonably practical.	Development of a Greenhouse Gas Management Strategy and implementation of the plan over the life of the project. Minimising emissions to levels as low as reasonably practicable on an on-

Environmental factor	Environmental objective	Project component / Potential impacts	Work required	Potential management
				going basis: • improving fuel consumption efficiency per tonne of ore hauled; • focussing on the quality of fuel / lubricants used with an objective to reduce hydrocarbon waste and increase productivity per truck; • assessing alternative waste and ore disposal technologies, such as in-pit crushing and conveyor to reduce fuel burn.
Surface and groundwater quality	Maintain the quality of surface water and groundwater to ensure that existing and potential uses, including ecosystem maintenance are protected	**Surface water** Potential for downstream water quality to deteriorate from the discharge of chemicals and hydrocarbons from the workshop and plant areas, seepage from the WDFs and discharge from the sewage treatment plant.	Describe the type and quantities of: • domestic and industrial wastes; • process wastes; and • construction wastes. Characterisation of waste materials and the potential for seepage to contaminate groundwater. Assess the environmental threats posed by the wastes identified. Determine appropriate disposal procedures and specify relevant limits and standards.	Project design to minimise waste and incorporate environmentally appropriate technologies for waste management. Development of a waste management plan with procedures to ensure appropriate handling, treatment and disposal of wastes and identification of opportunities to avoid, reduce, ameliorate and manage development wastes. Construction of diversion works around infrastructure areas to separate natural runoff waters from internal site runoff.
		Groundwater Potential contamination of the Fortescue River Alluvial aquifer.		Design of the WDFs to minimise seepage. Monitoring to detect any seepage and contingency measures to correct unacceptable contaminate loss.
		Pit void Long term build up of salinity in the pit lake from evaporative concentration which could locally impact groundwater	Assessment of changes to water quality in the pit over time and prediction of the likely environmental impact of these changes.	Minimisation of the final void and development of a Preliminary Decommissioning and Closure Plan which includes addressing the long term management of the pit void.

Environmental factor	Environmental objective	Project component / Potential impacts	Work required	Potential management
		quality.		
Marine water quality	Maintain water and sediment quality consistent with the Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Protect environmental values for recreation, aesthetics, aquatic life and maintenance of ecosystems in specified areas.	There is the potential to: • reduce local marine water and sediment quality; • adversely affect individual marine biota within the vicinity of the outfall; and • reduce the abundance of sensitive benthic primary producer habitat, including coral communities.	Field survey to describe the existing environment including mapping and benthic habitat characterisation and classification. Modelling of the Central Block and Balmoral South Iron Ore Projects outfalls to determine the cumulative impact of brine discharge on the marine environment. Modelling will predict the frequency, duration and intensity of discharge events to the marine environment and associated zones of impact. Hydrodynamic analysis in the context of understanding the marine environment, flushing capacity and dilution capacity for the desalinisation discharge. Assess impacts against EPA Guidance Statement No. 29. Impact predictions will be prescribed and spatially defined in the context of the environmental quality management framework presented in the Pilbara Coastal Water Quality Consultation Outcomes: Environmental Values and Environmental Quality Objectives (DoE 2006). Investigations will spatially define and justify the environmental quality objectives around the outfall and the environmental values that will be protected. Justify the location of the discharge point and confirm that the discharge will not impact water quality and biodiversity values of the Regnard Marine Management Area.	Develop a Quality Management Strategy for assigning zones of impact, predicting loss of benthic habitats and applying appropriate ecological water quality standards and criteria for monitoring and management. Monitor relevant parameters in the desalination plant outfall to confirm modelling predictions and ensure that salinity and toxicants do not exceed stipulated limits. Monitor ecosystem health indicators in the receiving environment.
Noise	Protect the amenity of nearby residents from noise impacts resulting from	Mining, ore processing and ore handling will produce noise emissions with the potential to	Noise and vibration modelling using SoundPLAN to demonstrate compliance with the *Environmental Protection (Noise) Regulations 1997*.	Design of the project to minimise noise and vibration emissions and review operational procedures if noise

Environmental factor	Environmental objective	Project component / Potential impacts	Work required	Potential management
	activities associated with the proposal.	impact the public and the workforce. Blasting will be employed during mining	Assessments and management of impacts to marine and terrestrial fauna associated with noise emissions during construction and operation.	emissions exceed agreed limits.
Solid and Liquid Wastes	Minimise any solid and liquid wastes produced as a result of the project. Integrate a waste hierarchy (i.e. avoid, reuse, reduce, recycle, treat, dispose) for waste minimisation and establish a 'closed loop' within as many waste streams as possible. Ensure no release of hydrocarbons to the environment, either as a result of storage or handling incidents. Ensure liquid and solid wastes are treated onsite or disposed of off-site at an appropriate landfill facility.	The project will generate a variety of waste materials including scrap metal, tyres, wood, paper, hydrocarbons, domestic solid and liquid wastes and processing wastes. If these wastes are not managed in an appropriate manner, a range of potential impacts are possible. These include the contamination of land, change in water quality of surface water and groundwater, and/or contamination of ecological habitats.	Describe the types of wastes including: • domestic, industrial and hazardous wastes (e.g. waste water and workshop wastes); • mining wastes (e.g. waste rock); and • process wastes (e.g. tailings and waste water). Identify management options for the various waste streams.	The management measures for solid and liquid wastes are: • storing hydrocarbons in approved bunded facilities; • bioremediating hydrocarbon contaminated soils onsite; • collect and remove waste oils; • recycling wastes such as batteries, and scrap metal; • disposing non-recyclable domestic and industrial waste to an onsite landfill; • treating sewage and grey water for reuse; and
SOCIAL SURROUNDS				

Environmental factor	Environmental objective	Project component / Potential impacts	Work required	Potential management
Recreation	Manage the impact of mine employees and contractors on the "visitor locations" within the vicinity of the project site. Ensure that access to popular "visitor sites" is maintained for the use of the general public. Ensure that recreational activities do not significantly increase pressure on the natural resources of the area.	Potential to impact on the camping ground at the mouth of the Fortescue River. An influx of construction and operations personnel has the potential to place additional pressure on the environment.	Quantify impacts on existing recreational uses and resources in the area.	All project personnel will undergo a site specific environmental induction before commencing work at the operation. The induction will include information regarding the responsibilities and expected behaviour of all personnel toward the environment, and will provide necessary awareness of recreational impacts and how those impacts will be managed.
Aboriginal Heritage	Avoid or minimise impacts to Aboriginal cultural heritage sites. To ensure that the proposal complies with the requirements of the *Aboriginal Heritage Act 1972*.	Potential impact on sites of Aboriginal significance.	Finalise Heritage Agreements, management plans or other agreements following further consultation with the Claimant Groups and the Department of Indigenous Affairs. Conduct further surveys across the Balmoral South Iron Ore project area in consultation with local Aboriginal groups.	Implement procedures for the identification and management of any additional sites located during the construction and operational phases of the project. This may include the use of monitors during ground disturbing activities and the development of specific procedures for the preservation of heritage sites.
European Heritage	Ensure that changes to the biological and physical environment resulting from the project do not adversely affect historical and cultural associations with the area and comply with relevant heritage legislation	There are no European heritage sites known to occur within the project Area.	-	No specific management is required.
Public health and safety	Ensure that the risk to the public is as low as	The potential health and safety issues for the project are:	Demonstrate an understanding of the potential impacts of the project on public health and safety	Exclusion of the general public from the project area.

Environmental factor	Environmental objective	Project component / Potential impacts	Work required	Potential management
	reasonably practicable and complies with appropriate standards♣. Ensure that traffic activities resulting from the project do not adversely impact on the social surroundings. Ensure that the risk is managed to comply with DoIR requirements and EPA criteria in respect of public health and safety.	• traffic on the Fortescue River access road; • public access to the project area; • spillage of hazardous materials on public roads; • process emissions from the pellet plant and power station; • dust from exposed areas and materials handling.	and document the measures proposed to minimise or mitigate the impact.	Ongoing management of the Fortescue River access road, dust management through the use of water carts (or similar), vehicle speed restrictions and adoption of safety procedures and installation of spill kits on transport vehicles.
OTHER				
Cumulative impacts for IM Assessment	Ensure that impacts from the project are understood and assessed in the context of impacts arising from other approved projects in the area.	Development of the Balmoral South Iron Ore project will result in impacts that that will need to be assessed in relation to the approved Central Block Project.	Quantify impacts associated with the Balmoral South Iron Ore project and assess impacts in relation to those predicted for the approved Central Block Project. In particular the PER will address individual and cumulative impacts associated with the following factors: • terrestrial flora and vegetation; • mangroves; • terrestrial fauna; • subterranean fauna; • marine ecology; • surface water including risk of infrastructure failure; • groundwater; • process emissions; • marine water quality; and • noise	Management measures will be determined on the issues identified and would be addressed under each specific factor.
Cumulative	Provide the EPA with a high	Provided for information	Assessment of the cumulative impacts of the four	-

Environmental factor	Environmental objective	Project component / Potential impacts	Work required	Potential management
Impacts considering all future Cape Preston projects	level understanding of the cumulative impacts arising from the development of four projects in the area.	purposes only and does not form part of the IM assessment.	projects proposed for the area at a high level, using available information and conceptual project descriptions. This Cumulative Impact Assessment will be appended to the PER.	
Decommissioning and Closure	To ensure that rehabilitation occurs in a planned sequential manner consistent with best practice.	Mining will result in excavation and the establishment of WDFs.	Assessment of potential impacts on existing landforms. Detail measures proposed to rehabilitate the impacted area to an acceptable standard which will integrate the post mining landform with the surrounding environment.	Preparation of a Mine Closure Plan. Progressive rehabilitation of disturbed areas. Ongoing monitoring.

9.0 CUMULATIVE IMPACT ASSESSMENT

9.1 Central Block and Balmoral South Iron Ore Projects

The Central Block Project received environmental approval for the development of a mine, processing plant, stockyards, villages, port, dredging and associated infrastructure (Ministerial Statement 000635) in October 2003. Construction activities associated with this project have commenced.

The assessment for the Balmoral South Iron Ore project has been prepared to quantify impacts associated with the development of this project in isolation and to address cumulative impacts based on the assumption that the impacts predicted for the Central Block Project have already occurred. In particular the PER will address individual and cumulative impacts associated with the following factors:

- terrestrial flora and vegetation;
- mangroves;
- terrestrial fauna;
- subterranean fauna;
- marine ecology;
- surface water;
- groundwater;
- process emissions;
- marine water quality; and
- noise

Where necessary, the prediction of impacts associated with development of the Central Block Project have been updated to reflect a greater level of knowledge gained through the continued collection of data over the last six years. For example, a better understanding of the hydrogeology of the region has allowed an upgraded regional groundwater model to be developed which better represents impacts associated with the development of multiple pits.

9.2 Mineralogy Proposed Projects

Two further projects are currently proposed by Mineralogy for the Cape Preston area (refer to "*Figure 7 Cape Preston Master Plan Mine and Port Cumulative Areas of Disturbance Sheet 1 of 2"* and "*Figure 8 Cape Preston Master Plan Mine and Port Cumulative Areas of Disturbance Sheet 2 of 2"*). These projects are:

- Austeel Steel Project; and
- Mineralogy Iron Ore Project.

Given that the projects are all located in the general area of Cape Preston, a number of cumulative environmental impacts are likely. At the request of the EPA, Mineralogy has agreed to prepare an assessment of the key environmental values that may be impacted through development of the four projects. This document will not attempt to quantify impacts, rather it will examine at a high level the likely impacts on key environmental values based on the current level of knowledge of these values and of the specific engineering details available on the projects.

IM has agreed to present this assessment in the Balmoral South Iron Ore Project PER for information purposes only on the understanding that it may assist in a better understanding of the impact of the further development on the key environmental values in the region.

Figure 7 Cape Preston Master Plan Mine and Port Cumulative Areas of Disturbance Sheet 1 of 2

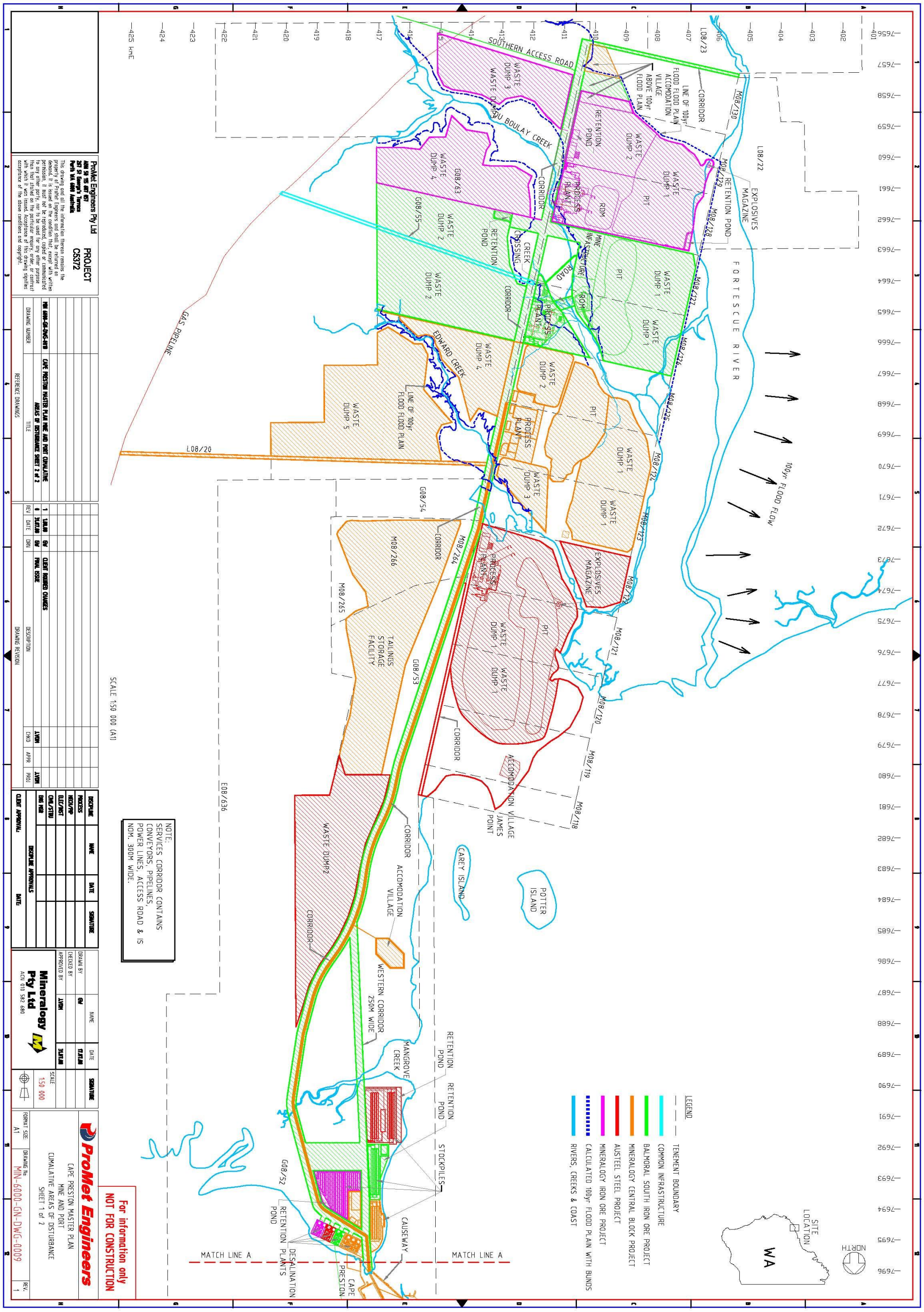
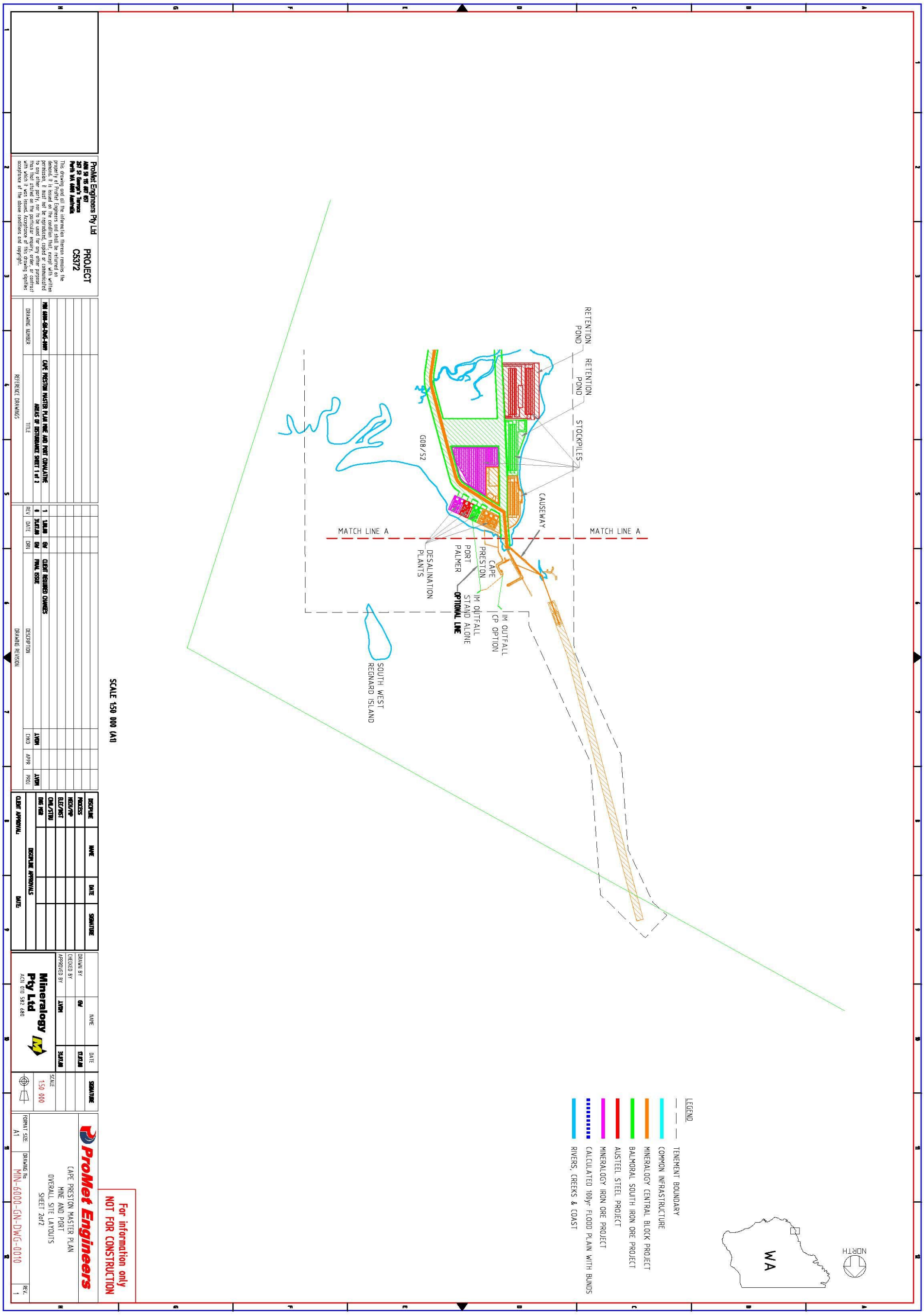


Figure 8 Cape Preston Master Plan Mine and Port Cumulative Areas of Disturbance Sheet 2 of 2



10.0 ENVIRONMENTAL MANAGEMENT STRUCTURE

IM will manage the development of the ore-body, associated processing and infrastructure in compliance with the environmental conditions and relevant legislation. To ensure a transparent transfer of commitments and statutory guidelines from the PER to onsite management for both the construction and operational phases of the project, the following will be implemented:

Project Environmental Management Plan (PEMP): this will be appended to the PER and will address the management of construction and operations impacts associated with the project. IM is seeking approval for the PEMP as part of the PER process;

Environmental Management System (EMS): To ensure that proper procedures are in place to manage all the environmental impacts of a proposal, IM will implement an EMS that complies with:

the EPA's Guidance for the Assessment of Environmental Factors Number 43 Guidance Statement to Assist Proponents in Understanding the EPA's Requirements in Relation to the Condition on Environmental Management Systems;

ISO 14001:1996 "Environmental Management Systems – Specifications for guidance and use"; and

ISO 14001:1996 "Environmental Management Systems – General Guidelines on principles, systems and supporting techniques".

IM believes that the integrated / streamlined approach to the preparation and use of a PEMP will allow for greater integration and transparency of environmental management practices during the construction and operation phases of the Balmoral South Iron Ore Project. Contractors and onsite environmental staff will have a single consistent document to guide their environmental management practices with the EMS framework ensuring best practice measures are being followed and recorded.

11.0 APPLICABLE LEGISLATION

The following tables list the legislation, policies, agency guidelines, standards and codes of practice relevant to this assessment.

Table 4 State Legislation

Legislation	Relevance / Application
Iron Ore Processing (Mineralogy Pty Ltd) Agreement Act 2002	Act under which the project is developed and to which IM is a co-signatory
Aboriginal Heritage Act 1972	Protection of Aboriginal heritage sites
Agriculture and Related Resources Protection Act 1976	Addresses the obligations for management, control, destruction, and notification of gazetted noxious plants and animals
Conservation and Land Management Act 1984	Protection and management of land vested for conservation purposes
Environmental Protection Act 1986	Mechanism that provides for formal assessment of the proposal and assigns impact management responsibilities to the proponent
Mining Act 1978	Act to consolidate and amend the law relating to mining and for incidental and other purposes.
Explosives and Dangerous Goods Act 1961	Correct procedures for transporting handling and storing explosive and dangerous goods such as explosives, hydrocarbons and chemicals
Health Act 1911 – Health (Treatment of Sewage and Disposal of Effluent and Liquid Waste Regulations) 1974	Procedures for the treatment and disposal of effluent waste
Mines Safety and Inspection Act 1994	Protocol for waste disposal
Occupational Health, Safety and Welfare Act 1984	Sets workplace limits for air quality
Rights in Water and Irrigation Act 1914	Governs water resource management and allocation ensuring water resources are comprehensively and appropriately managed. Regulation of draw on groundwater
Wildlife Conservation Act 1950	Provides for the conservation and protection of wildlife (flora and fauna). Special provisions and schedules cover protection and management of gazetted rare flora and fauna

Table 5 Policies, Guidelines and Standards

Best Environmental Practice in Mining
Community Consultation and Involvement
Tailings Containment
Rehabilitation and Revegetation
Planning a Workforce Environmental Awareness Training Programme
Managing Sulphidic Mine Wastes and Acid Drainage
Environmental management Systems
Water Management
Decommissioning and Planning for Mine Closure
Noise, Vibration, and Airblast Control
Dust Control
Environmental Monitoring and Performance
National Environmental Protection Council Guidelines
National Environmental Protection (Ambient Air Quality) Measure for Particles as $PM_{2.5}$
National Environment Protection (Ambient Air Quality) Measure. Technical Paper on Monitoring for Particles as $PM_{2.5}$

Table 6 EPA Position and Guidance Statements

Environmental Protection Authority Position Statements	
2	Environmental Protection of native Vegetation in Western Australia
3	Terrestrial biological Surveys as an Element of Biodiversity Protection
5	Environmental Protection and Ecological Sustainability of the Rangelands in Western Australia
6	Towards Sustainability
7	Principles of Environmental Protection
9	Environmental Offsets
Environmental Protection Authority Guidance Statements	
1	*Protection of Tropical Arid Zone Mangroves Along the Pilbara Coastline*
12	*Minimising Greenhouse Gas Emissions*
15	*Emissions of Oxides of Nitrogen from Gas Turbines*
18	*Prevention of Air Quality Impacts from Land Development Sites*
29	*Benthic Primary Producer Habitat Protection for Western Australia's Marine Environment*
51	*Terrestrial Flora and Vegetation Survey for Environmental Impact Assessment in Western Australia*
54	*Sampling of subterranean fauna in groundwater and caves*
54a	*Sampling Methods and Survey Considerations for Subterranean Fauna in Western Australia*
55	*Implementing best practice in proposals submitted to the environment impact assessment process*
56	*Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia*

Table 7 Works Approvals and Licensing

Category Number	Description of Category	Production or Design Capacity
5	**Processing or beneficiation of metallic or non-metallic ore**: premises on which a) metallic or non-metallic ore is crushed, ground, milled or otherwise processed; b) tailings from metallic or non-metallic ore are reprocessed; or c) tailings or residue from metallic or non-metallic ore are discharged into a containment cell or dam.	50 000 tonnes or more per year
6	**Mine dewatering**: premises on which water is extracted and discharged into the environment to allow mining of ore.	50 000 tonnes or more per year
44	**Metal smelting or refining**: premises on which metal ore, metal ore concentrate or metal waste is smelted, fused, roasted, refined or processed.	1000 tonnes or more per year
52	**Electric power generation**: premises (other than premises within category 53 or an emergency or standby power generating plant) on which electrical power is generated using a fuel.	20 megawatts or more in aggregate (using natural gas) 10 megawatts or more in aggregate (using a fuel other than natural gas)
54	**Sewage facility:** premises - a) on which sewage is treated (excluding septic tanks); or b) from which treated sewage is discharged onto land or into waters.	100 cubic metres or more per day
57	**Used tyre storage (general):** premises (other than premises within category 56) on which used tyres are stored.	100 tyres or more
58	**Bulk material loading or unloading:** premises on which clinker, coal, ore, ore concentrate or any other bulk granular material is loaded onto or unloaded from vessels by an open materials loading system.	100 tonnes or more per day
62	**Solid waste depot**: premises on which waste is stored, or sorted, pending final disposal or re-use.	500 tonnes or more per year

Category Number	Description of Category	Production or Design Capacity
64	**Class II or III putrescible landfill site**: premises on which waste (as determined by reference to the waste type set out in the document entitled "Landfill Waste Classification and Waste Definitions 1996", published by the Chief Executive Officer and as amended from time to time) is accepted for burial.	20 tonnes or more per year

Table 8 Commonwealth Legislation

Legislation	Relevance / Application
Environment Protection and Biodiversity Conservation Act, 1999	Protection for matters of national environmental significance from development impacts
Native Title Act, 1993	Affords certain rights to Indigenous land owners
National Occupational Health and Safety Commission Act, 1985	Healthy and Safety in the workplace

Table 9 Other Guidelines

Other	Relevance / Application
Recreational Fishing Guidelines – Pilbara and South Coast Regions 2003/04	Provides guidance to recreational fishers in coastal waters of WA
Recreational Net Fishing Guidelines for WA 2004	Controls use of fish nets in coastal waters of WA
Environmental Protection (Noise) Regulations 1997	Control of construction and operational noise
Environmental Protection (Controlled Waste) Regulations 2001	Management of Contaminated Soil Bioremediation landfarm.
Draft Code of Practice for Rural Landfills	Correct protocol for design and management of putrescible waste landfill.
Landfill Waste Classification and Waste Definitions	Classification of site waste.
Guidelines for Direct Land Application of Biosolids and Biosolids Products	Method for disposal of sludge
Bioremediation of hydrocarbon-contaminated soils in Western Australia	Methods for Contaminated Soil Bioremediation
Management of Asbestos in Mining Operations	Provides guidance for the appropriate handling and disposal of asbestiform minerals
Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2000	Provides criteria for marine water quality

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