CITIC PACIFIC MINING

SINO Iron Project

Operational Environmental Management Plan

APPENDIX C - Part 2

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Appendix C
PART 2

SINO Iron Project, Cape Preston Port Environmental Management Plan, Stage 1 Port Operational Activities - November 2011 (Version 15)

Appendix 2

Ballast Water and Biofouling Management Plan – Cape Preston

SINO IRON PROJECT

Cape Preston Port Environmental Management Plan

APPENDIX B

Ballast Water and Biofouling Management Plan

Prepared for

CITIC Pacific Mining Management Pty Ltd

Level 10, 99 St Georges Terrace
Perth WA 6000 Australia

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Project Managers:	Fred Wells Consultant Marine Ecologist	URS Australia Pty Ltd
	Kerry Neil Principal Environmental Scientist GHD, Cairns Qld.	Level 3, 20 Terrace Road East Perth WA 6004 Australia Tel: 61 8 9326 0100 Fax: 61 8 9326 0296
Project Director:	Ian Baxter Senior Principal Environmental Scientist	

Contents

Contents

Tables, Figures, Appendices

Tables

Figures

Appendix

Executive Summary

This Ballast Water and Biofouling Management Plan (BW&BFMP) has been prepared in accordance with conditions set in Minister for the Environment Statement 635. Specifically, this management plan relates to the following Conditions:

Condition 9-1 (5), the Port Environmental Management Plan (PEMP) shall '*incorporate a ballast water management plan*'.

Condition 9-1 (6) the PEMP shall '*include a hull-fouling organisms management plan, which includes a risk assessment and a baseline marine survey for benthic and planktonic organisms in the area designated for ship berthing to minimise the risk of introduction of exotic marine organisms from ships' hulls*'.

This plan is also in accordance with State and Commonwealth legislation.

There are two main vectors that can introduce marine pests and exotic marine organisms to Australian port waters. These include:

- ballast water contained within ship's tanks; or
- biofouling of ship hulls, underwater fittings and voids, and internal seawater systems.

Once established, invasive marine pest species (IMP) have the potential to cause major economic, social and ecological disruption. Costs for control can be significant and eradication, once established, is unlikely.

The BW&BFMP has been prepared as a stand alone document associated with the greater PEMP. It will be implemented during Stage 1 operations and will cover all shipping activities associated with the port facility.

In terms of ballast water, the objective of this plan is to ensure that the requirements of the Australian Quarantine and Inspection Service (AQIS) are met for vessels arriving from international waters. Domestic ballast water controls are not yet in place. When they are imposed this BW&BFMP will need to be amended as required to implement the necessary controls for Cape Preston operations.

In terms of biofouling, the objective of this plan is to avoid the introduction of IMP from ships' internal seawater systems and hulls establishing in the port. This plan will ensure that the taxa carried on or in hulls and internal seawater systems of vessels do not pose a threat to Australia's biosecurity. The applicable Australian National Biofouling Guidelines will be adhered to during construction, maintenance and operation of the port at Cape Preston to reduce biofouling risks.

The plan provides guidance on effective procedures for ballast water and biofouling management.

No IMP were found in a baseline survey conducted at Cape Preston in February 2009. Ongoing monitoring surveys will be undertaken in accordance with a standard survey protocol to be developed for Cape Preston. The surveys will be consistent with the requirements of the Australian *Marine Pest Monitoring Guidelines* and the associated *Marine Pest Monitoring Manual*.

Ultimate responsibility for ensuring that site environmental management requirements as per this BW&BFMP are met will rest with the Port Manager. The environmental responsibilities of the Port Manager will include:

- ensuring that all personnel, including both the proponent's workforce and contract personnel, conform with the requirements pursuant to this BW&BFMP;
- ensuring that contractor staff are fully inducted and aware of their environmental responsibilities and obligations; and
- ensuring that monitoring requirements are being met.

Executive Summary

In the case of an IMP emergency, both the Environment Manager and the Port Manager will be informed. The problem will then be dealt with by the two Managers and reported to the Board and the Department of Fisheries by the Environment Manager.

Contracting companies employed at the site will be required to appoint an environmental representative. The key responsibilities of this representative will be to:

- maintain routine contact with the Port Manager to ensure that environmental objectives of the BW&BFMP are being met;
- provide monthly reports to the Port Manager on environmental issues;
- conduct regular audits; and
- ensure that all management aims and monitoring requirements of this BW&BFMP are being met.

Section 1 Introduction and Background

1.1 Introduction

Mineralogy (the Proponent) submitted a Public Environmental Review (PER) to the Environmental Protection Authority (EPA) in December 2000 together with additional information contained in a Supplementary Environmental Review (SER) submitted in February 2002.

In accordance with Part IV of the *Environmental Protection Act 1986* (EP Act), the EPA reported on the Project in Bulletin 1056 in July 2002. The Project received Ministerial approval on 20 October 2003 (Statement 635).

Since 2003 there have been extensive revisions to the planned port construction that significantly reduces the risk of introducing marine pest species (IMP) to the Cape Preston area. Present plans are for the port consist of six elements as follows:

Stage 1

1. a solid rock causeway between the mainland shore at Cape Preston and the shallows to the north of Preston Island;
2. a solid rock breakwater that will extend from the end of the causeway around navigable waters to the northwest of Preston Island;
3. wharves, tug pens, export barge loading and heavy lift unloading and materials import facilities inside the breakwater;
4. a large volume seawater intake inside the western end of the breakwater and a brine disposal outfall and diffuser to the north of the breakwater;

Stage 2

5. a 1,400 m long piled jetty extending from the seaward end of the causeway; and
6. a dredged shipping channel adjacent to the jetty and heading north toward the open sea.

The first vessels for construction of the Stage 1 facilities are not likely to be on site until the second half of 2009.

Stage 1 (elements 1-4 above) of the development will involve ocean going vessels (OGVs) docking at the Transhipment Facility located some 20 km offshore from Cape Preston in 23.5 m water depth . There will be no bulk carriers coming into shallow nearshore waters until the jetty is built in Stage 2. Some roll on/roll off (RO/RO) and heavy lift vessels will be coming to the port, but this will be after they have first undergone inspection at Dampier by the Australian Quarantine and Inspection Service (AQIS).

There has been considerable increase in our knowledge of IMP in Australia, and in Western Australia in the five years since the Ministerial Conditions were released in 2003. Importantly, the National Introduced Marine Pests Coordination Group (NIMPCG 2006a,b) has undertaken a major risk assessment of all species worldwide that have been reported as invasive in one or more of the world's marine areas. The risk assessment was used to develop a national list of 55 target species for marine pest monitoring. It must be recognised that any monitoring program will be designed to incorporate the possibility that species not on the list may develop invasive characteristics.

A major paper by Huisman et al. (2008) compiled all available information on introduced marine species in Western Australia. Only four of the 55 species on the NIMPCG target list have been recorded in WA, and none have been found north of Fremantle.

The extensive information developed on IMP in Australia since 2003 is used as the basis for the development of the Ballast Water and Biofouling Management Plan (BW&BFMP).

Section 1 Introduction and Background

1.2 Project Objectives

Condition 9-1 of Statement 635 states:

"Prior to the commencement of ground-disturbing activities at Cape Preston or Preston Island (whichever is the sooner), the proponent shall prepare a Port Environmental Management Plan to address emissions from the port berthing facility, product-handling facilities, desalination plant, and associated structures, to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.

This plan shall also be submitted to the Department of Environment and Conservation and the Department of Fisheries."

Condition 9-1.5 states that the PEMP shall:

- "incorporate a ballast water management plan; and
- include a hull-fouling organisms management plan, which includes a risk assessment and a baseline marine survey for benthic and planktonic organisms in the area designated for ship berthing to minimise the risk of introduction of exotic marine organisms from ships' hulls."

The purpose of the project is to meet these Ministerial conditions. It should be noted that this report deals only with Stage 1. If a decision is made in the future to undertake Stage 2 (1400 m jetty and dredged shipping channel), this plan will be amended as required. The terminology 'Ballast Water and Biofouling Management Plan' has been developed in recognition that biofouling can occur on all vessel surfaces in contact with seawater, not just the hull. These additional surfaces include, but are not limited to, sea chests, internal piping, etc.

A baseline survey for marine pests was conducted at Cape Preston in February 2009 and the results presented by URS (2009); no IMP were found.

1.3 Vessel Operations

Vessel activities and associated operations around Cape Preston to be managed by this plan will include:

- operation of shallow draft, heavy lift barges, which will most likely come from Dampier;
- regular barge movements involving the barges being loaded with iron concentrate and towed out to the transhipment facility by tugs;
- a large transhipment facility moored offshore in deep water. The facility will be supplied from Dampier with food and diesel fuel so that it can re-fuel the tugs towing the barges offshore;
- OGVs which will tie up alongside the transhipment facility offshore and be loaded from barges tied up on the other side of transhipment facility.

1.4 Scope

This BW&BFMP provides a summary of the proposed port and the statutory requirements for preparation of this plan. The intent of this plan is to detail the management actions that will be taken to reduce the risk of introductions of IMP through ballast water and biofouling as a result of the operation of the offshore facilities at and near Cape Preston during Stage 1. The management objectives, key actions, responsibilities and timing are based on current and proposed government requirements and current best practice in the management of IMP issues.

Section 1 Introduction and Background

Management of ballast water and biofouling issues can be divided into two phases:

- the construction phase, during which the facilities will be built; and the
- the operational phase, when the marine facilities will be producing.

As indicated in Section 1.1, this plan is for Phase 1 of the development, which will last for the next several years. This plan will be amended as required before construction of Phase 2 port facilities commences. There is no firm timeline for the commencement of Phase 2.

It should be noted that this BW&BFMP is a dynamic document and will be reviewed and revised on a regular basis to ensure that it remains current and relevant.

It is likely that the Proponent will hand over management of the port to an external Port Manager. To allow for this contingency, this document refers to responsibilities for IMP management residing with the Port Manager.

Section 2 Summary of Existing Environment

This section forms a summary of the information provided in the Marine and Coastal Environmental Report (HGM 2006) as background information on current conditions at Cape Preston.

2.1 Coastal and Marine Environment

In the Cape Preston area (Figure 2-1), coastal habitats typically consist of mangroves, sandy beaches and rocky shores. No current developmental pressures have been identified for the existing coastal habitats.

The region's marine habitats include algal meadows, soft sediment communities and coral and rocky reefs (URS 2008), which support a variety of marine plants and animals. Current pressures in the marine environment include trawling, which is likely to have resulted in highly modified benthic habitats in the region.

The area is prone to cyclonic disturbance.

2.2 Marine Water Quality

Water quality sampling for the current proposal has been undertaken on a number of occasions including:

- March 2000 by DAL for Occtech Engineering
- November 2002 by HGM
- July 2004 by HGM

The physical and chemical characteristics of the waters of the Cape Preston region are currently relatively undisturbed. Water temperatures in the region vary considerably, from about 20°C in winter to about 30°C in summer, with shallower near-shore waters having a greater seasonal temperature range than the deeper offshore waters. The region is characterised by sheltered waters with high turbidity and fine sediments close to the mainland coast, and clearer waters further off-shore. Being relatively displaced from current industry in the Pilbara, the waters in the Cape Preston region are relatively free from any known metal contaminants. Despite relatively low chlorophyll *a* levels in the area, nutrient levels appear to be relatively high, suggesting that there is the potential for much higher chlorophyll *a* levels with the right conditions.

2.3 Marine Sediments

Marine sediments of the Cape Preston region are currently relatively pristine, although likely to be periodically disturbed by trawling activities and cyclones.

2.4 Biota

Analysis of both phytoplankton and zooplankton samples collected by Maunsell (2006) showed assemblages reasonably consistent with those expected in the region, with no taxa conspicuous by either their presence or absence in the assemblages (Maunsell 2006). A recent survey of Cape Preston found no marine pest species on the NIMPCG (2006a,b) target list (URS 2009).

Section 2 Summary of Existing Environment

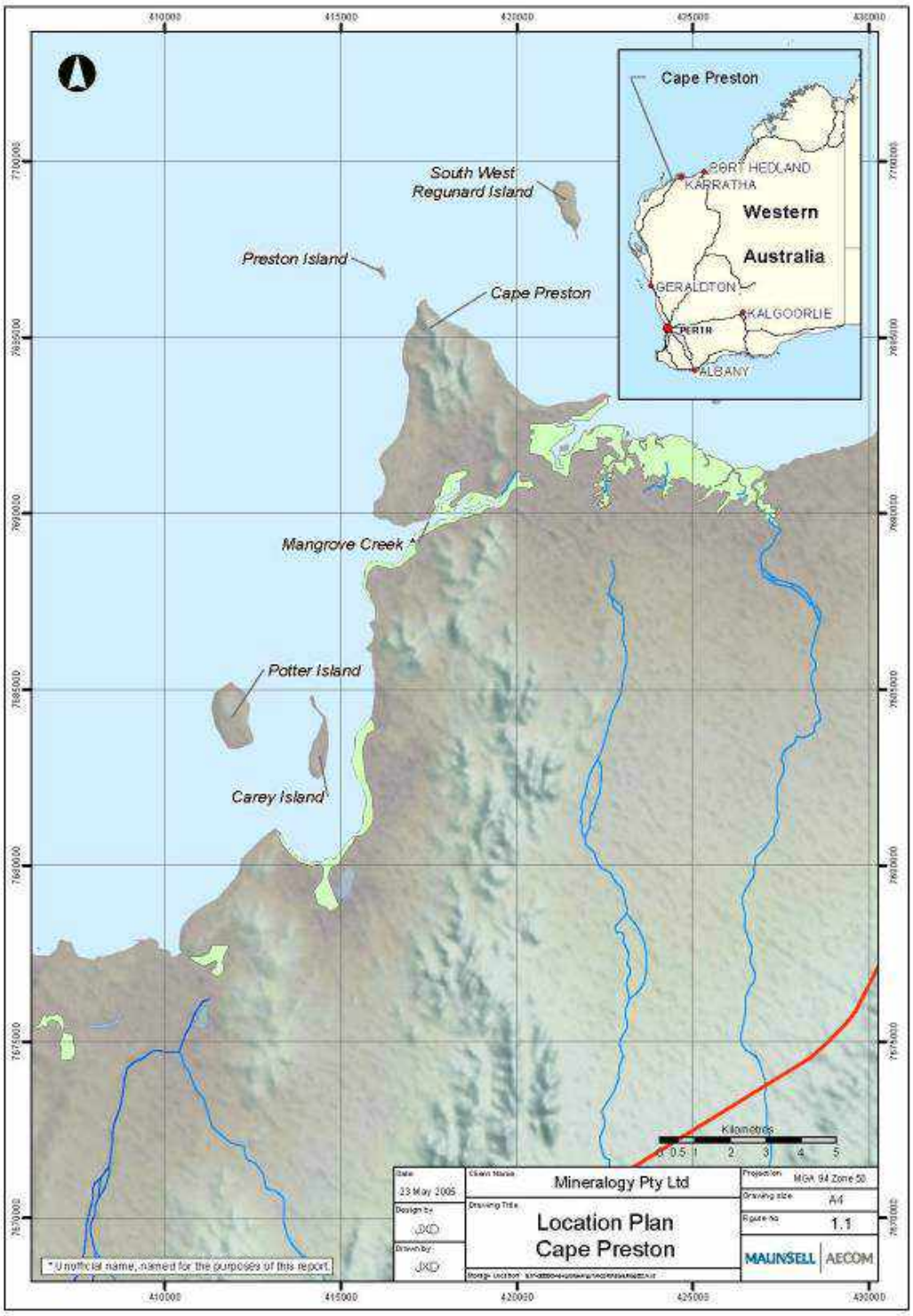

Figure 2-1 Locality map of Cape Preston, Western Australia

Section 3 Statutory, Policy and Regulatory Commitment

3.1 Ministerial Conditions

The Ministerial Conditions relevant to this plan are outlined in Section 1.2. These conditions are mandatory and were issued by the WA Minister for the Environment pursuant to the provisions of the EP Act.

3.2 National System for Marine Pest Management

The Ministerial Conditions are consistent with an integrated approach to managing IMP and their vectors currently being developed for Australia through the National System for the Prevention and Management of Marine Pest Incursions (the 'National System'). The Australian Government Department of Agriculture, Fisheries and Forestry (DAFF) is the lead agency responsible for coordinating the development of practical policy approaches to address the issue of IMP in Australian waters.

The Invasive Marine Pest Species Program within DAFF coordinates the development and implementation of the National System, with the responsibility of implementation shared between the Australian, State and Northern Territory Governments. DAFF coordinates IMP management with relevant Australian Government agencies, including the Department of the Environment, Water, Heritage and the Arts (DEWHA), the Department of Infrastructure, Transport Regional Development and Local Government (DoITRDaLG), the Australian Maritime Safety Authority, the Australian Quarantine and Inspection Service (AQIS), the Department of Industry, Tourism and Resources and the Defence Science and Technology Organisation. DEWHA is managing the development of the Ongoing Management and Control element of the National System.

The National System has three main components, namely:

- A prevention strategy, including systems and procedures to reduce the risk of introduction and translocation of marine pests in the first instance, with particular focus upon ballast water and biofouling.
- An emergency response framework, for coordination of appropriate responses to new IMP incursions and translocations.
- Ongoing control and management arrangements, aimed at containing the risks of IMPs already in Australia.

The National System is supported by an Intergovernmental Agreement that has been signed by the Australian Government, Northern Territory and all states except New South Wales. When fully in place, the National System will ensure that ballast water is handled consistently around Australia, whether vessels originate overseas or from a different Australian port. Under this agreement the Australian Government is responsible for implementing arrangements to manage the risk of IMP being introduced to Australia from other countries. It will also have several supporting components that are currently being developed, including strategies for research and development, communication, monitoring, evaluation and review. The States and the Northern Territory are responsible for managing the risks of a marine pest translocation within Australian waters. In Western Australia, the Department of Fisheries, in collaboration with AQIS, is responsible for the management of IMP.

This BF&BWMP has been developed to be consistent with current understanding of the expectations of the developing National System. Once the National System has been fully implemented, this BW&BFMP will be reviewed to ensure it is still consistent with national requirements.

Section 3 Statutory, Policy and Regulatory Commitment

3.3 Legislative Requirements

The various national and state responsibilities for managing IMP are exercised through a range of Commonwealth and Western Australian State legislative tools. The primary Commonwealth and Western Australian State legislation regarding the port at Cape Preston is:

Commonwealth

- *Quarantine Act 1908*

Western Australia

- *Fisheries Resources Management Act 1994*
- *Environmental Protection Act 1986*
- *DPI - Marine and Harbours Act 1981*
- *Biosecurity and Agricultural Management Act 2007*
- *Iron Ore Processing (Mineralogy Pty Ltd) Agreement Act 2002* (IOPAA)

The Commonwealth *Quarantine Act 1908* is the principal legislation to support actions to prevent border introductions of IMP species via ballast water. A significant amendment to this *Act* through the *Quarantine Amendment Act 1999* now defines ballast water as 'goods'.

The specifics of how each of these legislative pieces relates to IMP management are not described here. This plan focuses on how these various legislative tools are used by the Commonwealth and Western Australian State to prevent the introduction of any IMP.

3.4 International Border Control Legislation

The introduction of IMP to Australian waters may occur via a number of different vectors, however, ballast water and biofouling are widely considered as the most significant of these vectors.

3.4.1 International ballast water management

An International Convention for the Control and Management of Ships' Ballast Water and Sediments (the Convention) has been developed through the International Maritime Organization (IMO). The text of the Convention was adopted at a Diplomatic Conference in February 2004. The Convention provides for consistent ballast water management requirements to be implemented worldwide. Australia signed the Convention subject to ratification in May 2005.

The Australian Government, through AQIS, is responsible for managing the day-to-day actions to enable border control of IMP incursions from internationally sourced ballast water. AQIS implemented mandatory ballast water management arrangements under the *Quarantine Act 1908* in July 2001, following a period of voluntary implementation. These requirements are administered by the Seaports Program within AQIS. Under these requirements, ballast water must be exchanged at sea unless it is determined to be low risk for carrying IMP.

Ballast water risk levels were determined through the AQIS Ballast Water Decision Support System (DSS) that enabled an assessment of the risk of IMP introduction through a ship's (international) ballast water, based on a number of factors including species present at origin and destination ports, journey duration, ballast water exchange history and species survivability. However, the rules have subsequently changed and the DSS is no longer in use. AQIS now considers **ALL** salt water from ports and coastal areas outside Australia to be high risk. **The current Australian requirement is that**

all ballast water from ports or coastal regions outside Australia must be exchanged at sea prior to arrival in Australia *if* it is to be discharged in the Australian territorial sea (within 12 nautical miles of shore). The exchange should preferably occur outside the 200 m depth contour. The requirement is that 95% or more of the ballast water be exchanged in the open sea as far from land as possible. As most of the species that can be introduced are coastal, they have few larvae in open ocean waters and dilution substantially reduces the risk of their being introduced.

AQIS (2008) further recommends that **all** ballast water in a vessel be exchanged in the open ocean. Having exchanged all ballast water provides a buffer that covers changed conditions while the vessel is in port that may make it desirable to discharge water ballast tanks that were not originally planned for discharge. During the arrival inspection, AQIS officers will check the vessel records of ballast water exchange and may relate them back to GPS positions of the ship at the time, pump operational records, etc.

There may be circumstances, such as storms, where at sea exchange would endanger the vessel and/or its crew and ballast water exchange has not taken place when the vessel arrives in Australia. In such instances, AQIS must be contacted in advance. Discharge cannot take place in Australian waters without the **written** authority of AQIS.

Further details on management of ballast water are described in Section 5.2.

3.4.2 Biofouling management of vessels arriving from overseas

National IMP incursion prevention efforts have, to date, focussed on the risks associated with ballast water from international shipping. DAFF has been consulting with a range of sectors including non-trading, petroleum, commercial shipping and yachting to develop the proposed Australian Biofouling Management Requirements. A targeted quarantine inspection regime has been developed using a risk based approach, but is not yet in place (DAFF 2008). The risk assessment criteria and the quarantine inspection regime include a hazard analysis of vessel classes, on-arrival biofouling risk assessments and in-water inspections, if required by AQIS. The proposed Australian Biofouling Management Requirements includes a hazard analysis for vessel classes to assess their relative risk of translocating quarantinable biofouling pests into Australian ports and waters. Moderate and high hazard vessels classes (i.e. petroleum production and exploration) will be subject to an AQIS biofouling risk assessment upon arrival to Australia. If on completion of an on-arrival risk assessment AQIS has determined that a vessel is, or is highly likely to be, contaminated with any of 14 species of quarantinable biofouling pests then an in-water inspection will be undertaken. The cost of an in-water inspection will be borne by the vessel operator. When inspecting vessels AQIS will look for quarantinable biofouling species, which are known to be associated with tertiary level biofouling communities (DAFF 2008).

Until the proposed Australian Biofouling Management Requirements are in place, the primary requirement for inspection of dredges and other construction vessels arriving from overseas will be through the environmental assessment process (section 3.4.3 below).

3.4.3 Domestic border control legislation

As indicated above, the goal is to have a single National System for management of marine pest issues in Australia. The national ballast water management arrangements being developed will be consistent with the Convention and consistent across Australia. These arrangements will be implemented under State/Territory legislation for domestic ballast water and will be a single set of requirements with a single co-ordination contact centre (reference http://www.daff.gov.au/animal-plant-health/pests-diseases-weeds/marine-pests/national-system). Until the National System is implemented, each State and Territory jurisdiction will have its own arrangements. This section describes present and proposed arrangements in Western Australia.

Section 3 Statutory, Policy and Regulatory Commitment

Department of Fisheries

The Department of Fisheries (DoF) is the lead agency in the Western Australian state government for management of IMP issues. DoF administers several WA acts, the most important of which is the *WA Fish Resources Management Act 1994* (FRMA). Section 176 of the accompanying *Fish Resources Regulations 1995* (as amended) states:

1. A person must not bring into the State, or particular area of the State, a live fish of a species not endemic to the State, or that area of the State, other than in accordance with:

    a) the written approval of the Chief Executive Officer;

    b) the written authority of the Chief Executive Officer under sub-regulation (2); or

    c) an aquaculture licence.

The term "fish" in the Act "means an aquatic organism of any species (whether alive or dead) and includes:

a) the eggs, spat, seeds, spawn, spores, fry, larva or other source of reproduction or offspring of an aquatic organism; and

b) a part only of an aquatic organism (including the shell or tail), but does not include aquatic mammals, aquatic reptiles, aquatic birds, amphibians or (except in relation to Part 3 and Division 1 of Part 11) pearl oysters."

This is the primary authority by which DoF can regulate importation of marine species, including potential pest species. In managing IMP issues, DoF works with the various Commonwealth departments and WA State agencies such as the port authorities and the Environmental Protection Authority (EPA). The EPA is advised through the WA Department of Environment and Conservation (DEC).

Minister for the Environment

As required by the EP Act, the EPA assesses proposals for their potential environmental impact. In so doing, the EPA has a range of options. No formal assessment is required for projects where the environmental effects are considered to be limited and local. There are three types of formal assessments that include public comment, with the highest assessment being the Environmental Review and Management Plan (ERMP). DEC coordinates public comments and those of other government agencies, including DoF, and presents them to the EPA. After consideration of the issues, the EPA recommends acceptance or rejection of the proposal to the WA Minister for the Environment.

The Minister may accept or reject the EPA advice. The Minister often imposes a series of legally binding Ministerial Conditions that the proponent must meet for the project to be approved. Following the arrival of the dredge *Leonardo da Vinci* in Geraldton in October 2002 with a variety of exotic species, including potential pest species (Wells et al. in press), the Minister has imposed a requirement that dredges, and some other construction equipment, be inspected for IMP prior to arrival in Australia or within 48 hours of arrival. If marine pests are found on a vessel on arrival, it can be denied entry into Western Australia. Other conditions the Minister may require include conducting a baseline marine pest survey and establishment of a marine pest monitoring program.

Biosecurity and Agricultural Management Act 2007

To develop a coordinated mechanism for handling all biosecurity issues in Western Australia, the Parliament passed the *Biosecurity and Agricultural Management Act 2007* (BAM Act). Although the BAM Act has been proclaimed, regulations to implement the Act are now being drafted but are not yet public. A key purpose of the BAM Act is to provide State agencies with a better legislative basis to combat biosecurity threats. In the case of the DoF, it can be expected that the BAM Regulations will

provide DoF with additional powers to deny entry to State waters to vessels potentially carrying IMP. The Regulations are likely to include requirements for drydocking and vessel inspections prior to or immediately upon arrival.

IOPAA

The IOPAA was produced as an agreement between the State, Mineralogy and other relevant parties. Various parts of the IOPAA have relevance to this BW&BFMP and the greater PEMP, but of particular relevance are the following sections:

4.(3): 'On the said Bill commencing to operate as an Act, this Agreement shall operate and take effect according to its terms notwithstanding the provisions of any Act or law of Western Australia.';

24:'The State shall ensure after consultation with the relevant local government that the Mining Leases, any Ancillary Tenements and any lands the subject of any lease licence or easement granted to the Company under this Agreement shall be and remain zoned for use or otherwise protected during the currency of this Agreement so that the activities of the Project Proponents hereunder may be undertaken and carried out thereon without any interference or interruption by the State or by any State agency or instrumentality or by any local government on the ground that such activities are contrary to any zoning by-law regulation or order.'

43:'The Company, the Co-Proponents and the Project Proponents shall during the currency of this Agreement consult with and keep the State fully informed on a confidential basis concerning any action that the Company, any Co-Proponents and Project Proponents propose to take with any third party (including the Commonwealth or any Commonwealth constituted agency authority instrumentality or other body) which might significantly affect the overall interest of the State under this Agreement.'

Consultative Committee on Introduced Marine Pest Emergencies

The Consultative Committee on Introduced Marine Pest Emergencies (CCIMPE) is a national body with representatives of all of the government jurisdictions. CCIMPE has a national plan to combat IMP emergencies anywhere in the nation that can be examined at:

http://adl.brs.gov.au/mapserv/marinepest/html/emerg.php

The plan has four stages:

- Investigation;
- Alert;
- Operation; and
- Stand down

CCIMPE is notified if a jurisdiction detects a potential IMP. In Western Australia, the notification will come from the WA representative on CCIMPE, the DoF. Following notification of detection of a potential IMP, an investigation is initiated to determine the extent of the infestation and whether further action is required. If necessary, action is then undertaken and a follow up investigation may be made to measure the success of the operation. DoF will remain in control of the actual work in WA to mitigate or eliminate the pest but CCIMPE can provide advice and access to other resources. In particular, a key component of the national IMP emergency plan has been development of a funding pool by the various government jurisdictions so, if agreed, the cost of meeting the emergency is shared by the jurisdictions.

Section 4 Introduced Marine Pests

4.1 IMP and Exotic Organisms

4.1.1 Potential impacts

In ecological and economic terms, IMP, which may be translocated in ballast water or as biofouling, can:

- out-compete, prey upon, or otherwise displace native species;
- alter natural ecological and bio-physical processes;
- act as vectors for pathogens which can impact upon ecological or human health;
- degrade or cause the collapse of commercial fisheries and aquaculture enterprises, either through direct competition with target species or via the introduction of a pathogen;
- cause problems for industrial infrastructure and navigation aids, for example, by blocking seawater intakes/outlets, impairing the operation of undersea valves, or causing buoys to sink.

IMP and exotic marine organisms threaten the ecological balance of port and marine waters. The presence of IMP has the potential to reduce biodiversity and fish populations and disrupt natural ecosystems.

4.1.2 Potential contamination vectors

There are two main vectors via which IMP and exotic marine organisms can be introduced to Australian waters in association with activities at Cape Preston. These include:

- via the ballast water contained within the ship's tanks; or
- via biofouling of ship hulls, underwater fittings and voids, internal seawater systems or sediments

IMP and exotic marine organisms originate from vessels which have visited other ports around the world. The pests and exotic organisms can be transferred to Australian waters when ships discharge ballast water. Additionally, marine pests that have fouled ship hulls and other immersed surfaces of the vessel have the potential to spawn or detach and establish in the new location. These organisms then have the potential to migrate through a number of methods into other geographic regions within Australia.

4.1.3 Target IMP species

Various definitions of what constitutes a marine pest exist within the literature. Typically a pest is recognised to be a non-indigenous taxon that threatens human health, economic or environmental values (Carlton 1996, 2002 among others). This is in contrast to introduced or cryptogenic taxa that are considered to be taxa that have been introduced but may not be negatively affecting a system where they have been introduced or species that are neither demonstratively native nor introduced.

In Australia, a national list of 55 target species for IMP monitoring has developed by the NIMPCG (2006a,b). These 55 species are known IMP or are considered likely to become IMP if introduced into Australian waters (Table 4-1). Any monitoring program will be designed to incorporate the possibility that species not on the list may develop invasive characteristics.

Section 4 Introduced Marine Pests

Knowledge of what species may become pests in Australian waters is subject to change on a regular basis as new understanding of risks develop. As such, legislation makes reference to target lists; most up to date versions of which need to be accessed through the appropriate management agency when assessing concerns (eg refer http://www.daff.gov.au/__data/assets/pdf_file/0011/551864/ccimpe-trigger-list.pdf).

Information on IMP in Western Australia was compiled by Huisman et al. (2008). This found that only four of the 55 species on the NIMPCG target list have been recorded in WA, and none has been found north of Fremantle. The four species found in WA are: *Codium fragile* subspecies *fragile, Musculista senhousia, Sabella spallanzanii* and *Alexandrium minutum.*

Table 4-1 Target species of introduced and potentially introduced marine species on the national monitoring program (NIMPCG 2006a,b)

Group	Species		Group	Species
BALLAST WATER				
Dinoflagellates	*Alexandrium catenella*		Diatoms	*Chaetoceros convolutus*
	Alexandrium minutum			*Chaetoceros concavicornis*
	Alexandrium monilatum			*Pseudo-nitzschia seriata*
	Alexandrium tamarense		Ctenophorans	*Beroe ovata*
	Dinophysis norvegica			*Mnemiopsis leidyi*
	Gymnodinium catenatum		Copepods	*Acartia tonsa*
	Pfiesteria piscicida			*Pseudodiaptomus marinus*
				Tortanus dextrilobatus
HULL FOULING AND BALLAST WATER				
Algae	*Bonnemaisonia hamifera*		Cnidarians	*Blackfordia virginica*
	Caulerpa racemosa		Polychaetes	*Sabella spallanzanii*
	Caulerpa taxifolia			*Hydroides dianthus*
	Codium fragile spp. *fragile**			*Marenzelleria* spp.
	Grateloupia turuturu		Barnacles	*Balanus eburneus*
	Sargassum muticum			*Balanus improvisus*
	Undaria pinnatifida		Crabs	*Callinectes sapidus*
	Womersleyella setacea			*Carcinus maenas*
Bivalves	***Corbula amurensis***			***Charybdis japonica***
	Ensis directus			***Eriocheir sinensis***
	Limnoperna fortunei			***Hemigrapsus sanguineus***
	Mya arenaria			***Hemigrapsus takanoi/ penicillatus***
	Varicorbula gibba			*Rhithropanopeus harrisii*
	Musculista senhousia		Ascidians	***Didemnum vexillum***
	Mytilopsis sallei		Starfish	*Asterias amurensis*
	Perna perna		Fish	*Neogobius melanostomus*
	Perna viridis			*Siganus luridus*
	Crassostrea gigas			*Siganus rivulatus*
Gastropods	***Crepidula fornicate***			*Tridentiger barbatus*
	Rapana venosa			*Tridentiger bifasciatus*

*NIMPCG (2006a,b) actually lists *Codium fragile* spp. *tomentosoides*, but Maggs & Kelly (2007) considered this to be the same as *Codium fragile* spp. *fragile*.

Section 4 Introduced Marine Pests

Table 4-1 also contains the list (in bold) of 14 proposed quarantinable biofouling pests listed in the draft Australian Biofouling Management Requirements (DAFF 2008). All vessels entering Australian water will be required to be free of these quarantinable biofouling pests.

Section 5 Ballast Water Management

5.1 Objectives of the BW&BFMP

The BW&BFMP will ensure that the AQIS ballast water requirements are met for vessels arriving from overseas and that the plan also meets the objectives of the developing National System for marine pest management.

5.2 Ballast Water Management

All international trading vessels are required to manage their ballast water in accordance with AQIS requirements. The discharge of high-risk ballast water in Australian ports or waters, or anywhere inside Australia's territorial seas (12 nautical mile limit generally applies) is prohibited.

AQIS recognises that all ballast water from ports (or coastal waters) outside Australia's territorial sea present a 'high risk' of introducing exotic IMP into Australia. Ballast water must be exchanged at sea unless it is determined to be low risk for carrying select IMP (Section 3.3.1).

Australia's requirements include several that are mandatory under an Act of the Australian Parliament, including reporting and access to onboard sampling points. Additionally, the discharge of ballast tank sediments into the Australian marine environment is prohibited.

Most of the shipping activities associated with the Stage 1 port development will be within 12 nm of the coast (i.e. the transport of processed iron ore products from Cape Preston to the offshore loading area). Ballast water management will apply to vessels that load iron ore at the offshore moorings.

It is intended that controls will be introduced on 'domestic' ballast water movements (i.e. ballast water moved within or between Australian states and the Northern Territory). Once these domestic ballast water controls are imposed this BW&BFMP will be amended as required to impose the necessary controls for Cape Preston operations.

Vessel masters are required to comply with the Australian Ballast Water Management Requirements, which are based on the IMO Ballast Water Management Guidelines [IMO Resolution A.868(20)].

It is recognised that the safety of the crew and ship is paramount in deciding whether to follow any of these procedures. If no ballast water management is undertaken, this must be indicated in the AQIS Ballast Water Reporting Form.

Australia reserves the right to require a ship that has not undertaken an approved ballast water management or treatment measure to comply with any contingency action determined by AQIS if the ship has taken up ballast water in a high risk port where, for instance, toxic algal blooms are occurring or where there is a cholera outbreak. If unable to comply with AQIS' requests, discharge of ballast water in a port may be refused.

Additionally, the IMO has developed the International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004, of which Australia is a signatory. The Convention is due to be phased in via a number of stages, such that by 1 January 2017 ships will no longer be able to discharge to sea ballast water which has not been treated to the standard mandated in the Convention. Ballast water exchange will not be a permitted management option for any ship once the Convention is fully established.

Ships using the facilities at Cape Preston will be required by the Port Manager to comply with all existing requirements of AQIS and all future regulations as they are enacted. The Environmental Management System (EMS) and PEMP for the port will ensure that AQIS reporting requirements are acknowledged by Ship's Masters. These arrangements are monitored by AQIS on a regular basis.

Section 5 Ballast Water Management

They will include provisions for recording the point of ballasting and implementation of protocols for exchange of ballast so as to minimise any potential risks.

Ballast water management will entail the following reporting requirements and ballast water collection and sampling techniques. These procedures will allow for the early identification of infected ballast water, prior to discharge into the sea.

Mandatory Report

- All ships must fully and accurately complete a ballast water report form. These documents must be forwarded to the Port Manager at least 12 hours prior to arrival. These forms can be sent by fax or by telex.
- Ships not completing the report form will, on arrival in port, be required to complete the form with an AQIS officer present, without cost to the Port Manager.

Procedures for Ships

All ships travelling in Australian territorial waters and/or visiting an Australian port are required to manage 'high risk' ballast water through one of the following approved options (refer Section 3.3.1):

- Full ballast water exchange at sea. This exchange should take place as far as possible from the nearest land, however, as a minimum, it must take place outside the Australian 12 nm limit. The exchange must achieve at least 95 per cent volumetric exchange and should be undertaken in water at least 200 m deep. Where the empty/refill method is employed, all of the ballast water should be discharged until pump suction is lost. Stripping pumps or eductors must be used if possible, before refilling ballast tanks; or:
- Where the flow-through method is employed in the open ocean by pumping ballast water into the tank or hold and allowing the water to overflow, at least three times the tank volume must be pumped through the tank; or
- Tank to tank transfer. This may be employed where the vessel is able to move 'high risk' ballast water from tank to tank within the vessel to avoid discharging high risk ballast water in Australian ports or territorial waters; or
- Non-discharge of 'high risk' ballast water in Australian ports or territorial waters; or
- Alternative Ballast Water Management Methods. The use of an alternative method not specified above requires a written application be forwarded to AQIS before the event.
- Where ballast water exchange is not possible due to weather, sea conditions or operational impracticability, the master must report this fact as soon as possible prior to entering the port.
- Access to an on-board sampling point must be provided upon request, provided it is safe for the ship and crew. The location of suitable access points for sampling ballast or sediment will be described in the ship's operational manuals. This will allow crew members to provide maximum assistance when samples of the ballast water or sediment are required.

Ships are required to complete the AQIS Ballast Water Reporting Form, which is part of and attached to the AQIS Quarantine Declaration for Vessels (Pratique). All details on the AQIS Ballast Water Reporting Form must be completed by international ships before visiting their first Australian port of call and must be sent to AQIS Quarantine Declaration for Vessels. The Quarantine Declaration must be completed no more than 24 hours and no less than 12 hours before a ship enters its first Australian port of call.

Section 5 Ballast Water Management

5.3 Monitoring and Administration of Procedures

- All ships must have a ballast water record book on board. To facilitate the administration of ballast water management procedures on board each ship, a responsible ship's officer shall be appointed to maintain appropriate records and to ensure that ballast water management procedures are followed and recorded.
- When taking on or discharging ballast water, the dates, geographical locations, depth of water, ship's tank(s) and cargo holds as well as the amount of ballast water loaded or discharged will be recorded on the report form.
- Compliance monitoring of the above strategy will be undertaken by AQIS by, for example, taking and analysing ballast water and sediment samples to test for the continued survival of harmful aquatic organisms and pathogens, and by verifying the accuracy of data provided on the report form.
- All shippers will be requested to provide evidence of their policy and procedures on ballast water management prior to the award of any shipping contracts.
- Regular IMP monitoring of the port, transhipment facility and surrounding areas will be undertaken. This is expanded upon in Section 7.

Inspections and Sampling

If requested by AQIS ballast water and sediment samples will be collected for analysis. Sampling may also be on a random basis as a means of providing information on whether ballast water management procedures are effective. If abuse of de-ballasting approval is detected, appropriate action to minimise environmental impact will be taken and action against the Vessel Master and/or Owners will be considered by AQIS.

Sampling Techniques and Equipment

The location of, and suitable access points for sampling ballast or sediment must be described in the ship's ballast water management plan and/or other documentation.

Ballast water and sediment samples can be satisfactorily collected by simple submersion of a clean sampling container in the water. It is essential that the bottle be washed out several times with the water to be sampled before the definitive sample is collected.

All samples should be collected in plastic or glass containers. Plastic gloves should be worn by the sampler to avoid contamination of the sample. The sample should then be transferred to an appropriately labelled sterile sampling bottle for analysis.

Preservation and Handling

All water sample containers should be delivered to the laboratory in a tightly sealed container, protected from the effects of light and excess heat. Samples that can be analysed within two days need to be cooled to 4^{o}C. For longer periods the samples need to be frozen to -20^{o}C.

Sampling Identification

All sampling containers are to be clearly and unambiguously marked. Details relevant to sample analysis must be recorded on a label attached to the container, with any other relevant information recorded on a sample report. Labels and Chain of Custody forms are to be completed at the time of sample collection.

For each water sample the following information is to be recorded:

Section 5 Ballast Water Management

- the vessel being sampled;
- the sampling point and associated ballast tank/s;
- the details of the ballast water being sampled (i.e. date and location of uptake and exchange)
- the date and time of sampling;
- the purpose of sampling;
- details of sampling method; and
- details of any visible oil sheen.

Sediment Removal

Sediment resulting from tank and/or hold cleaning must be disposed of in an AQIS approved manner on land. It is not to be released at sea within 12 nm of the coast.

Section 6 Biofouling Management

6.1 Construction Phase

Management of IMP during the construction phase of the port will be in accordance with CPM's Environmental Management Program – Phase 3. This Program was approved by the EPA in March 2009. The BW&BFMP is therefore intended to manage the operational activities of the port at Cape Preston, commencing with the importation of heavy equipment by heavy lift barges.

6.2 Operational Phase

Most of the vessels in the operational phase of Stage 1 will be tugs and barges moving from Cape Preston to the offshore transhipment area. Offshore vessels will load at the offshore transhipment area for only a short period. These will typically be well maintained with up to date antifouling coatings; and will operate at relatively high speeds, which reduces the ability of organisms to maintain purchase on external surfaces. There may be some smaller overseas vessels moving directly to the Materials Offloading facility (MOF). The measures that will be taken to minimise biofouling during the Stage 1 operational phase are shown on Table 6-1. In keeping with DOF in-water cleaning of vessels will be denied. The Vessel Risk Assessment Scoring Sheet (VRASS) in Appendix A outlines the steps to follow.

Table 6-1 IMP reduction measures during the Stage 1 operational phase

Activity	Action/Response	When	Instigator/s	Other/s
Cleaning of hull and propeller	Deny requests for in-water cleaning, and forward any request for cleaning in Dampier to the DPA	All times	Port Manager	DPA Ship Agents
Undertake risk assessment using form at Appendix A	Undertake marine pest risk assessment using the VRASS	Before arrival	Port Manager	
Cleaning of medium and high risk vessels	Vessels determined to be of medium or high risk to be inspected by qualified and experienced marine scientist if recommended by DoF Fax or e-mail report to DoF (cc. to AQIS, DPA) Collect and retain samples for DoF Obtain scientific identification of the biofouling organisms Cooperate to identify remedial action/s and develop tailored action plan in consultation with DoF Re-inspect vessel, and instigate appropriate remedial	Within 48 hours of arrival	Port Manager	DPA, DoF

Section 6 Biofouling Management

Activity	Action/Response	When	Instigator/s	Other/s
	actions as may be warranted on the basis of that inspection			
Review and report on results of risk assessments	Inform ship agent, charterer, broker	After incident, and/or in annual environmental reporting	Port manager	AQIS Ship charterers Ship agents

6.3 Contingency Response Strategy for Ballast Water and Biofouling

It is critical that any possible introduction of IMP be handled with the utmost urgency. It is only in the early stages of infestation that a species can be contained; once it becomes established removal of a pest species is very difficult, if not impossible. If a potential IMP is discovered, it will most likely be during monitoring at Cape Preston. DoF must be notified immediately.

If such an event occurs, specimens of the suspect species will be collected. DoF can advise on the most appropriate method of preserving the material and who would be the most appropriate scientist to identify the species.

Once notification of a potential IMP is received, DoF will assume the management role for determining an appropriate response. DoF will notify CCIMPE and will determine in consultation with CCIMPE whether the national protocols are invoked. The Port Manager will assist wherever possible with the response determined by the government agencies.

6.4 Summary of Marine Pest Management Commitments

Table 6-2 provides a summary of the Stage 1 commitments made in the BW&BFMP.

Table 6-2 Summary of stage 1 commitments made in the BW&BFMP

Activity	Action/Response	When
Ballast water		
Ballast water, all international vessels	On arrival at Cape Preston	Vessels satisfy all AQIS requirements. Arrive at Cape Preston with only oceanic, low risk ballast water. Only required amount of ballast water exchanged at Cape Preston. If, for any reason, ballast water exchange has not been done before arrival, vessel returns to sea and exchanges outside the 12 nm boundary.
Biofouling		

Section 6 Biofouling Management

Activity	Action/Response	When
Iron ore carriers (at transhipment facility)	Cleaning of hull and propeller	Deny requests for in-water cleaning
	Conduct risk assessment	Vessels determined to be of medium or high risk to be inspected by qualified and experienced marine scientist if recommended by DoF Fax or e-mail report to DoF (cc. to AQIS, DPA) Collect and retain samples for DoF Obtain scientific identification of the biofouling organisms Cooperate to identify remedial action/s and develop tailored action plan in consultation with DoF Re-inspect vessel, and instigate appropriate remedial actions as may be warranted on the basis of that inspection
Maintenance vessels	Routine maintenance of Cape Preston facilities	Undertake risk assessment Medium and high risk vessels inspected if recommended by DoF If biofouling is detected, vessels will be promptly cleaned
Marine pest monitoring		
IMP monitoring	Develop midterm monitoring program using National System guidelines	Commence six months after bare artificial surfaces created during construction
	Disseminate results	Include IMP monitoring results in annual review and reporting activities
		In long-term, negotiate with DoF inclusion of Cape Preston monitoring into Dampier monitoring program
Stage 2 development		
Stage 2 development	Amend and implement revised BW&BFMP	Prior to construction stages of Stage 2 Incorporate any changes to legislative requirements and National System

Section 7 Interim Monitoring Program

The port will be subject to periodic monitoring to detect the presence of any exotic marine species, particularly those known or considered to have invasive characteristics.

When construction activities begin at Cape Preston, bare artificial habitat will be created that will be colonised by marine species, potentially including IMP. If a pest species is already in the harbour, and conditions are suitable in the newly created habitat, the species could potentially start colonising the new facilities before the operational phase starts.

Accordingly, the Port Manager will commence a monitoring program of newly constructed facilities as soon as practicable but no more than six months after the first artificial substrates are placed in location. The monitoring program will use the NIMPCG (2006a,b) methodology as modified in any subsequent versions. The monitoring program, summarised in Table 6-1 will continue for the medium term of five years, after which it will be reviewed. If possible, the Cape Preston monitoring will be incorporated into the monitoring of the Port of Dampier that will be undertaken by DoF under the National System.

Table 7-1 Terminal operations: IMP monitoring and reporting

Activity	Action/Response	When	Instigator/s	Other/s
Interim monitoring for IMP	Undertake routine monitoring program	First five years after construction commences	Port manager	DPA
Regular IMP surveys	Support and participate in port-wide IMP surveys coordinated by the DoF	As determined by DoF	DoF	DPA Other port operators in Dampier
Disseminate results of IMP monitoring activities to DoF	Include IMP monitoring activities in annual review and reporting activities	Annual environmental reporting	Port manager	

Section 8 Management Plan Implementation, Reporting and Responsibilities

8.1 Roles and Responsibilities

This BW&BFMP has various responsibilities for management and reporting associated with it. These will all occur as directed in this section.

Ultimate responsibility for ensuring that port environmental management requirements are met will rest with the Port Manager.

The main responsibilities of the Port Manager will include:

- ensuring that all personnel, including all workforce and contract personnel, conform with the requirements pursuant to this BW&BFMP;
- ensuring that contractor staff are fully inducted and aware of their environmental responsibilities and obligations; and
- ensuring that monitoring requirements are being met.

In the case of emergency environmental situations, both the Port Environment Manager and the appropriate Manager will be informed. The problem will then be dealt with by the two Managers and, if necessary, reported to the Board by the Port Manager and DoF.

Contracting companies employed at the site will be required to appoint an environmental representative. The key responsibilities of this representative will be to:

- maintain routine contact with the Port Environmental Manager to ensure that environmental objectives of the BW&BFMP are being met;
- provide monthly reports to the Port Environmental Manager on environmental issues and conduct regular audits; and
- ensure that all management aims and monitoring requirements of this BW&BFMP are being met.

8.2 Training, Inductions and Awareness

All employees shall receive environmental training, to make them aware of their responsibilities and are competent to conduct work in an environmentally acceptable manner.

Site inductions will explain to all employees the project's environmental requirements. Regular tool box meetings will be conducted to ensure on-going training is provided. All inductions and on-going training will be recorded within a register.

All employees (including sub-contractors) will receive environmental training in the following areas:

- environmental policies;
- the requirements of this BW&BFMP;
- the requirements of the greater PEMP;
- the Project EMS and other related documents;
- site environmental objectives;
- understanding authorities and their responsibilities;
- identification of their legal obligations;

- potential consequences of departure from procedures; and
- emergency procedures and responses

Personnel performing tasks that may cause significant environmental impacts shall be competent on the basis of appropriate education, training and/or experience to perform the tasks.

8.3 Communication

Internal and external communication mechanisms, such as discussed below, will be established to ensure that all employees, senior management and other interested parties are appropriately informed on project related environmental issues.

Internal communication methods may include the following, as applicable:

- meetings;
- project reports;
- performance assessment reports;
- notice boards;
- employees inductions, training and toolbox sessions (as required); and
- subcontractor co-ordination meetings.

External communication methods may include the following, as applicable:

- meetings and correspondence with appropriate regulatory authorities;
- discussions and consultation with adjoining landowners; and
- handling of and responding to complaints.

8.4 Performance Indicators

Performance indicators are:

- compliance with AQIS Ballast Water Management targets and reporting;
- compliance with biofouling requirements as they are developed;
- no presence of exotic IMP at Cape Preston as determined by regular monitoring to National System requirements.

8.5 Reporting and Recording

Performance reporting is required to provide systematic, comprehensive and informative documentation of the environmental performance, management and monitoring during the Project. The following reports will be provided to the Port Environmental Manager, for action as appropriate, and to relevant regulatory authorities, as appropriate:

- reports in support of annual licences and permit renewal applications;
- all significant records and reports submitted to the EPA;

- records maintained in accordance with other environmental commitments;
- results of audits, including any environmental monitoring results and compliance with Ministerial Conditions;
- Monthly Incident Reports summarising any incidents occurring during the relevant period, including comments on response procedures and preventative actions; and
- Monthly Complaint Reports summarising any complaints received by contractors, Port Environmental Manager in the reporting period, including comments on the course of action taken and any responses to that action.

A register of preventative and corrective actions implemented will be maintained

8.6 Auditing and Compliance

Auditing of the Condition of Approval and the environmental management commitments will be undertaken as follows:

- annual system audits, including Ministerial Conditions and compliance procedures;
- quarterly on-site PEMP compliance audits;
- regular audits of contractor performance; and
- on-going work area inspections and audits.

Persons responsible for environmental auditing will be suitably qualified, to comply with ISO 14012:1996 Guidelines for Environmental Auditing: Qualifications Criteria for Environmental Auditors.

8.7 Non-conformance, and Corrective and Preventive Action

The procedure to prevent any non-conformances or non-compliances with this plan is based upon the following process:

- Legislation and other requirements – Determine relevant legislation and other requirements
- Evidence of compliance – records or evidence of compliance (e.g. groundwater abstraction licence, audit)
- Timeframe – when is it to be completed or frequency of monitoring or recording (monthly reporting). Records of periodic evaluations
- Responsibility – who is responsible for monitoring or recording compliance?
- Regulatory authority – who to report information to? (EPA, stakeholders)
- Status – what is the current status of the requirement?

8.8 Document Revision

The auditing and annual environmental reporting will be used to assess whether environmental objectives have been met. This information can therefore be used to determine whether any changes need to be made to this BW&BFMP.

Section 8 Management Plan Implementation, Reporting and Responsibilities

This document along with the remaining PEMP will be a 'living' document and be continuously updated to conform to the latest modifications to ballast water and biofouling standards and best practice.

Section 9 References

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Section 10 Limitations

URS Australia Pty Ltd (URS) has prepared this report in accordance with the usual care and thoroughness of the consulting profession for the use of CITIC Pacific Mining Management Pty Ltd and only those third parties who have been authorised in writing by URS to rely on the report. It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this report. It is prepared in accordance with the scope of work and for the purpose outlined in the CITIC Request for Tender dated 19 December 2008.

The methodology adopted and sources of information used by URS are outlined in this report. URS has made no independent verification of this information beyond the agreed scope of works and URS assumes no responsibility for any inaccuracies or omissions. No indications were found during our investigations that information contained in this report as provided to URS was false.

This report was prepared in March and April 2009, and revised in June 2009, and is based on the information reviewed at the time of preparation. URS disclaims responsibility for any changes that may have occurred after this time.

This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. This report does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners.

Appendix A

Cape Preston Vessel Risk Assessment Score Sheet for Biofouling IMP

Cape Preston Vessel Risk Assessment Score Sheet for Biofouling IMP

Ref:		**Completed by:**	
Date:		**Vessel Name or Number:**	

Vessel Risk

Type of Anti-fouling Control (AFC)								**Score**
AFC type is known, suited to vessel activity and operating speed, and is <2 years old = 0.0								
AFC type is unknown, unsuited , absent or >2 years at mobilisation = 3.0								
Age of AFC at mobilisation date								
Documented age of AFC				>1 year old, absent or unknown = 3.0				
				between 6 - 12 months = 2.0				
				3 - 6 months = 1.0				
				1 - 3 months = 0.5				
				< 1 month = 1.0				
				< 14 days = 0.0				
IMS infection risk - Location of 'home' ports/main supply base since last AFC								
Regions of the home ports or long term supply bases				Tropical region = 3.0				
since last AFC renewal have included:				Subtropical region = 2.0				
(use highest scoring region only)				Temperate region = 1.0				
IMS infection risk - number of stationary/slow speed periods over 7 days								
Number of weeks anchored or alongside or periods operating at <6 knots in a port or coastal waters (<100m deep) since last drydocking/slipping for cleaning						No. of 7 day periods divided by 2 =		
IMS infection risk- region of the stationary/slow speed periods								
Regions of the home ports or coastal waters where above stationary or slow speed periods occurred included (*use highest scoring region only)*				Tropical region = 3.0				
				Subtropical region = 2.0				
				Temperate region = 1.0				

Remediation

Will vessel be entering WA waters?								
Yes							= 1.0	
No							= 0.0	
Vessel is based in region and has been in region continuously for previous 3 months							= 0.0	
IMS biofouling survival risk								
No drydock/slipway cleaning and inspection prior to mobilisation							= 1.0	
One independent in-water inspection within 7 days before mobilisation							= 0.5	
Two independent in-water inspections within 30 days before mobilisation							= 0.3	
One independent drydock/slipway inspection within 30 days before mobilisation							= 0.1	

Appendix A

Cape Preston Vessel Risk Assessment Score Sheet for Biofouling IMP

Infection Risk - internal niches (i.e seawater pipework, anchor, bilge)								
Above checks included seawater system flushing or inspection, and check of strainers, spuds, anchor/s, cable locker/s, other niches							Yes = 0.5	
							No (or no inspections) = 1.0	
Subsequent transfer to site as deck cargo or road freight or lay-up on hardstand, that will provide a continuous total haul-out period that is:							< 7 days = 1.0	
							7 - 13 days = 0.8	
							14 - 27 days = 0.3	
							> 28 days = 0.1	
						Vessel Risk Score		0
						Mitigation Factor		0
						Total Score		0
Risk Level								
Low	If score is <20, risk is considered low. Vessel details require checks/confirmation only							
Mid	If score is 20 to 80, risk moderate. Independent validation inspection and/or cleaning action required							
High	If score is >80, risk is high. Premobilisation inspection and/or cleaning actions required							

Appendix 3

Fauna Management Plan

Sino Iron Project

Fauna Management Plan

Prepared for
CITIC Pacific Mining Management Pty Ltd
on behalf of Mineralogy Pty Ltd
by Strategen

March 2009

Sino Iron Project

Fauna Management Plan

Strategen is a trading name of
Glenwood Nominees Pty Ltd
Suite 7, 643 Newcastle Street Leederville WA
ACN: 056 190 419

March 2009

Disclaimer and Limitation

This report has been prepared for the exclusive use of the Client, in accordance with the agreement between the Client and Strategen ("Agreement").

Strategen accepts no liability or responsibility whatsoever for it in respect of any use of or reliance upon this report by any person who is not a party to the Agreement.

In particular, it should be noted that this report is a qualitative assessment only, based on the scope of services defined by the Client, budgetary and time constraints imposed by the Client, the information supplied by the Client (and its agents), and the method consistent with the preceding.

Strategen has not attempted to verify the accuracy or completeness of the information supplied by the Client.

Client: CITIC Pacific Mining Management Pty Ltd

Report	Version	Prepared by	Reviewed by	Submitted to Client	
				Copies	Date
Preliminary Draft Report	V-1	PB-C	-	1	10/1/08
Draft Report	V-2	PB-C/JT	CW	1	20/2/08
Final Report	V-3	JT	CW	Electronic and 3x hard copy	10/3/08
Amended Final Report	V-4	JT	Mineralogy	1	21/06/08
Final Report	V-5	XL	JT	1	27/10/08
Amended Final Report	V-6	XL	CW	1	06/03/09

Acknowledgements

Much of the content of this Fauna Management Plan (FMP) has been derived from the Fauna Environmental Management Plan prepared by Maunsell Australia Pty Ltd for Mineralogy Pty Ltd in February 2007 (Revision I, dated 12/02/2007) and in addition incorporates comments received from the Environmental Protection Authority (EPA) service unit on 5 and 23 February 2009, respectively.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDICES

1. INTRODUCTION

1.1 PROJECT BACKGROUND

Mineralogy Pty Ltd (the Proponent) proposes to develop an iron ore mine, processing plant and port facility in the general location of Cape Preston, approximately 80 km south west of Karratha (the Sino Iron Project (the Project). The Project has been assessed by the Environmental Protection Authority (EPA) at Public Environmental Review (PER) level. The PER (Austeel, 2000) was submitted in December 2000 and a Supplementary Environmental Review (SER) (Austeel, 2002) was submitted in February 2002 to address changes to the original proposal, and approval was granted in 2003 under Statement 635.

In 2004 the Minister for the Environment approved a change to the Project under s45c of the *Environmental Protection Act 1986* to increase iron ore mining rate to approximately 68 million tonnes per annum (Mtpa) and processing and export of:

- concentrate – approximately 20 Mtpa
- pellets – approximately 14 Mtpa
- direct-reduced/hot-briquetted iron – approximately 5 Mtpa.

1.1.1 Location and environmental setting

The Project layout is shown in Figure 1. The elements of the Project are described in the PER/SER, and the key characteristics of the Project are given in Schedule 1 of Statement 635.

The environmental setting of the Project area encompasses both terrestrial, coastal and marine environments, including the Fortescue River Floodplain, the mangrove tidal-creeks and sandy beaches at Cape Preston, and the off-shore island and marine environments. The faunal components and habitats of these environments are described in the PER and SER. This document is a synthesis of that information, and is compiled as a management plan for the implementation of environmental protection measures to protect significant fauna that may be impacted by the Project.

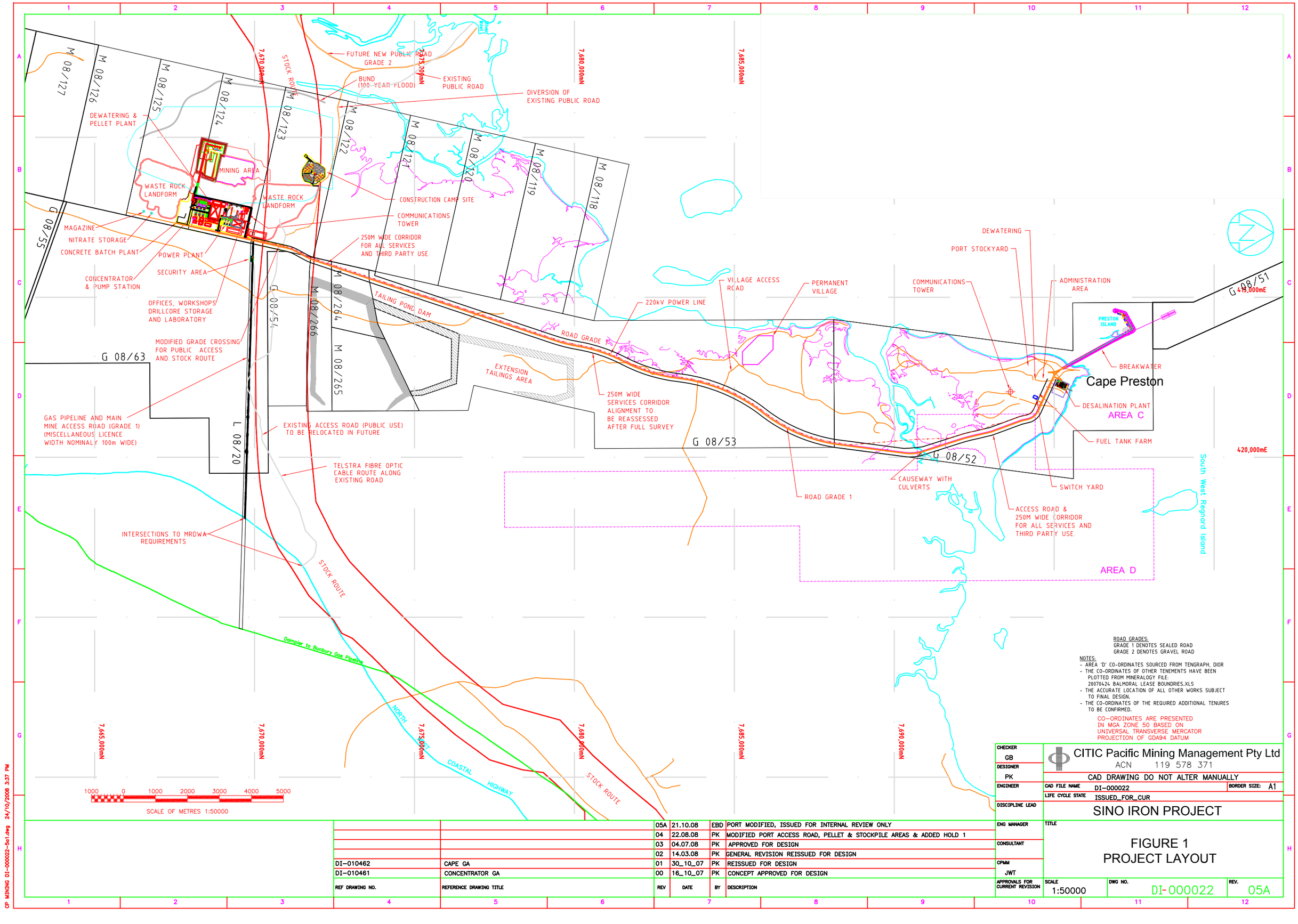
1.2 REQUIREMENT FOR A FAUNA MANAGEMENT PLAN

Mineralogy committed in Commitment 6 of Statement 635 to prepare a Fauna Management Plan (FMP) for the Project to address potential impacts to wading birds and turtles. The objective of Commitment 6 is to establish the importance of specific areas for wading birds and turtles in order to avoid sensitive areas and ensure their protection from Project-induced impacts. The actions following from that objective are stated in Commitment 6 as:

> *Prepare a Fauna Management Plan which will include:*
>
> 1. *fauna counts at appropriate times of the year*
> 2. *results from turtle baseline survey to develop strategies that protect areas and minimise effects of lighting.*

With regard to timing, Commitment 6 states that the FMP would be prepared prior to the construction of the jetty at Cape Preston and implemented during the construction and operational phases.

The FMP was to be prepared with advice from the Department of Conservation and Land Management (CALM) – now the Department of Environment and Conservation (DEC).



ROAD GRADES:
GRADE 1 DENOTES SEALED ROAD
GRADE 2 DENOTES GRAVEL ROAD

NOTES:
- AREA 'D' CO-ORDINATES SOURCED FROM TENGRAPH, DIOR
- THE CO-ORDINATES OF OTHER TENEMENTS HAVE BEEN PLOTTED FROM MINERALOGY FILE: 20070424 BALMORAL LEASE BOUNDRIES.XLS
- THE ACCURATE LOCATION OF ALL OTHER WORKS SUBJECT TO FINAL DESIGN.
- THE CO-ORDINATES OF THE REQUIRED ADDITIONAL TENURES TO BE CONFIRMED.

CO-ORDINATES ARE PRESENTED IN MGA ZONE 50 BASED ON UNIVERSAL TRANSVERSE MERCATOR PROJECTION OF GDA94 DATUM

REF DRAWING NO.	REFERENCE DRAWING TITLE	REV	DATE	BY	DESCRIPTION
		05A	21.10.08	EBD	PORT MODIFIED, ISSUED FOR INTERNAL REVIEW ONLY
		04	22.08.08	PK	MODIFIED PORT ACCESS ROAD, PELLET & STOCKPILE AREAS & ADDED HOLD 1
		03	04.07.08	PK	APPROVED FOR DESIGN
		02	14.03.08	PK	GENERAL REVISION REISSUED FOR DESIGN
DI-010462	CAPE GA	01	30_10_07	PK	REISSUED FOR DESIGN
DI-010461	CONCENTRATOR GA	00	16_10_07	PK	CONCEPT APPROVED FOR DESIGN

CHECKER: GB
DESIGNER: PK
ENGINEER:
DISCIPLINE LEAD:
ENG MANAGER:
CONSULTANT:
CPMM: JWT
APPROVALS FOR CURRENT REVISION:

CITIC Pacific Mining Management Pty Ltd
ACN 119 578 371

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CAD FILE NAME: DI-000022 | BORDER SIZE: A1
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SINO IRON PROJECT

TITLE

FIGURE 1
PROJECT LAYOUT

SCALE: 1:50000 | DWG NO.: DI-000022 | REV.: 05A

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This FMP has derived much of its content from a Fauna Environmental Management Plan (Maunsell, 2007a) and Sea Turtle Management Plan (Maunsell, 2007b) prepared previously for the Project. Advice received on these plans from the DEC and EPA Service Unit has been taken into account in this FMP, particularly for the management actions to avoid or minimise impacts on turtles and wading birds.

2. FAUNA MANAGEMENT

2.1 FAUNA SPECIES AND SIGNIFICANT HABITAT

Turtle surveys at Cape Preston have identified the following four species of marine turtles as seasonally nesting, or having the potential to seasonally nest, at Cape Preston:

- Green Turtle (Schedule 1[1]);
- Hawksbill Turtle (Schedule 1);
- Loggerhead Turtle (Schedule 1); and
- Flatback Turtle (Schedule 1) (Maunsell, 2007b).

These four marine turtle species are potentially vulnerable to disturbance from the development of the Project port facility.

A migratory shorebird survey, conducted at Cape Preston by Hassell 2002, recorded 16 migratory shorebirds listed under both the China-Australia Migratory Bird Agreement and Japan-Australia Migratory Bird Agreement. Two species of migratory shorebird listed under the EPBC Act (*Arenaria interpres* [ruddy turnstone] and *Calidris alba* [sanderling]) have been recorded from roosting sites at this location in numbers that were previously considered potentially greater than the 1% criterion[2] used to determine an area of international importance (URS 2008). However, the global estimates have increased and the previously recorded numbers would not meet the 1% criterion. A recent survey conducted by Bennelongia (2008) of shorebird values at Cape Preston recorded lower numbers than the previous survey conducted in 2001, and no species were recorded in internationally significant numbers (Figure 2).

The significant fauna species and sensitive habitats that require specific management measures are:

- marine turtles and nesting beaches habitat; and
- migratory shorebirds and the coastal habitat.

The management actions, monitoring regime and corrective actions for marine turtles, migratory shorebirds and their habitat are described below. General management measures will also be implemented throughout the Project area to achieve the management goal of minimising the Project's impact on fauna.

2.2 TURTLES AND NESTING BEACHES HABITAT

The Cape Preston beaches were surveyed for turtle nesting activity by CALM in Dec 2000 and 2004 (CALM, 2000; 2005), Maunsell Australia in Dec 2002 and Jan-Feb 2003 (Maunsell, 2004) and the DEC in Dec 2006 (DEC, 2006). While only low densities of turtle nesting activities were observed, the survey results show there to be zones of turtle nesting activity at the Cape (Figure 3). Analysis of turtle tracks and eggshells indicate that the Green Turtle, Hawksbill Turtle, Flatback Turtle and Loggerhead Turtle are accessing, or potentially accessing the Cape Preston beaches (Maunsell, 2004; DEC, 2006). Seasonal nesting data from significant nesting beaches in the region indicate the 'peak' turtle nesting period to be from October to January.

[1] Under the *Wildlife Conservation Act 1950*

[2] Wetlands that regularly support 1% or more of the individuals in a population of one species or sub-species of waterfowl (including shorebirds) are considered to be of international importance under the Ramsar Convention (Hassell 2002).

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Figure 2
Cape Preston Shorebird Habitat

0 0.5 1 1.5 2
Kilometres
1:40,000

Datum: GDA94
Projection: MGA Zone 50

Department:	ENV	Date:	24/10/2008
Sheet Size:	A4	Status:	Draft
Drawn by GS	Requested by –	Internal Reference 0506_00_2008	

Legend

- Significant shorebird habitat (Southern Beaches)
- Non-significant shorebird habitat (Eastern Beaches)

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Figure 3
Cape Preston Turtle Nesting Activity

0 0.5 1 1.5 2
Kilometres
1:40,000

Datum: GDA94
Projection: MGA Zone 50

Department:	ENV	Date:	28/10/2008
Sheet Size:	A4	Status:	Final
Drawn by GS	Requested by	Internal Reference 0505_02_2008	

Legend

Locations with evidence of turtle nesting activity

Data derived from CALM (2000, 2005), Maunsell (2004a), DEC (2006)

The further turtle monitoring proposed under this FMP (see Section 2.2.2) will increase the current knowledge of turtle usage at the Cape Preston beaches, and will enable the management actions to be refined as required over time based on the results of the monitoring.

Appendix A contains a summary of the fauna counts from the shorebird and turtle surveys.

2.2.1 Impacts, environmental objectives and targets

The potential impacts from the Project's activities, as identified in consultation with the DEC on the Sea Turtle Management Plan and the previous versions of the FMP, may include:

- loss or disturbance of important fauna habitat from construction of port facilities within or close to beaches;
- disruption of turtle feeding and nesting behaviour from access to, or improper behaviour at, the beaches, mangroves, tidal creeks and near-shore waters;
- disorientation of turtle hatchlings from light spill and noise emissions from both the port's land-based facilities and shipping operations;
- introduction or spread of feral animals (e.g. foxes, dogs) from improper waste disposal and employees bringing pets into the Project area; and
- disruption to turtle migration along the coast from ship movements.

The environmental objective is to avoid significant disturbance to the turtle populations, and the target is to maintain the current level of turtle usage of the area (as determined from the on-going monitoring program). To address the potential impacts, the Proponent will implement the following seven strategies:

1. setback distances[3] for port facilities;
2. control of access to nesting beaches;
3. lighting design and use during turtle nesting season;
4. management of drainage;
5. feral animal control programs;
6. training/induction of employees/contractors; and
7. control of small vessel movements.

This FMP compiles the management actions to implement these seven strategies from the previous EMPs and the DEC comments on those EMPs, which are based upon Witherington and Martin (1996). A monitoring regime will be conducted to evaluate the success of the management actions, and corrective or contingency actions will be undertaken if the target is not achieved.

[3] CITIC Pacific Mining Management discussed appropriate setback distances from turtle nesting beaches with Dr Peter Kendrick (DEC) on 13 March 2008. Dr Kendrick advised that the glow of lighting at the beach is the most critical factor for disorientation of turtles, and that the setback distance is therefore irrelevant if there is still any light glow on the beaches (pers. comm. P. Kendrick, DEC 2008).

2.2.2 Management actions, monitoring regime and corrective actions

The management actions are listed in Table 1, and, whilst considered adequate at this stage, the management actions will be refined and amended as required based on site specific information and the monitoring results. Minor requirements will be documented using internal environmental procedures. Any significant changes will require amendment of this FMP.

Table 1 Turtle and nesting beaches habitat management actions

Item #	Action	Timing	Responsibility
1.	Install lighting which is: • Shielded/redirected/lowered/recessed to avoid/minimise light spill towards the southern and eastern beaches • of low disruptive colour (yellow and red)/long wavelength (e.g. low-pressure sodium vapour lights, or yellow filters/bug lights for larger areas/roads, or red LED lights for paths) and, if practicable and safe, develop a procedure for minimal light use during February to April. Buildings will use low reflectivity paints.	During design and on-going	Project Manager, Manager Environment
2.	Authorised access only to beaches utilised by marine turtles between October to April,. All interaction is to be in accordance with the DEC Code of Conduct for interaction with turtles[4].	On-going	Project Manager
3.	Conduct post-construction assessment of light spill and effectiveness particularly during nesting season and hatching periods, for turtle response to lighting.	On-going	Environmental Superintendant/Advisor (ES/A)
4.	Restrict recreational activities by employees in mangrove creeks and near-shore waters used by turtles for foraging, through education programmes, signs and barriers.	On-going	Project Manager
5.	Develop a procedure and induct/train personnel, who are either in control of boats or interact with nesting turtles, of correct behaviour in accordance with the DEC Code of Conduct.	On-going	ES/A
6.	Install stormwater drainage from Project facilities with appropriate treatment structures to be collected and, where practicable, disposed of away from the southern and eastern beaches.	During Project design	Project Manager
7.	Dredging and spoil disposal activities (if required) will be planned to include procedures to minimise disturbance to turtles. Note that no dredging activities are required at this stage.	Prior to dredging	Project Manager, Manager Environment
8.	Establish a fox baiting program and, if necessary, control programs for other feral animals.	2009	Manager Environment
9.	Install facilities with higher noise and vibration levels as far as practicable from the beaches and, where practicable, noisy construction activity will be avoided/minimised in near-shore areas during October to April.	Design and construction	Project Manager
10.	, Seal surfaces near to beaches where practicable to minimise dust emissions.	Design and construction	Project Manager
11.	Training/induction for all employees/contractors will cover management actions in the FMP, including measures to avoid disturbance to turtles.	On-going	Project Manager, Manager Environment
12.	Prepare a Turtle Monitoring Program in consultation with the DEC.	2009	Manager Environment

[4] See http://www.naturebase.net/content/view/2462/1401/1/3/

The proposed monitoring regime (Table 2) includes activities to be performed throughout the life of the Project and which, if the target is not achieved, will result in corrective action. If needed, contingency actions will be developed in consultation with the Project Manager and Manager Environment. The monitoring regime will be adjusted based on the results.

Table 2 Turtle and nesting beaches habitat monitoring regime and corrective actions

Item #	Activity, location	Frequency	Target	Corrective Action	Responsibility
1.	Observe light spill on nesting beaches.	Light audit at beginning of nesting season. Hatchling fan monitoring for two weeks during peak hatching season.	Nesting turtles and turtle hatchlings are not disturbed or disoriented by Project activities.	Identify cause of disturbance. Light audit surveys. Manage the light source. Compile Incident Report and, if needed, develop further contingency actions, e.g. manual intervention.	ES/A Project Manager
2.	Check for evidence of predation on nesting beaches.	Weekly during turtle nesting and hatching.	No more than 10% predation of nests by non-native predators.	Increase feral animal control program. Protect nests using grids, etc.	ES/A Manager Environment
3.	Check for evidence of unauthorized access to nesting beaches.	Weekly during nesting and hatching periods.	No unauthorised access.	Compile Incident Report. Develop contingency action, which may include barricades to prevent access, improve signage, review and improve educational activities, training and inductions.	ES/A Project Manager
4.	Conduct Turtle Monitoring Program	During turtle nesting season.	Turtle Monitoring Program completed on an annual basis.	Review monitoring procedures annually based on results.	Manager Environment

Monitoring Item 1

The light spill on nesting beaches and the potential impacts to adult and hatchling turtles will be monitored using two methods:

1. A light audit survey will be conducted annually at the beginning of the nesting season (i.e. October) to determine if light spill may affect nesting turtles.
2. Hatchling fan monitoring program as part of the Turtle Monitoring Program will be conducted for two weeks during March each year to determine whether hatchlings are being disoriented by light spill from the Project.

The hatchling fan monitoring will be conducted by trained on-site environmental staff daily for a two week period. All nesting beaches on the Cape will be monitored and accessed using ATVs. Successful nests are recorded when five or more tracks are sighted. Fan spread and fan offset angles are measured to determine the extent to which hatchlings are being disoriented.

If hatchlings are found to be disoriented by light spill from the Project then contingency actions will be implemented to mitigate the determined impacts. These may include:

- additional light audit surveys to determine the light source responsible

- manage the light source including can the light source be:
    - removed;
    - lowered;
    - shielded;
    - filtered;
    - changed for a longer wavelength;
    - wattage reduced;
    - redirected;
    - repositioned;
    - put on a motion sensor/timer.

If these measures are not effective then manual intervention may need to be considered, i.e. collecting the hatchlings and transferring them to a dark beach for release.

Monitoring Item 2

Inspections to determine predation on nesting beaches will be conducted weekly during the nesting and hatching periods (i.e. October to April). This will be done by on-site environmental staff patrolling the eastern and southern beaches on quad bikes (or similar). Any evidence of predation will be recorded, including the species, number of nests, etc. If more than 10% of nests are found to be predated by non-native predators (i.e. foxes), then corrective actions will be implemented. Corrective actions may include increasing the feral animal control program and placing grids over nests to protect the eggs and hatchlings.

Monitoring Item 3

Evidence of any unauthorized access to nesting beaches will be monitored weekly by environmental staff during the nesting and hatching periods (i.e. October to April). Any unauthorised access of the eastern and southern beaches will be reported using an Incident Report and appropriate contingency actions will be developed and implemented. These actions may include barricades to prevent access, improve signage, review and improve educational activities, training and inductions.

Monitoring Item 4

The methodology and scope of the annual Turtle Monitoring Program will be finalised in consultation with the DEC. The aim of the Program will be to determine the usage by turtle populations of the Cape Preston beaches and the impact on usage resulting from the Project. The surveys will be conducted to cover the peak nesting periods for the four most common species; the green, flatback, hawksbill and loggerhead turtles. The monitoring program will consist of:

- a track census survey of all nesting beaches on the southern and eastern sides for a two-week period in October and December/January to identify the relative significance of nesting beaches for each species, monitor populations and assess trends at key nesting beaches and to measure effectiveness of sea turtle management;
- a water activity census in areas considered to be of significance to feeding turtles; and
- consultation with port staff to establish any incidents/information in relation to sea turtles (e.g. hatchling disorientation reports, etc.).

The track census survey will be conducted on all nesting beaches on the southern and eastern side of the Cape for a two-week period in October to capture the peak nesting of hawksbill turtles and December/January to capture the peak nesting of green, flatback and loggerhead turtles. Given the low density of nesting recorded on the Cape, all beaches will be monitored to provide a more accurate picture of turtle usage on the Cape. The track census survey will be conducted daily by trained on-site environmental staff using ATVs to access the beaches. ATVs are commonly used in other programs for monitoring turtle nesting beaches. The number of overnight tracks will be recorded as well as the species if known (or a photo will be taken for later identification). Any new nests associated with tracks will be recorded to determine the abundance of nests on sections of nesting beaches. Opportunistic observations such as any predated nests, emerged nests, etc will also be recorded.

The hatchling fan monitoring program discussed as Monitoring Item 1 above will form part of the Turtle Monitoring Program. It is anticipated that this monitoring program will contribute to a greater understanding of the turtle populations in this region and assist in addressing information gaps.

Training will be essential for the on-site environmental staff conducting the monitoring program and will be provided in the field by qualified marine conservation biology consultants. Qualified marine conservation biology consultants will manage and provide technical support for the Turtle Monitoring Program.

The Turtle Monitoring Program will be implemented during construction and then two years post-construction depending on the results collected and review of the Turtle Monitoring Program.

2.3 MIGRATORY SHOREBIRDS AND COASTAL HABITAT

Migratory shorebirds utilise the coastal habitat at Cape Preston, particularly on the southern beach and around the tidal creek, either as a stopover site before continuing their southern migration, or as a seasonal refuge site (Figure 2). The survey of the beach to the east of Cape Preston concluded that this beach does not appear to have favourable feeding or roosting habitat, and is therefore not considered to be a significant habitat for shorebirds (Figure 2).

2.3.1 Impacts, environmental objectives and targets

The potential impacts from Project's activities include:

- loss or disturbance of habitat from construction of port facilities within or close to coastal habitats;
- disruption of shorebird feeding and roosting behaviour from access to the beaches, mangroves and tidal creeks;
- disruption of shorebird behaviour from light spill and noise emissions from the port's land-based facilities; and
- introduction or spread of feral animals (e.g. foxes, dogs).

The environmental objective is to avoid loss of coastal habitat, specifically at Cape Preston southern beach, and to avoid significant disturbance to both the migratory (and endemic) shorebird populations. The target is to not affect the current level of shorebird usage of the area (as determined from current and future surveys).

Strategies to address the potential impacts include:

- setback distances for port facilities;
- control of access;
- lighting design;

- management of drainage; and
- feral animal control programs.

These strategies are common for the protection of turtles because they share the same beach habitat, and, therefore, the management actions are similar.

2.3.2 Management actions, monitoring regime and corrective actions

Management actions to implement these five strategies are designed to achieve the environmental objective (Table 3). A monitoring regime will be conducted to evaluate the success of the management actions and, depending on the results, corrective/preventative actions or contingency actions will be undertaken if the target is not achieved.

Table 3 Migratory shorebirds and coastal habitat management actions

Item #	Action	Timing	Responsibility
1.	Install lighting which is: • Shielded/redirected/lowered/recessed to avoid/minimise light spill towards the southern and eastern beaches • of low disruptive colour (yellow and red)/long wavelength (e.g. low-pressure sodium vapour lights, or yellow filters/bug lights for larger areas/roads, or red LED lights for paths) and, if practicable and safe, develop a procedure for minimal light use during October and November. Buildings will use low reflectivity paints.	During design and on-going	Project Manager, Manager Environment
2.	Install facilities with higher noise and vibration levels as far as practicable from the beaches and, where practicable, noisy construction activity will be avoided/minimised in near-shore areas during October/November.	During design and construction	Project Manager, Manager Environment.
3.	Prohibit unauthorised access to coastal habitat of the southern beach between September and April.	On-going	Project Manager
4.	Maximise distance between noise sources and the coastal habitat, and construct noise barriers if required, in consultation with DEC.	During design	Project Manager
5.	Install stormwater drainage from Project facilities with appropriate treatment structures to be collected and, where practicable, disposed of away from the southern beaches.	During design and construction	Project Manager
6.	Conduct further annual surveys of the shorebirds at Cape Preston in consultation with DEC and, based on the information, establish a monitoring regime.	Commencing in October 2008	Manager Environment

The monitoring regime includes activities to be performed throughout the life of the Project and which, if the target is not achieved, will result in corrective action (Table 4). If needed, contingency actions will be developed in consultation with the Project Manager and Manager Environment. The monitoring regime will be adjusted based on the results.

Table 4 Migratory shorebirds and coastal habitat monitoring regime and corrective actions

Item #	Activity	Frequency	Target	Corrective Action	Responsibility
1.	Observe light spill and noise level on coastal habitats	Monthly during construction between September and April	Birds are not disturbed or disorientated by Project activities	Identify cause of disturbance. Light audit surveys. Manage the light source. Compile Incident Report and, if needed, develop further contingency action to reduce or redirect light if that is a problem and/or to modify noise characteristics causing disturbance. Assess effectiveness of mitigation.	ES/A Project Manager
2.	Check for evidence of predation on shorebird coastal habitat.	Weekly during nesting season of key shorebirds species.	No more than 10% predation of nests by non-native predators.	Increase feral animal control program. Protect nests using grids, etc.	ES/A Manager Environment
3.	Check for evidence of unauthorized access to coastal habitats	Monthly at all times and weekly during nesting season of key shorebirds species	No unauthorised access by employees	Compile Incident Report. Develop contingency action, which may include barricades to prevent access, improve signage, review and improve educational activities, training and inductions.	ES/A Project Manager
4.	Conduct shorebird Monitoring Program	Annually, towards the end of the southward migration period (November)	Shorebird numbers should not reduce by more than 30% compared to previous bird counts conducted	Review monitoring procedures annually based on results.	Manager Environment

3. IMPLEMENTATION OF THE PLAN

Mineralogy has an approved Environmental Management System (EMS) that designates the roles of 'Project Manager' and 'Manager Environment' to support its implementation. CITIC Pacific Mining Management Pty Ltd (CPMM), which will develop and operate the Project, has developed its own corporate and Project specific EMS to meet the requirements of:

- Statement 635;
- other legal requirements including (*Aboriginal Heritage Act 1972*, *Mining Act 1978*, etc); and
- CPMM's Environmental Policy and objectives.

CPMM's Systems Controller and Manager Environment will ensure the compatibility of the Mineralogy EMS and CPMM's EMS in liaison with Mineralogy's Project Manager and Environment Manager.

The Project's Environmental Management Framework (Figure 4) describes the linkage between the requirements of Statement 635, which required the development of an EMS (Commitment 1), an Environmental Management Program (EMPgm) (Commitment 2) and a number of EMP's.

This FMP will be implemented under CPMM's EMS and the EMPgm.

3.1 ENVIRONMENTAL MANAGEMENT SYSTEM ELEMENTS

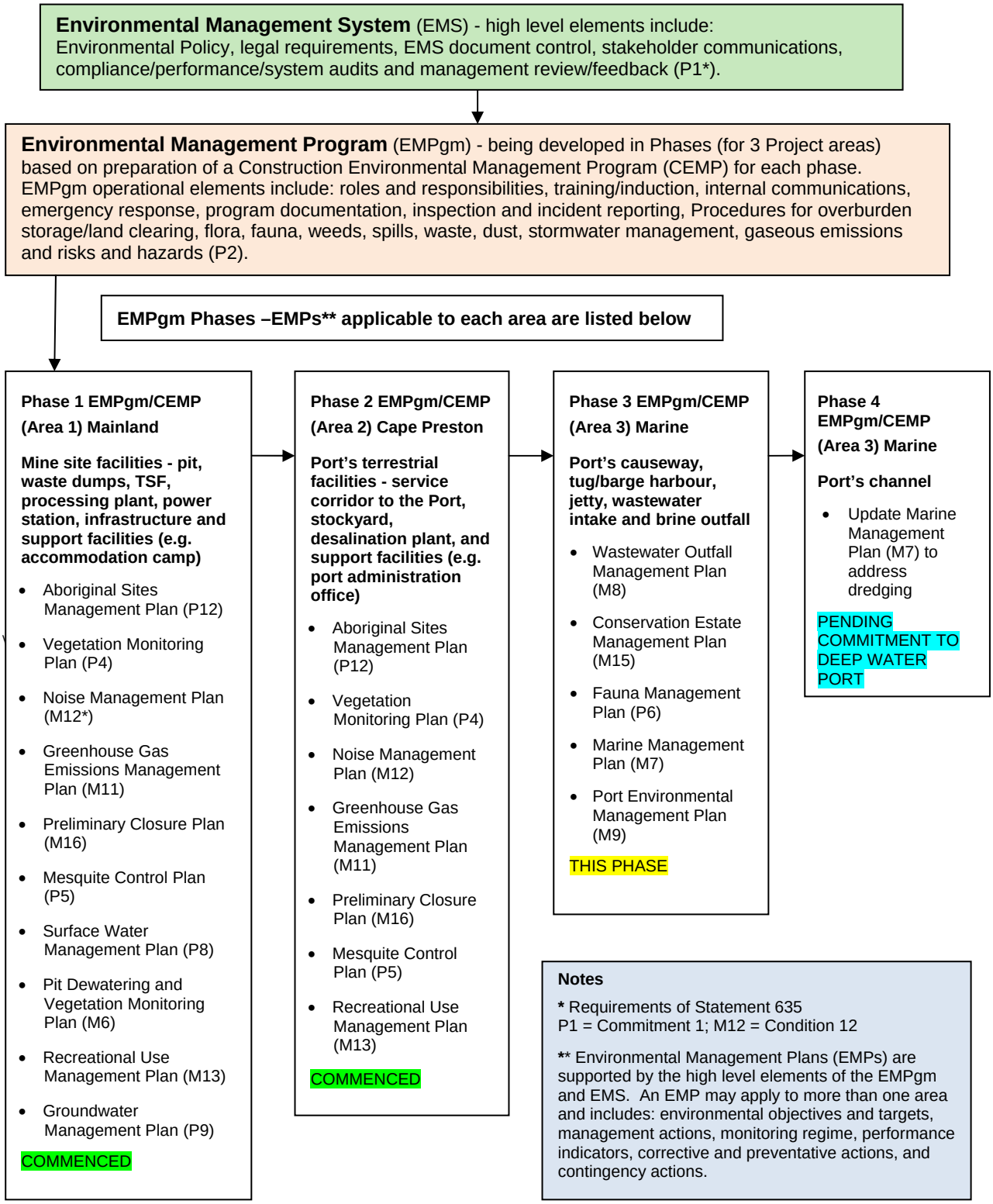
The key elements of CPMM's EMS, which support the EMPgm and the FMP, include:

- environmental policy
- legal requirements
- EMS document control
- stakeholder communications
- compliance, performance and system audits
- management review/feedback.

The Project's Environmental Policy commits all CPMM personnel and its contractors to:

- minimise ecosystem disturbance
- support the principles of sustainable development and foster a waste minimisation ethic
- establish and maintain responsible standards, objectives and targets for managing environmental impacts of Project services and processes
- encourage environmental awareness and responsibility through the internal and external reporting performance
- monitor, review and audit documentation, processes and performance against recognised environmental benchmarks, address any non-conformances and strive for continual improvement
- ensure all employees and contractors accept that working according to the relevant management systems is a condition of employment
- comply with the requirements of applicable environmental legislative obligations, and be sensitive to community expectations.

Figure 4 Environmental Management Framework



In order to achieve these management aims, a systematic approach to environmental management has been developed in accordance with the AS/NZS ISO 14001:2004 standard. The documentation and procedures to implement the high level elements of the EMS are available to all staff on the CPMM intranet. The EMPgm and the EMPs contain the documentation and procedures to implement the operational elements of the Project's EMS.

As with the Phase 1 & 2 EMPgms, the key elements of the Phase 3 EMPgm that support the implementation of the FMP include:

- roles and responsibilities (including contractor management)
- training/induction
- internal communications
- emergency response
- EMPgm document control
- inspection and incident reporting
- procedures for: overburden storage/land clearing, flora, fauna, weeds, spills, waste, dust, stormwater, gaseous emissions, risks and hazards.

During the implementation of the FMP, management actions, monitoring tasks and corrective/preventative actions or contingency actions will be amended, as and if required, in order to meet the environmental objectives and targets.

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Appendix A

Fauna counts from migratory shorebird and turtle surveys conducted at Cape Preston

October 2002 Shorebird Survey Results

Total counts of birds at Bird Sites* 1 – 6 during the survey

Date	Bird Site*	Total Shorebirds
8 October 2002	Bird 1	440
8 October 2002	Bird 2	109
8 October 2002	Bird 3	55
9 October 2002	Bird 4	252
9 October 2002	Bird 5	680
9 October 2002	Bird 6	zero
10 October 2002	Bird 1	575
10 October 2002	Bird 2	89
10 October 2002	Bird 3	50
11 October 2002	Bird 1	534

*Refer to Figure A.1

Highest count of each individual species of shorebird recorded by Bird Site* during the survey

Species	Highest Count	Date	Bird Site
Bar-tailed Godwit	102	10th October	Bird 1
Whimbrel	30	11th October	Bird 1
Eastern Curlew	9	8th October	Bird 1c
Marsh Sandpiper	1	8th October	Bird 2
Common Greenshank	14	9th October	Bird 5
Terek Sandpiper	15	11th October	Bird 1
Common sandpiper	1	12th October	Creek exploration
Grey-tailed Tattler	217	11th October	Bird 1
Ruddy Turnstone	190	9th October	Bird 5
Great Knot	20	8th October	Bird 1
Sanderling	124	9th October	Bird 5
Red-necked Stint	106	11th October	Bird 1
Beach Stone-curlew	2	10th October	Bird 2
Pied Oystercatcher	6	8th October	Bird 5
Grey Plover	20	9th October	Bird 5
Red-capped Plover	65	11th October	Bird 1
Lesser sand Plover	1	10th October	Bird 1
Greater Sand Plover	113	11th October	Bird 1
Oriental Plover	13	10th October	Bird 1

*Refer to Figure A.1

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Figure A.1
Location of Bird Sites

0 0.5 1 1.5 2
Kilometres
1:40,000

Datum: GDA94
Projection: MGA Zone 50

Department:	ENV	Date:	27/10/2008
Sheet Size:	A4	Status:	Final
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Legend

- Bird Site 1 (Southern Beaches)
- Bird Site 2 (Southern Beaches)
- Bird Site 3 (Southern Beaches)
- Bird Site 4 (Southern Beaches)
- Bird Site 5 (Southern Beaches)
- Bird Site 6 (Eastern Beaches)

Data from Maunsell (2004a)

Combined totals of the highest counts from Bird Sites* 1, 4 & 5

Species	Total Bird Site 1	Total Bird Site 4	Total Bird Site 5	Total Minimum Number
Bar-tailed Godwit	102	25	32	159
Whimbrel	30	0	11	41
Eastern Curlew	9	0	0	9
Marsh Sandpiper	1	0	0	1
Common Greenshank	11	10	14	35
Terek Sandpiper	15	0	0	15
Common sandpiper	1	0	0	1
Grey-tailed Tattler	217	51	124	392
Ruddy Turnstone	72	135	190	397
Great Knot	20	10	15	45
Sanderling	3	6	124	133
Red-necked Stint	106	0	46	152
Beach Stone-curlew	2	0	0	2
Pied Oystercatcher	2	0	6	8
Grey Plover	12	4	20	36
Red-capped Plover	65	5	0	70
Lesser sand Plover	1	0	0	1
Greater Sand Plover	113	10	98	221
Oriental Plover	13	0	0	13
TOTALS	**795**	**256**	**680**	**1731**

*Refer to Figure A.1

Reference: Hassell (2006)

December 2000 Turtle Survey Results

No live sea turtles were observed at Cape Preston. Fresh tracks, probably resulting from nesting activity during the previous night, were found scattered along the length of both the eastern and southern beaches of Cape Preston (see Figure 1). At several sites, fox tracks were observed around or near turtle nest excavations.

1. Eastern Beach.

Most activity (5 tracks, 2 older nests) was at the eastern end of the beach (see below). Of the five tracks, three were ‘opposite’ (flatback or green turtles), and one was ‘alternate’ (loggerhead or hawksbill). One track was too eroded to be determined. Two old nest excavations were also present. A dead mature male green turtle was washed up on the beach near the nests (carapace length approx 800mm).

In the central part of the beach, two older nest excavations were present.

At the western end, two tracks were found, one ‘opposite’ and one ‘alternate’. Two old nest excavations were observed.

No hatchling activity was observed. Fox activity was obvious around nests.

2. Southern Beach.

Nesting activity occurred all along the beach, but was concentrated at the southern end.

At the northern end, three 'alternate' and a single 'opposite' track were observed, with two old nesting excavations. In the central part of the southern beach, one 'opposite' track was seen, with two older nesting excavations. At the southern point of the beach, eleven 'opposite' tracks were observed.

Summary of December 2000 Turtle Survey Results

Cape Preston Beach		**Turtle species**		
		Greens / Flatbacks	Hawksbills / Loggerheads	Old Nests
Eastern Beach	East	3	1	3
	Central	0	0	2
	West	1	1	2
Southern Beach	East	1	3	2
	Central	1	0	1
	West	11	0	2

Reference: CALM (2000)

December 2002/January-February 2003 Turtle Survey Results

Cape Preston Beach		**Turtle species**			
		Greens / Flatbacks	Hawksbills / Loggerheads	Old tracks/ uncertain IDs	Old nests/body holes
Eastern Beach	East	2	0	0	16
	Central	1	0	0	4
	West	0	0	0	0
Southern Beach	North	1	4	2	5
	Central	2	0	0	1
	South	1	0	0	0
Mangrove Beach		1	0	0	0
Totals		**8**	**4**	**2**	**26**

Reference: Maunsell (2004)

December 2004 Turtle Survey Results

No turtle tracks were observed on any mainland beaches during aerial surveys conducted between Karratha and Onslow in 2004.

Reference: DEC (2006)

December 2006 Turtle Survey Results

No marine turtles were observed nesting at Cape Preston. No fresh tracks (from the previous night) were seen along the beaches. A total of 24 older nesting activities (tracks, nests or both) were recorded along the length of both the eastern and southern beaches of Cape Preston. No hatchlings or hatchling tracks were seen.

Eastern Beach

One nest and two sets of tracks were seen on the eastern beach of Cape Preston (Table 1).

Table 1 Turtle nesting activity on eastern beach, Cape Preston

Activity Number	Track(s)	Nest	Species
1	None	Yes	Unknown / Flatback?
2	Emerge and Return	Not seen	Flatback?
3	Emerge and Return	Not seen	Flatback?

Southern Beach

Twenty-one nesting activities were recorded on the southern beach of Cape Preston. These included 17 sets of tracks and 11 nests (Table 2).

Table 2 Turtle nesting activity on southern beach, Cape Preston

Activity Number	Track(s)	Nest	Species
4	One track	Not seen	Unknown / Flatback?
5	Emerge and Return	Not seen	Flatback?
6	Emerge and Return	Not seen	Flatback?
7	Emerge and Return	Not seen	Flatback?
8	Emerge and Return	Yes	Flatback?
9	Emerge and Return	Yes	Flatback?
10	Emerge and Return	Not seen	Unknown / Flatback?
11	Emerge and Return	Yes	Unknown / Flatback?
12	Emerge and Return	Not seen	Flatback?
13	Emerge and Return	Yes	Flatback?
14	Emerge and Return	Not seen	Flatback?
15	Emerge and Return	Yes	Flatback?
16	Emerge and Return	Not seen	Unknown / Flatback?
17	Emerge and Return	Not seen	Unknown / Flatback?
18	Emerge and Return	Yes	Unknown / Flatback?
19	Emerge and Return	Not seen	Unknown / Flatback?
20	Emerge and Return	Yes	Unknown / Flatback?
21	None	Yes	Unknown / Flatback?
22	None	Yes	Unknown / Flatback?
23	None	Yes (dug up)	Flatback?
24	None	Yes	Flatback?

Reference: DEC (2006)

Appendix 4

Response to DEC comments on a previous version of PEMP

Attachment 1: Response to DEC comments on previous version of the PEMP[1]

No.	DEC Comments (Aug 2007)	Response	Reference in PEMP or Other Plan
1	Figure 2 of Schedule 1 does not appear to be the correct reference. In Statement 635, Figure 2 of Schedule 1 is titled "Key Project Components and Groundwater Depletion Zone". This figure does not show the Environmental Quality Objective (EQO) zones referred to in Condition 9-1. It would seem that Condition 9-1 incorrectly refers to this figure or the figure is wrong. The EQOs that are required to be established in the PEMP must be consistent with the EQOs and levels of ecological protection shown in Map 3 of the document – 'Pilbara Coastal Water Quality Consultation Outcomes: Environmental Values and Environmental Quality Objectives'. The environmental management frame work outlined in this document has been endorsed by the EPA for interim use.	Agree. It is assumed that Condition 9-1 of Statement 635 incorrectly referred to Figure 2 of Schedule 1. The EQOs established in the current PEMP are consistent with the EQOs and levels of ecological protection set by the DEC in the document titled *Pilbara Coastal Water Quality Consultation Outcomes: Environmental Values and Environmental Quality Objectives*.	PEMP - Figure 16
2	Figure 2.3 shows Mineralogy's proposed change to the level of ecological protection applying along the shipping channel (from High to Moderate protection). This proposed change was submitted by Mineralogy during the Pilbara Coastal Water Quality public consultation process but was not accepted by the EPA.	Accepted. The PEMP shows the shipping channel as being a high protection zone.	PEMP - Figure 16
3	Many of the figures in the document are inadequate in both scale and detail and some are almost impossible to read. Many figures and tables are incorrectly referred to in the text and contain errors.	All figures in the revised PEMP (and associated appendices) are now adequate in terms of scale and detail, and all figures and tables are error free and correctly referred to in the text.	PEMP and Appendices
4	The objectives for determining Environmental Quality Criteria (EQCs) are outlined in Table 2.2 of the PEMP, but absolute numerical values can only be determined for some EQC when the natural state of the undisturbed environment is known. This is OK provided the PEMP describes a baseline environmental quality monitoring program that will provide the information needed to derive the EQC and commits to the baseline environmental quality monitoring program being completed prior to any construction group activity. It should also be noted that Table 2.2 shows an EQC of 95% species protection in High protection areas. This should be 99% species protection.	Revised EQC's have been developed based on best available data as assessed by Oceanica Consulting Pty Ltd. The PEMP now shows there being an EQC of 99% species protection in High protection areas.	PEMP – Section 6
5	The PEMP discusses the environmental values, EQOs and levels of ecological protection that will apply to the port, but has not set out an Environmental Monitoring and Management Program that describes in detail how the environmental performance of the port will be assessed and managed. Aspects that would be addressed include, but are not limited to, sampling locations (impact and reference sites), environmental quality indicators to be measured, EQC that the indicators will be assessed against, management actions/strategies to be implemented if the EQC are exceeded and reporting procedures.	Agree. The PEMP now includes details of environmental monitoring and management	SPEMP - Section 5-7
6	Figure 1.3 indicates a rock causeway from Cape Preston to Preston Island. Section 1.3.3.2 states "rock causeway or trestle bridge from Cape Preston to Preston Island". It then goes onto refer to is as a "bridging structure"?	These inconsistencies between the figures and text have been corrected in the PEMP. The structure will be a solid rock causeway, which was approved by the EPA in their approval of the MMP.	Figures 1 & 2

[1] Including the previous OSCP and Ballast Water and Hull-fouling Organisms Management Plan

No.	DEC Comments (Aug 2007)	Response	Reference in PEMP or Other Plan
7	There is no evidence provided that shows that the construction of a rock causeway would not seriously disturb the flow and circulation of waters around Cape Preston.	This comment is relevant to the project Marine Management Plan (MMP) which has been approved by the EPA.	MMP
8	Section 2.3.4 states that approximately 4.5 million cubic metres of dredge spoil will need to be dumped, and yet footnote 7 states that the dredging channel design will change pending further engineering design.	The Stage 1 Port does not require dredging therefore it has not been included in the PEMP.	N/A
9	Section 1.3.4 states that the brine discharge from the desalination plant will be 57.8 million cubic metres per annum (=1.83 m^3/s). However, section 1.3.4.2 estimates brine flow rate of 1 m^3/s which equals 31.5 Mm^3/yr. Which figure is correct and which figure was used in modelling the required mixing zone?	Noted. The text related to this comment has been deleted from the PEMP. Issues associated with the desalination plant brine discharge are now appropriately addressed in the project WWOMP.	WWOMP
10	There is contradiction with regard to the proposed size of the moderate protection mixing zone for the desalination plant brine discharge. A 1 ha mixing zone is shown in Figure 2.5 and mentioned in section 1.2.5 (vii) of the Oil Spill Contingency Plan but a 4 ha zone is mentioned in Section 2.3.4. Ministerial condition 8.2.2 states up to 4 ha.	See response above.	WWOMP
11	Section 1.3.4.2 states that small quantities (< 10tpa) of detergent, caustic soda and anti-microbial will be added. Unclear if that is 10 tpa of each or total. Also around 270 tpa (~740kg/day) of the antiscalent Flocon 100 will be added. It is claimed that Flocon 100 is an organo-phosphorus but a web search suggested that it is in fact a polycarboxylic acid.	See response above.	WWOMP
12	Whole of effluent testing will be necessary to demonstrate that 90% species protection is possible within the desalination plant brine discharge mixing zone and 99% species protection will be achieved at the edge of the mixing zone 95% of the time.	See response above.	WWOMP
13	Given the high salinity of the brine discharge (64ppt) it is not clear how the Environmental Quality Guideline for moderate ecological protection (± 1.2 ppt) will be met at the outfall.	See response above.	WWOMP
14	Will the desalination plant brine discharge water temperature be an issue?	See response above.	WWOMP
15	Based on Condition 8-2 (Item 1), a High level of protection should apply to the waters in the region of Cape Preston except for the Moderate Protection Mixing Zone surrounding the desalination plant brine discharge.	See response above.	WWOMP
16	EQO 1 states that three levels of ecological protection shall apply to Cape Preston: High, Moderate and Low whereas Section 2.3.4 states Maximum, High and Moderate.	This inconsistency in referring to ecological protection levels has been corrected in the PEMP.	PEMP – Section 6.1
17	Section 2.3.4 claims there will be Moderate Protection buffer zones around jetties, berthing areas, ship harbours and a 250 m buffer around the dredging areas. Figure 2.5 also shows the proposed Moderate protection zoning for the shipping channel and a 250 m buffer either side. Please note that a Moderate level of ecological protection does not apply to dredged shipping channels and a Maximum level of ecological protection will apply in the conservation zone of the Cape Preston Marine Management Area.	Noted. The PEMP shows the shipping channel as being of high protection, and the proposed Regnard Marine Management Area[2] will be maximum protection.	PEMP - Figure 16

[2] The proposed Cape Preston Marine Management Area has been replaced by the proposed Regnard Marine Management Area.

No.	DEC Comments (Aug 2007)	Response	Reference in PEMP or Other Plan
18	Mineralogy estimated that 701 ha will receive Moderate protection. This is not consistent with Condition 8-2 (Item 1).	The text related to this comment has been deleted from the PEMP. This issue is associated with Condition 8-2, and is therefore covered in the WWOMP.	WWOMP
19	Regarding the statement in Section 2.2.6 of the PEMP "on being granted the lease site for the pearl farm, Indian Ocean Pearls agreed not to lodge complaints regarding Mineralogy's impacts on their pearl production", EQO2 and EQO3 (Table 2.1) state that water quality must be suitable for fishing and aquaculture. This should be the case regardless of any agreements with this lease, and the proponent will be expected to confirm that these EQO's are met throughout the area through performance monitoring.	Agree. The text related to this comment has been deleted from the PEMP. The EQO's in the PEMP ensure that water quality will be suitable for fishing and aquaculture, regardless of any agreements that may or may not have previously been made.	PEMP – Section 6.1
20	The section in the PEMP on light spill management does not adequately address light spill issues. The proponent states lighting requirements are largely dictated by Occupational Health and Safety Regulations. They have suggested some measures to reduce light spill but have not indicated the proximity of nesting beaches.	The containment of light spill measures are addressed within the Project FMP, which contains information and management actions relating to the location of turtle nesting sites in relation to the Port. The FMP has been approved by the EPA. A summary of light spill management has been included in the PEMP for reference purposes.	FMP, PEMP – Section 5.1
21	2.6.2 "An artificial lighting source is likely to cause problems for sea turtles if light from the source can be seen by an observer standing anywhere on the nesting beach" Figure 2.2 appears to show a proposed conservation area (flora and fauna protection) within a few km of the port. The impact of light spill will need to be assessed in more detail and advice should be sought from the DEC's Environmental Management Branch.	See above	FMP
22	There is a power station but no mention of a cooling water outfall. If a marine outfall is anticipated, then the thermal plume would be significant and it has been the experience of DEC Officers that cooling water can be highly contaminated with metals if treated timber is used in cooling tower construction.	No cooling water outfall is being proposed for the Project.	N/A
23	Mention is made of a sewage treatment plant but no mention of an outfall.	There will be no sewage treatment plant marine outfall.	N/A
24	No mention is made of the expected frequency of maintenance dredging of shipping channels or the environmental monitoring and management program that might be used to minimise the impact of dredging.	Dredging is to be discussed as part of future amendments to the MMP, in accordance with Statement 635. The PEMP will also be amended to incorporate additional environmental monitoring and management of dredge impacts	N/A - MMP and PEMP will be amended in the future to incorporate dredging
25	Advice should be sought from the DPI Marine Environmental Protection Unit as to the suitability of the OSCP presented in the PEMP.	Advice has been sought from the DPI Marine Environmental Protection Unit, and its comments have been addressed in the OSCP.	OSCP
26	No mention is made in the OSCP on what response equipment will be on site or available at short notice.	The OSCP has been amended to contain details of the equipment that will be available on site.	OSCP – Section 5.1

No.	DEC Comments (Aug 2007)	Response	Reference in PEMP or Other Plan
27	No discussion is made in the OSCP of how beaches, mangroves, mud flats, etc. will be accessed for cleanup.	The OSCP now includes basic details of coastline access for clean up. More detail will be developed as the port area designs are finalised.	OSCP
28	Bunkering fuel will be available on the load out jetty. Clear procedures for refuelling vessels and maintenance of pipes and other equipment should be included in the OSCP to ensure industry best practice.	Bunkering fuel will no longer be available on the load out jetty. Management of general refuelling practices has been included in the PEMP.	PEMP - Section 5.2

Appendix 5

Oceanica review of previous water quality sampling at Cape Preston

Water quality surveys have been undertaken at Cape Preston on a number of occasions by various survey teams, namely by Maunsell in 2002, and by URS on several occasions in 2007, and once in 2008. The URS surveys targeted two sites, while Maunsell surveyed 6 sites off Cape Preston.

In all studies, the analyses were conducted using relatively high laboratory LORs (rather than ultra-trace techniques), as the objectives were directed at obtaining data for use for the desalination plant purposes.

The survey results are discussed separately below.

Maunsell 2002 survey

The laboratory LORs used in the Maunsell survey were above the 99/95% species protection level for aluminium, cadmium, cobalt and lead. The analysis results showed that the maximum recorded levels were above the 99/95% species protection level for cadmium, copper, mercury and zinc. The full data sets for these four analytes are presented in Table A1.

For cadmium, copper, mercury and zinc there were no apparent patterns in metal concentrations between surface and bottom waters (Table A1). High mercury levels were found in almost all samples, while cadmium found in approximately half the samples, copper in about a quarter, and only one sample was above the guideline level for zinc.

URS 2007 surveys

The laboratory LORs used by URS 2007 differed between surveys, making compliance assessment difficult. Some LORs were at times above the 99/95% species protection levels.

The results for all samples are presented in Table A2.

Zinc and lead sporadically occurred at high levels. Though not all samples with detection of these analytes were above the guideline levels, the levels were up to three times the order of magnitude recorded for background unimpacted sites by the DEC (Wenziker et al. 2006). A review of the results found that, in 2007, transport blanks and field blanks contained both zinc and lead when this analyte was recorded in any sample, indicating that the high zinc and lead levels reported had most likely originated from cross-contamination during sampling and sample handling.

The URS sampling reported elevated boron levels which would not be expected in this undeveloped environment. Boron is a significant natural constituent of seawater (values typically ~ 4-5 mg/L) and the slightly elevated values reported by URS were from a single survey and so may have been a laboratory error. At this stage it is considered highly unlikely that Boron levels are naturally about EQG values, however, the wastewater discharge testing will include boron and will be used to confirm this.

Cadmium occurred above the 99/95% species protection level in one sample. All other samples were below LOR.

URS 2008 survey

In 2008, no transport blank or field blanks were analysed, instead the quality control samples consisted of field duplicates (Table A3). The high levels of lead were found only in one sample, with two duplicate samples also containing high lead levels. All other samples contained lead below the laboratory LOR, bar one sample, with lead at the LOR. Again, such levels are up to three orders of magnitude above the background levels recorded for unimpacted sites by Wenziker et al. (2006). Given that similar field practices were most likely undertaken both in 2007 and 2008, it is considered likely that the high lead levels reported in the 2008 survey also originated from cross-contamination rather than from actual high levels in the seawater.

Boron was consistently above 99% species protection level in all samples.

Comparison of water quality data

The surveys undertaken in 2002, 2007 and 2008 found differing analytes at elevated levels, with no consistent trend:

- Maunsell 2002: cadmium, copper, mercury, zinc
- URS 2007: zinc, lead, copper, aluminium
- URS 2008: lead, boron.

Comparison of results

Though the varying LORs between surveys and within surveys makes it difficult for a straight comparison between data sets, some conclusions can still be made. The high levels of mercury reported by Maunsell were not found in subsequent surveys by URS. Likewise, cadmium was recorded in 2002 but was not found in 2007 and 2008. However, copper and zinc were found both in 2002 and in 2007, but not in 2008. Lead was found both in 2007 and 2008. Boron was found at high levels in 2008 only.

Cadmium was detected above LOR (and the 99/95% species protection level) in several samples in 2002. Subsequently cadmium was only detected above LOR in one sample in 2007 with all other samples below LOR. In most surveys the LOR was sufficiently low to assess the results against the 99/95% species protection level. Sediment sampling undertaken at 11 sites at Cape Preston in 2002 found low levels of cadmium in the sediments, well below the ISQG-low level (Table A4). It therefore seems unlikely that the waters off Cape Preston are high in cadmium, and the 2002 data may have arisen from cross-contamination issues.

Copper was found at elevated levels in several samples in 2002 and in all three replicates from one site in the February survey of 2007. The LOR was not sufficiently low in any of the surveys to undertake an assessment against the 99/95% species protection level. However, sediment sampling on 11 sites at Cape Preston in 2002 found that the copper levels were very low in the sediments, well below the ISQG-low (Table A4). As copper was only detected in one water sample in 2007, and not at all in 2008, it seems unlikely that the waters off Cape Preston are high in copper, and the issue could potentially have originated from cross-contamination of the water samples.

Mercury was found in almost all samples obtained in 2002, but not in any samples in 2007 or 2008. The LORs used in all the water quality surveys were sufficiently low to assess against the 99/95% species protection level. Sediment sampling undertaken in 2002 at 11 sites at Cape Preston did not find mercury in the sediments above the ISQG-low, in fact all samples bar one was below LOR of 0.01 mg/kg (Table A4). It therefore seems most likely that the waters off Cape Preston are not naturally high in mercury and that the high levels recorded in 2002 could have originated from cross-contamination.

Zinc was found above the 99/95% species protection level in the 2002 survey, and in two 2007 surveys. In 2007, zinc was also present in the transport and field blanks, indicating the likelihood of cross-contamination of the samples. Sediment samples obtained at 11 sites at Cape Preston in 2002 had low levels of zinc, well below the ISQG-low level (Table A4). It is therefore unlikely that the waters at Cape Preston have high zinc levels, rather it is thought that the high levels in the samples originated from contamination in the field. CSIRO had similar issues with zinc during the pilot study (Wenziker et al. 2006).

Likewise, lead found in 2007 and 2008 was likely to have originated from cross-contamination, as this analyte was also found in transport and field blanks in the 2007 surveys.

The LORs used for aluminium in all surveys were too high for assessment against the 99/95% species protection level. However, on one occasion in 2008 aluminium was above the assessment level in a

field replicate sample (but not in the other). It is considered unlikely that this reflects sporadic high aluminium levels at Cape Preston, and again, cross contamination of the sample may be a more plausible explanation.

Boron was found consistently above the low reliability 99% species protection level in 2008. The only other testing undertaken for this analyte was on one occasion in 2007, where the levels were well below the low reliability 99% species protection level. There are no previous reports of boron being naturally elevated in Pilbara waters. Boron is a significant natural constituent of seawater (values typically ~ 4-5 mg/L) and the slightly elevated values reported by URS were from a single survey and so may have been a laboratory error. At this stage it is considered highly unlikely that Boron levels are naturally above EQG values. The wastewater monitoring program includes toxicants and would pick up if elevated levels of boron existed.

Table A1 Metal concentrations in Marine Waters inshore at Cape Preston in November 2002 (µg/L) (Maunsell, 2006)

Analyte	LOR	Results	99/95% species protection1
Aluminium	10	All <LOR	0.5#
Antimony	20	All <LOR	N/A
Arsenic	10	All <LOR	N/A
Bismuth	10	All <LOR	N/A
Cadmium	1	Min <1 **Max 3**	0.7
Chromium	1	All <LOR	27.4 (Cr III) 4.4 (Cr IV)
Cobalt	2	All <LOR	1
Copper	1	Min <1 **Max 26**	1.3
Iron	1	Min <1 Max 89	N/A
Lead	10	All <LOR	4.4
Manganese	1	Min <1 Max 1	80*
Mercury	0.1	Min <0.1 **Max 1.4**	0.1
Nickel	4	All <LOR	7
Selenium	20	All <LOR	N/A
Tin	20	All <LOR	N/A
Titanium	1	All <LOR	N/A
Vanadium	1	All <LOR	100
Zinc	2	Min <2 **Max 24**	15

[1]ANZECC/ARMCANZ (2000a) modified in EPA (2005a)

Low reliability marine trigger value (ANZECC/ARMCANZ, 2000a)

GREEN: Green cells indicate parameters without sufficient LOR for comparison to the 99% species protection level

BLUE: Exceedence of the 99% species protection levels marked in blue

Table A2 Metal concentrations in all samples taken inshore at Cape Preston in November 2002 (µg/L) (Maunsell 2006)

Sampling site	Sampling depth	Replicate	Cadmium	Copper	Mercury	Zinc
99/95% species protection level)[1]			**0.7**	**1.3**	**0.1**	**15**
1	Surface	1	**1**	**2**	**1**	9
		2	<1	<1	<0.1	4
2	Surface	1	**1**	<1	**0.4**	3
		2	**1**	<1	**0.6**	5
	Bottom	1	<1	<1	**0.4**	9
		2	<1	1	**0.4**	10
3	Surface	1	<1	<1	**0.8**	2
		2	**1**	**2**	**0.3**	14
	Bottom	1	**1**	<1	**0.7**	3
		2	**3**	3	**1.1**	10
6	Surface	1	**1**	<1	**1.4**	10
		2	**1**	<1	**0.5**	10
	Bottom	1	<1	<1	**0.6**	5
		2	<1	<1	**0.3**	5
11	Surface	1	<1	<1	**0.2**	5
		2	<1	<1	**1.3**	5
12	Surface	1	**1**	<1	<0.1	2
		2	<1	<1	**0.5**	2
	Bottom	1	<1	**26**	**1.2**	24
		2	**2**	**7**	<0.1	7

[1]ANZECC/ARMCANZ (2000a) modified in EPA (2005a)

BLUE: Exceedence of the 99% species protection levels marked in blue

Table A3 Metal concentrations in surface water inshore at Cape Preston in 2007 (URS, 2007) (µg/L)

Date	Sample site	Rep	Aluminium	Arsenic	Beryllium	Boron	Cadmium	Chromium	Copper	Iron	Lead	Manganese	Mercury	Nickel	Zinc
99/95% species protection level[1]			0.5*	N/A	N/A	5100*	0.7	27.4 (CrIII) 4.4 (CrVI)	1.3	N/A	4.4	80*	0.1	7	15
27/02/07	I	1	<100	<10	<10	-	**1.6**	-	**10**	<500	<10	<10	<0.1	<10	<50
		2	<100	<10	<10	-	<1	-	**11**	<500	<10	<10	<0.1	<10	<50
		3	<100	<10	<10	-	<1	-	**11**	<500	<10	<10	<0.1	<10	<50
22/03/07	I	1	<10	2.4*	<1	-	<0.5	<2	<5	<50	<1	<1	<0.1	<5	**18**
		2	<10	<2	<1	-	<0.5	<2	<5	150	<1	<1	<0.1	<5	<10
		3	<10	<2	<1	-	<0.5	<2	<5	270	<1	<1	<0.1	<5	11
	ADCP	1	<10	<2	<1	-	<0.5	<2	<5	280	<1	<1	<0.1	<5	<10
		2	<10	<2	<1	-	<0.5	<2	<5	280	<1	<1	<0.1	<5	<10
		3	<10	<2	<1	-	<0.5	<2	<5	280	<1	<1	<0.1	<5	<10
	Field blank	-	<10	<2	<1	-	<0.5	<2	<5	**90**	<1	<1	<0.1	<5	**5**
04/04/07	I	1	<100	<2	<1	-	<0.5	<2	<5	<500	**10.8***	<10	<0.1	<5	**24**
		2	<100	<2	<1	-	<0.5	<2	<5	<500	1.1	<10	<0.1	<5	<10
		3	<100	<2	<1	-	<0.5	<2	<5	<500	**4.5***	<10	<0.1	<5	13
	ADCP	1	<100	<2	<1	-	<0.5	<2	<5	<500	<1	<10	<0.1	<5	<10
		2	<100	<2	<1	-	<0.5	<2	<5	<500	<1	<10	<0.1	<5	<10
		3	<100	<2	<1	-	<0.5	<2	<5	<500	<1	<10	<0.1	<5	<10
	Field blank	-	<100	<2	<1	-	<0.5	<2	<5	**60**	**1.4***	<10	<0.1	<5	**4**
	Transport blank	-	<100	<2	<1	-	<0.5	<2	<5	<500	**4.2***	<10	<0.1	<5	<10
19/04/07	I1					-				<500					
	I2					-				<500					
	Transport blank					-				<500					
	Field blank					-				**160**					

Date	Sample site	Rep	Aluminium	Arsenic	Beryllium	Boron	Cadmium	Chromium	Copper	Iron	Lead	Manganese	Mercury	Nickel	Zinc
99/95% species protection level[1]			0.5*	N/A	N/A	5100*	0.7	27.4 (CrIII) 4.4 (CrVI)	1.3	N/A	4.4	80*	0.1	7	15
03/05/07	I1	-	-	-	-	3860	-	-	-	<500	-	-	-	-	-
	I2	-	-	-	-	3830	-	-	-	<500	-	-	-	-	-
	I3	-	-	-	-	4000	-	-	-	<500	-	-	-	-	-
	Transport blank	-	-	-	-	<50	-	-	-	**80**	-	-	-	-	-
	Field blank	-	-	-	-	<50	-	-	-	**90**	-	-	-	-	-
07/06/07	I1					-				<100					
	I2					-				<100					
	I3					-				<100					
	Transport blank					-				<50					

[1]ANZECC/ARMCANZ (2000a) modified in EPA (2005a)

*Low reliability marine trigger value (ANZECC/ARMCANZ, 2000a)

BLUE: Exceedence of the 99% species protection levels marked in blue

RED: Presence of trace metals in quality control samples marked in red

GREY: Grey cells indicated quality control samples

Table A4 Metal concentrations for surface water inshore at Cape Preston on 16 May 2008 (URS, 2008) (µg/L)

Analyte	Aluminium	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Copper	Iron	Lead	Manganese	Mercury	Nickel	Strontium	Zinc
99/95% species protection1	0.5*	N/A	N/A	N/A	5100*	0.7	27.4 (CrIII) 4.4 (CrVI)	1.3	N/A	4.4	80*	0.1	7	N/A	15
Surface 1	<5	2	7	<1	**5500**	<0.1	<1	<1	<5	<1	<1	<0.1	<1	6500	<1
Surface 2	<5	2	7	<1	**5800**	<0.1	<1	<1	<5	1	<1	<0.1	<1	6500	<1
Surface 3	<5	1	7	<1	**5600**	<0.1	<1	<1	<5	**23**	<1	<0.1	<1	6600	<1
Surface duplicate XX	<5	2	7	<1	**5500**	<0.1	<1	<1	<5	**24**	<1	<0.1	<1	6800	<1
Surface duplicate YY	8	1	8	<1	**5500**	<0.1	<1	<1	<5	**79**	<1	<0.1	<1	7100	<1
Bottom 1	<5	2	7	<1	**5600**	<0.1	<1	<1	<5	<1	<1	<0.1	<1	7400	<1
Bottom 2	<5	2	9	<1	**5500**	<0.1	<1	<1	<5	<1	<1	<0.1	<1	7700	<1
Bottom 3	<5	1	7	<1	**5700**	<0.1	<1	<1	<5	<1	2	<0.1	<1	7600	1
Bottom – duplicate XX	<5	2	7	<1	**5500**	<0.1	<1	<1	<5	<1	<1	<0.1	<1	7800	<1

[1]ANZECC/ARMCANZ (2000a) modified in EPA (2005a)

*Low reliability marine trigger value (ANZECC/ARMCANZ, 2000a)

GREY: Grey cells indicate quality control samples (field splits)

BLUE: Exceedence of the 99% species protection levels marked in blue

Table A5 Sediment data from 2002 at Cape Preston (Maunsell 2006)

Sampling site	Replicate	Cadmium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Zinc (mg/kg)
2	1	0.2	2	2	0.02	9.3
	2	0.2	1.6	2	<0.01	5
3	1	0.2	1.6	2	<0.01	5.1
	2	0.2	1.7	2	<0.01	3.6
4	1	0.2	1.5	<2	<0.01	3.1
	2	0.2	1.3	<2	<0.01	2.9
5	1	0.2	1.4	2	<0.01	3.3
	2	0.2	1.8	2	<0.01	5.6
6	1	0.3	5.9	3	<0.01	8.8
	2	0.4	6.5	4	<0.01	11
7	1	0.4	3.6	3	<0.01	6.6
	2	0.3	3.9	3	<0.01	6.9
8	1	0.1	0.7	2	<0.01	1.5
	2	0.1	0.6	1	<0.01	1.4
9	1	0.5	2.7	4	<0.01	6.1
	2	0.4	3	4	<0.01	7.2
10	1	0.2	1.6	2	<0.01	3.7
	2	0.2	1.4	2	<0.01	3.8
11	1	0.1	0.8	1	<0.01	2.9
	2	0.1	0.3	1	<0.01	2
13	1	0.2	0.6	1	<0.01	1.4
	2	0.1	0.6	1	<0.01	2.1
Mean		0.22	2.1	2.1*	0.006	4.7
ISQG-low1		1.5	65	50	0.15	200

*Average calculated using the value of LOR/2 for results below LOR.

[1]ANZECC/ARMCANZ (2000a)